Cape Peninsula
University of Technology

DESIGN FOR HEALTH: CO-DESIGNING HEALTH INFORMATION SERVICES IN THE AFRIKAN CONTEXT

by

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DECLARATION

I, **Ralitsa Diana Debrah**, declare that the contents of this thesis represent my own unaided work and that this thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology (CPUT).

Signed: **Date:** 05 February 2021

ABSTRACT

"Innovative design aims at emancipating people to become animators of change in their communities" – Ralitsa Diana Debrah

Maternal and Child Health (MCH) plays a vital role in the socio-economic development of countries and in particular, sub-Saharan Afrika. Children are the future of a nation; therefore, their health and wellbeing becomes critical to national development. Health information and education have been identified as possible ways of promoting preventive care, particularly amongst mothers with infant children in sub-Saharan Afrika. The provision of quality healthcare services is of great importance in any given community. Thus, health education needs to be extended to mothers in underserved communities in Afrikan sub-regions.

This study was predominantly conducted in the Grabouw community in the Western Cape Province of South Africa and partially in the Kumasi-Asante region of Ghana as a replication case. This study aims to contribute to the improvement of healthcare services in underserved communities and accelerate South Africa's progress towards meeting global health-related targets such as the United Nations (UN) Sustainable Development Goal three (UN SDG 3) by 2030.

Service design and sensemaking theories have been explored to gain insights and to search for possible solutions within the problem space in Grabouw. Co-design activities have been conducted with the participating health intermediaries such as caregivers, midwives and patients (women), which have resulted in prototyping a technology-enabled health information system. The system, which is a multimodal health information system, is envisioned to facilitate the transmission of health information in underserved communities. It is also designed to facilitate interaction between health intermediaries (caregivers) and patients (mothers) when implemented in the future.

Projections from the study include the proposed health information system, which has multimodal functions, will equip caregivers, and enable them to promote health literacy among women in the Grabouw area. Mothers will be empowered to make informed decisions for themselves and their children to reduce maternal morbidity and mortality in the context of Grabouw in the Western Cape, South Africa. Future work is suggested to extend health information services to mothers in other underserved communities towards fostering a healthy society. A healthy society will accelerate the attainment of health-related UN SDGs in South Africa, Ghana and other countries in sub-Saharan Afrika.

Keywords: Afrika; Caregivers; Design Thinking; Healthcare Services; Participatory/Co-Design; Sensemaking; Service Design; Transdisciplinarity

GRAPHICAL ABSTRACT

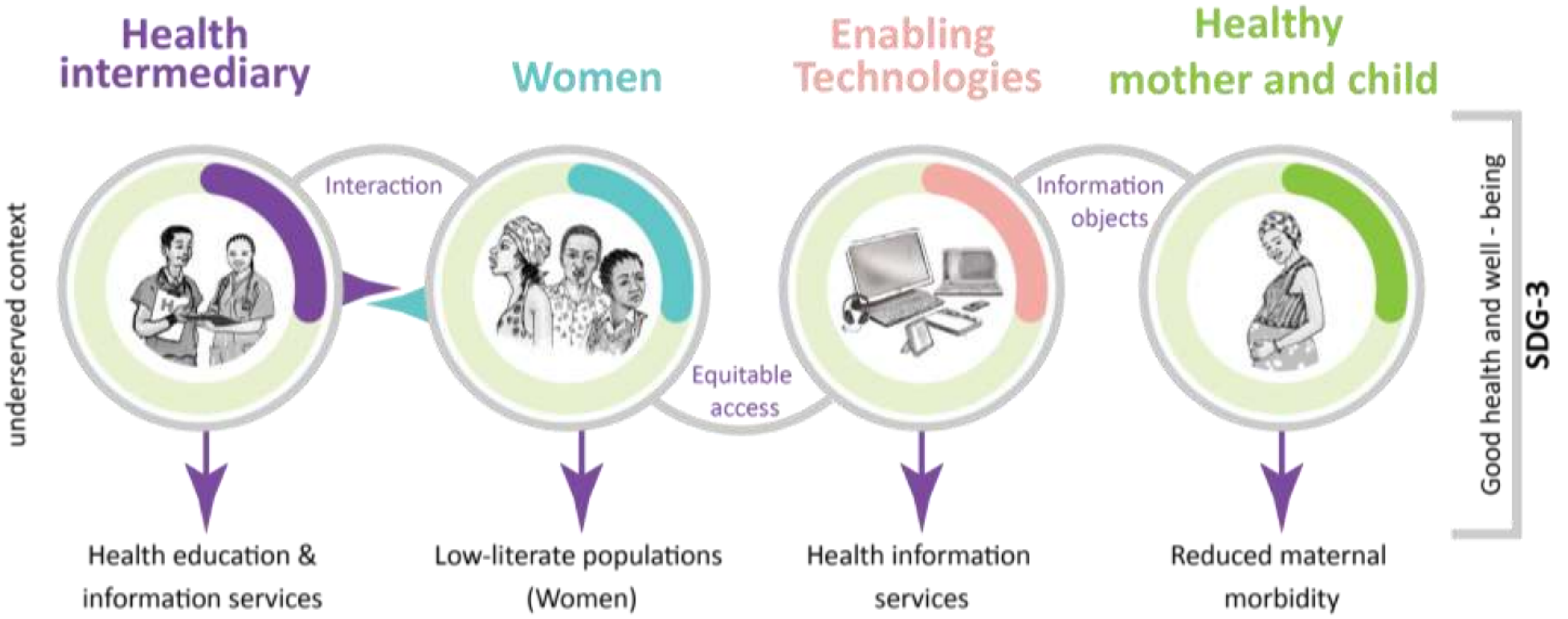

Figure I: Graphical abstract depicting key concepts in this study (Audio-visual abstract: click to listen [audio] and watch [video])

PREFACE

The Role of the Designer-Researcher in a Transdisciplinary Research Domain – ISD4D

"My eyes hurt, but my hand keeps sketching"– Pablo del Valle

In this section of the study, I describe how my research path has evolved through design. As a design-researcher, I have been involved in the larger transdisciplinary research project called Information Systems Development for Development (ISD4D). The larger transdisciplinary research team consisted of researchers from the following areas: Health Science, Information Science, Communication Science, Education Science, Information Communication Technology (ICT) and Design Science with a focus on improving Maternal and Child Health Care (MCH) information services (Debrah, Bhebe *et al.*, 2014:96-97; M'Rithaa, 2015:4). The research was predominantly conducted with community stakeholders in underserved communities in Afrikan sub-regions in Ghana and South Africa.

Over the years, I have acquired practical knowledge and skills in communication design and other related fields, which I bring to this research case, exploring the designing of health information services. As a designer, I contributed to the larger research project (ISD4D) from the service designer's point of view in the research context. Therefore, data obtained in this research are described from the service designer's perspective, which examined the case of designing health information services in underserved communities in Afrika (Figure II).

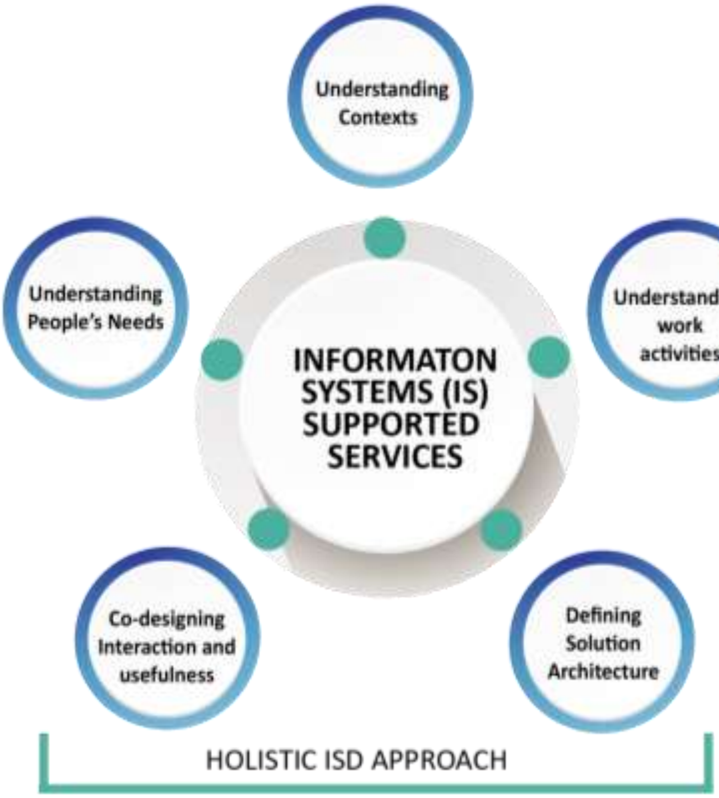

Figure II: Daisy approach
(Source: Adapted from www.uef.fi/act)

My research journey began in Ghana, West Africa, which formed part of the preliminary phases of the study exploring healthcare service design. The preliminary stages of the research conducted in Ghana were highly exploratory to discover possibilities of the research areas in healthcare services in the selected context. Insights derived provided strategies to design health information services in the selected research contexts. Successively, the main study was then conducted in the Western Cape Province of South Africa with health intermediaries and women in underserved communities (Figure III). At a later stage, some of the outcomes of the research from the main research case in Cape Town, South Africa, were replicated in Kumasi, Ghana for validation purposes.

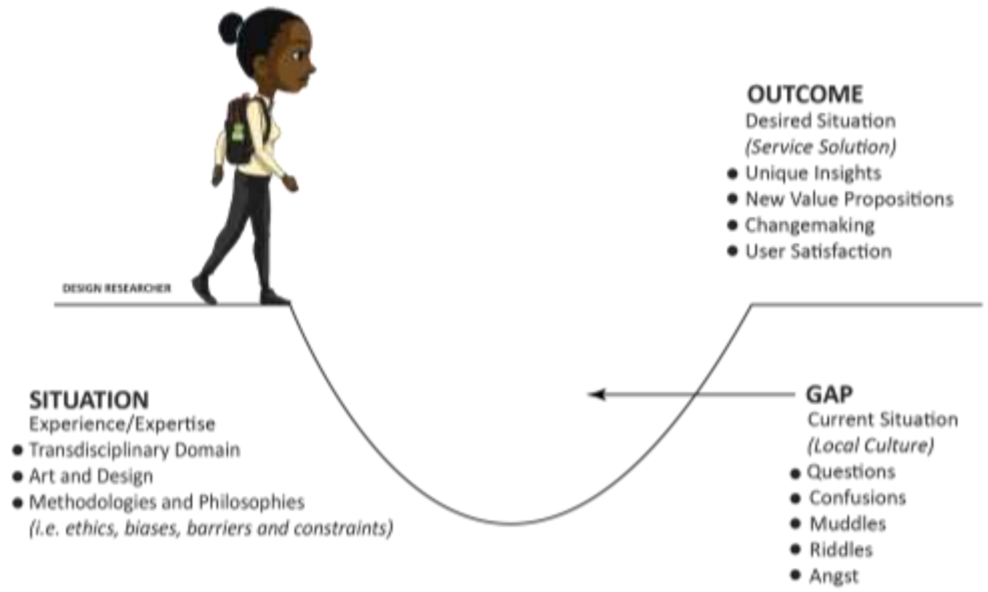

Figure III: Making sense of the research context
(Source: Adapted from Dervin, 1999, cited in Agarwal, 2012:9)

The ISD4D project aimed at providing information systems in healthcare settings for development. The ISD4D team consisted of an international research team from Europe and other Afrikan countries. This team consisted of transdisciplinary researchers from countries such as Finland, Mozambique, South Africa, Nigeria, Kenya, Zimbabwe and Ghana. Some of the core research team members were practicing professions such as doctors, nurses, midwives and other stakeholders from the local communities in South Africa. Other participating researchers included programmers, developers, public relation officers, project managers, and myself. Since I am from a design background, my contributions were mainly from the designer-researcher’s perspective located in the co-designing petal as indicated in Figures II, III and IV.

My involvement in the ISD4D project forms part of my PhD studies in Design at CPUT. Participating in hands-on projects through ISD4D offered me the opportunity to learn more about service design concepts as applied to living projects in underserved communities in the Western Cape Province, South Africa. This study is conducted through the lens of design as part of the larger transdisciplinary research domain. The

Daisy Model was used as an approach to categorise and distribute the role of team members in the larger ISD4D project. Researchers in the ISD4D team played a specific role in the entire research processes as indicated in the various petals in the daisy model (Figure II). My research was situated in the co-design petal in the Daisy model, which shaped the entire research. I participated in most of the ISD4D workshop activities as a design researcher and an observer at the same time. I observed that design thinking was part of the core process of the ISD4D team, which made me appreciate the designer's role in such a complex research domain. My expertise as a designer was applied throughout the research activities conducted. This helped researchers to make collectively *sense* of service context for *changemaking* to improve healthcare services within the selected research context in Afrika (Figure IV).

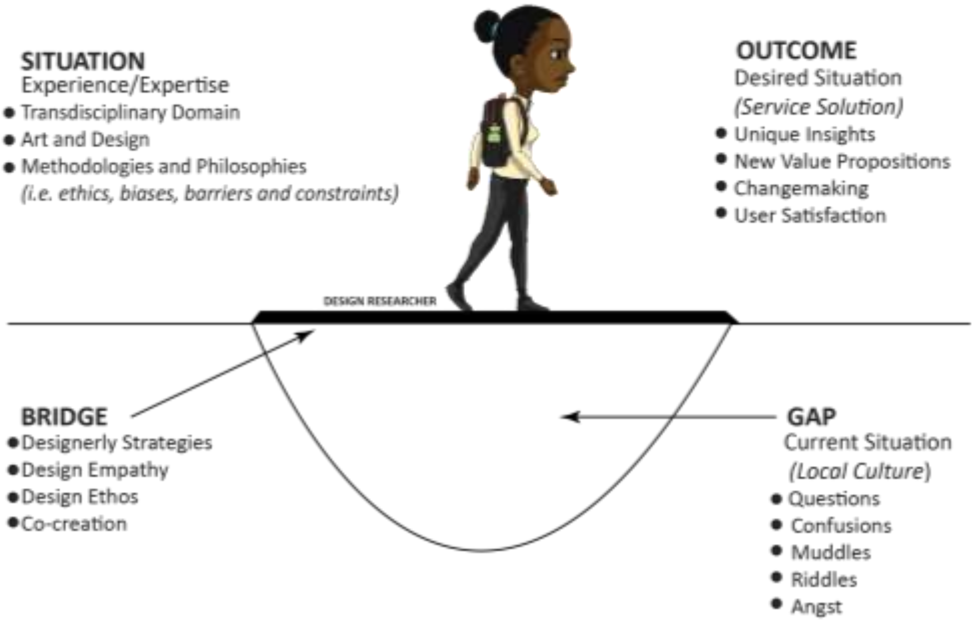

Figure IV: Sensemaking for changemaking from the designer-researcher's perspective (Source: Adapted from Dervin, 1999, cited in Agarwal, 2012:9)

Additionally, my capabilities in service design evolved through experiential learning due to my active involvement in the ISD4D project and other design-related learning activities. I was able to acquire additional skills through service design training seminars, workshops and working with practicing service designers and other researchers in the ISD4D project. The experiences acquired through all the design-related projects and experts in the field provided further understanding of service design. My participation in the larger project unearthed the critical role that designers play when working in the transdisciplinary research domain to design socially responsive processes in underserved communities in Afrika. In this research case, it was evident that the designers' role is critical, as they are able to contribute enormously as facilitators while exploring designerly processes to find solutions to complex societal problems. In summary, knowledge generated through the study has been shared in reputable journals, conferences, workshops, and forums in the field of Health Informatics and Design.

ACKNOWLEDGEMENTS

My research journey has been successful through the contributions of many people. This research was extremely interesting but demanding and many people supported me throughout my research activities. The study required comprehensive planning, before and during, and in some instances after the major research activity. The work was human-centred and demanded substantial communications and resources before the research was undertaken. Therefore, I would like to thank all persons who supported me throughout this study.

- I would like to thank my supervisor, **Professor Mugendi Kanampiu M'Rithaa** for all his support throughout my PhD journey. **Mugendi** has generously shared his time, knowledge and experience from start to finish of my research and PhD journey. My supervisor has provided me with hands-on experience in the field of design research, which has developed my research skills and ability to work with larger research teams and communities. The research skills and experience acquired has made me a conscientious researcher that I will transfer to other research settings. Above all, he has given me the needed exposure and opportunities on global platforms such as conferences, forums, and seminars to share my research findings and to develop my skills as a design researcher

- I also thank **Dr Mrs Alettia V Chisin** for all her support and motivation throughout my PhD journey. You have been my research advisor and provided me with all the needed guidance as well as international opportunities throughout my PhD journey. Thank you!

- Special thanks to Professor Johannes Cronje (**"The Dean"**, FID, CPUT), for giving me the opportunity to participate in the exchange programme between CPUT and KNUST. Please continue with your hobby of **"hunting"** for students in Afrika to enrol in PhD programmes at CPUT. Thank you!

- I would also like to express my profound gratitude to all colleagues and friends who served as editors and reviewers for publications arising out of the study, and seeing to it that the text quality was improved

- I wish to thank Elgin Learning Foundation (ELF) for permitting us to partner with their organisation to undertake this research and for providing us with the needed on-site logistics and immeasurable hospitality throughout the study

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- To Professor Mikko Korpela and all friends from the ISD4D Academy of Finland, I say thank you for all the support throughout the research processes

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- My deepest gratitude goes to all caregivers, women, and all the participants for their kind co-operation and participation throughout the study

- I am grateful to all staff and students from the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, for their support throughout the study. Mrs Janet Joyce Stuber, Mr Gilbert Amegatcher, Mr Ato deGraft Johnson, Dr Edward Appiah, Dr Eric F Eshun, Mr Kwabena Kusi-Appouh, Reverend Martin Adi-Dako, Professor Kwasi Opoku Amakwah, Professor Nana A A Opoku-Asare, and **DeCoDe staff**, thank you for all your support

- My sincerest appreciation goes to my family, colleagues, and friends for constantly motivating me to complete my studies. Special thanks to Dr Laban Bagui, Dr Mrs Millicent Agangiba, Dr Eddie Naa Dakora, Dr Eric K Simpe, Reverend Dr E Offei Akrofi, Dr Tsum Darko, Prof Dr Morris Dassah, Mr Kwabena Poku, Mrs Letitia Maud Poku, Mr Chris A Umoh, Mrs Josephine Peace Enninful, Mrs Kate Anamoo, Mrs Janet Appiah, Dr Mrs Naa Dedei Tagoe, and the entire Ghanaian community in Cape Town

- I also thank all the Ghanaian contingents – **"the chosen ones"** for their support and making my experience in Cape Town, South Africa, a memorable one!

- I express my profound appreciation to all members of the following design community: e/Merge Africa, Network of Afrikan Designers (NAD), Ghana Design Network (GDN), DesignGhana (DG), GhiGha, Pan Afrikan Design Institute (All the Design PADIs), Open Design Afrika (ODA), Cape Town, Design Research Activities Workgroup network (DRAWn-CPUT and KNUST) for all your support!

- To all those who contributed and assisted me in this research project whose names have not been mentioned, my heartfelt thanks go to you during this intensive research period. I say **"ENKOSI"** as said in South Africa and **"DANKIE"** as said in Afrikaans; **"ASANTE"** as said in Kenya, **"MEDASE", MOTSUM, OYIWALADON", "AKPE", "NAGODE"** as said in Ghana—all meaning thank you!

DEDICATION

Firstly, I dedicate this research work to all caregivers in Grabouw and all the participants for their kind co-operation and willingness to share ideas and engage in the research. Secondly, the study is dedicated in loving memory of *Ms Charlene Joorst*, the Hospitality Manager and Librarian at Elgin Learning Foundation (ELF) who passed away on May 5, 2015—on behalf of the ISD4D team and myself, we say thank you for making it possible for us to conduct this research. You took such good care of us in Elgin, Grabouw, South Africa. You are deeply appreciated and will forever remain in our heart.

Finally, this thesis is dedicated to all my family members and friends, especially my parents, Mavis Korkor Agbloe Simpson Debrah and Kwabena Simpson Debrah; Swinneta M D A Simpson Debrah, Herbert Oko Obodai Torto, Hilbert Akwerteh Adja Torto, Justina Agbloe Alloye, Enid Ohui Alloye, and Ellis Ofoe Alloye. Your support throughout my studies over the years is deeply appreciated.

AFRIKOLOGY

Afrikan perspectives in this study

__"Ubuntu"__ (South Africa), __"Noboa/ Ekome"__ (Ghana): "I am because we are"
(Translated as humanity or togetherness),
Afrikan Proverb (Figure V)

Figure V: Afrikology – Afrikan philosophies

"If you want to walk fast, walk alone. If you want to __go far__, __walk together__",
Afrikan Proverb (Figure V)

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GLOSSARY OF TERMS

Clarification of Basic Terms and Concepts

- **Afrikan:** This word is another version of the word Africa to highlight the richness of the Afrikan continent. It is the correct spelling of **"Afrika"** with the **"K"** in the thesis and is not a wrong spelling. The spelling was adopted from Saki Mafundikwa's work on "Afrikan Alphabets" (Mafundikwa, 2004a:IX-X). Additionally, **"Afrika"** with the **"K"** is adopted to project the continent from the 'inside-out' to highlight its own realities and aspirations. This is based on philosophical insights drawn from **Afrikology** to distinguish Afrika from how it is viewed from the 'outside-in' (M'Rithaa & Jamie, 2017:1-2). Afrika is used in place of "Africa" throughout the study, except for names of countries such as "South Africa" where Africa is maintained

- **Boundary objects**: These are objects or artefacts used to generate discussions. In the context of this study, they are mainly the visual elements that were used during co-design activities such as the illustrations and videos

- **Design fiction:** It is another form of speculative design, exploring both designerly ways and design thinking approaches to critique or explore future possibilities

- **Frugal innovation:** This is the process of reducing the complexities surrounding the cost of goods and services. It sometimes refers to the removal of functions that are not essential in a product, such as unessential applications (apps) on mobile devices in developing contexts

- **Information objects**: Any form of information presented through different media for communication in a particular context (Gorichanaz, 2016:7-8; Pluye *et al.*, 2019:11). Information objects are used in this study to represent both artefacts and systems of communication

- **mHealth**: The use of mobile phones in health systems is called mobile health (Noordam *et al.,* 2011:622)

- **Mass communication**: Is a branch of Social Science that deals with the study of dissemination through mass media (such as digital/print media) to large segments of the population at the same time

- **Multimodal Cryptographer**: This is a visual media tool proposed for use by health intermediaries to facilitate communication between them and their patients in underserved communities

- **Opinionnaires:** These are questionnaires or surveys used as elicitations in research activities. They are mainly used in qualitative research to solicit the opinions of participants to gain a better insight into a particular phenomenon under investigation

- **Health communication**: Is the art of giving information to another person or group of persons to achieve a specific health object (Ministry of Health Ghana (MOH), 2002:71)
- **Health education**: Is defined by Greene as "any combination of learning experiences designed to facilitate voluntary adaptations of behaviour conducive to health" (Ministry of Health Ghana (MOH), 2002:6)
- **Visual communication**: Is the conveyance of ideas and information in forms that can be read or viewed

GLOSSARY OF ABBREVIATIONS

Abbreviations	Definitions
AMA:	American Medical Association
ANC:	Antenatal Care
CPD:	Continuing Professional Development
CPUT:	Cape Peninsula University of Technology, South Africa
CHWs	Community Health Care Workers
CHCS:	Centre for HealthCare Strategies, Inc.
DOH:	Department of Health, South Africa
DVD:	Digital Video Device
ELF:	Elgin Learning Foundation
GSS:	Ghana Statistical Service
GHS:	Ghana Health Service
GDH:	Ghana Demographic Health Survey
HBC:	Home Based Care
HCWs:	Health Care Workers
ICT:	Information and Communications Technology
ISD4D:	Information Systems Development for Development
INP:	Intra-Natal Period
IOM:	Institute of Medicine (IOM), America
KNUST:	Kwame Nkrumah University of Science and Technology, Ghana
MDGs:	Millennium Development Goals
MOH:	Ministry of Health, Ghana
NNP:	Neo-Natal period
PNC:	Post-Natal care
PNP:	Post-Natal Period
SDGs:	Sustainable Development Goals
UN:	United Nations
UNDP:	United Nations Development Programme
UNICEF:	United Nations International Children's Emergency Fund
WHO:	World Health Organisation

CHAPTER ONE

INTRODUCTION TO THE STUDY

"Good design is making something intelligible and memorable.
Great design is making something memorable and meaningful" – Dieter Rams

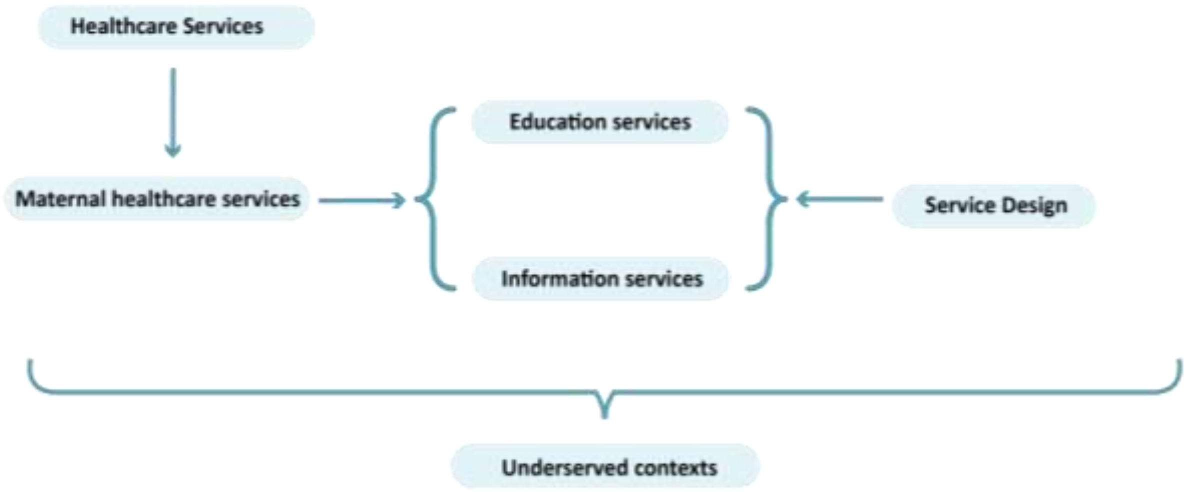


Figure 1.1: Diagram highlighting key concepts in this study

1.1 OVERVIEW – BACKGROUND TO THE STUDY

Service design has emerged as a viable discipline that provides a leverage for different multidisciplinary fields, professionals, stakeholders and community partners to work towards a common goal (Moritz, 2005:45-51; Fuad-Luke, 2011:5; Trischler & Zehrer, 2012:58-59). Service design aims at designing services that will meet customer satisfaction (Mager, 2006:6-7; Mager & Sung, 2011:1). Service design employs a wide range of designerly methods and tools that can be explored to design innovative services in a given context (Moritz, 2005:185; Mager, 2008:356-357). Today, many researchers continue to explore solutions that go beyond the boundaries of their specified disciplines via service design strategies to drive innovation (Fuad-Luke, 2011:181; Moritz, 2005:55). Service design as an approach is explored in different research scenarios to find new service value propositions that could address the needs of **"ALL"** or **"EACH"** person within a particular context. In the process of such research activities, newer disciplines continue to emerge through interdisciplinary, multidisciplinary, poly-disciplinary, and quite recently, transdisciplinary research. This study is situated within a transdisciplinary research domain, which is concerned with the team efforts of different disciplines working beyond their boundaries to solve a common societal or wicked problem (McGregor, 2004:2; Rittel & Webber, 1973:115). The major fields of study that served as lenses to gain insight into the context within a transdisciplinary domain are described as follows (Figure 1.2).

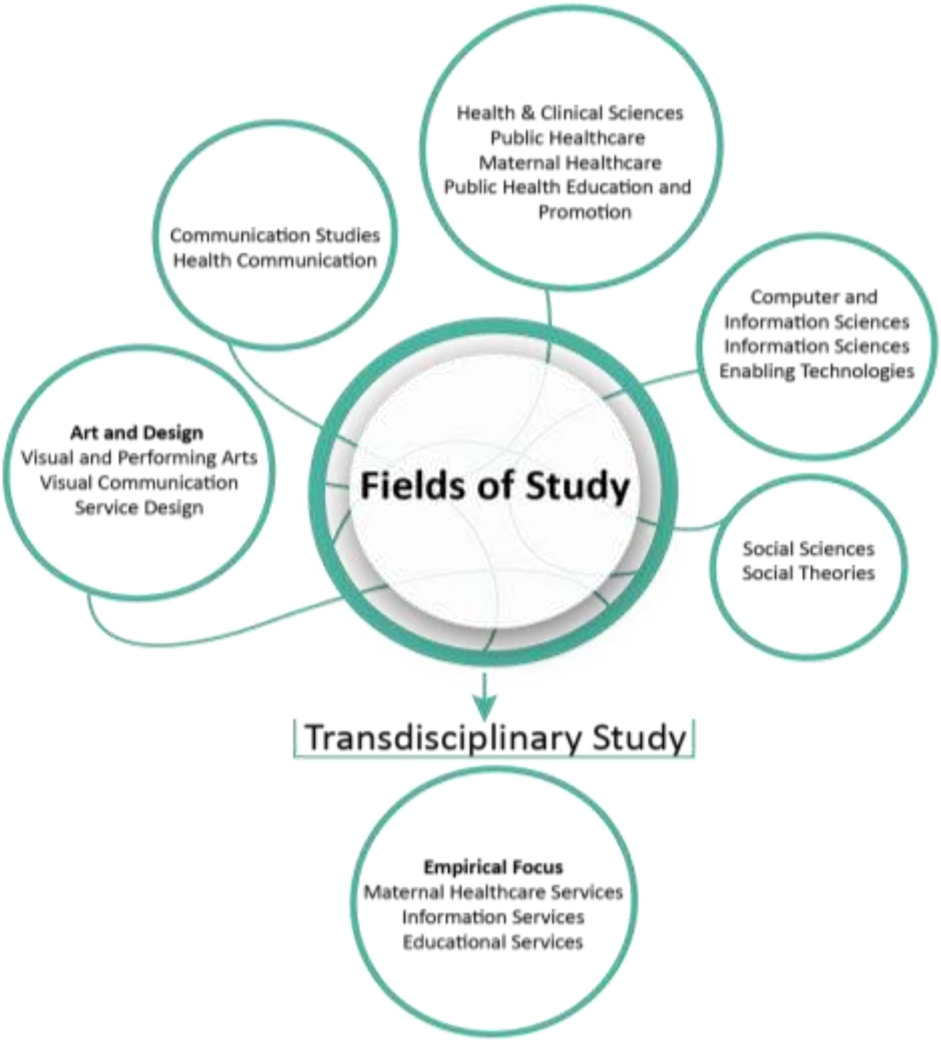


Figure 1.2: The various fields of study –
Situating the study within a transdisciplinary domain
(Source: Authors' own construct)

Fields of Study – Transdisciplinary Domain

- *Art and Design* – Visual and Performing Arts, Visual Communication and Service Design
- *Communication Studies* – Health Communication
- *Health & Clinical Sciences* – Public Healthcare, Maternal Healthcare, Public Health Education and Promotion
- *Computer and Information Sciences* – Information Sciences and Enabling Technologies
- *Social Sciences* – Social Theories

Additionally, this investigation was carried out with the involvement of local community members, stakeholders, and research partners who formed part of the core research team within a transdisciplinary setting. However, the **Empirical Focus** of this research is situated within **Maternal Healthcare Services** with emphasis on **Information Services** and **Educational Services** (Figure 1.2).

Further, the information presented in this research is based on my reflections as a designer-researcher exploring the lenses of transdisciplinary fields of this study (Figure 1.2). Hence, the discussion in this study is predominantly informed by **Art and Design** perspectives and not as a specialist in the aforementioned disciplines in this study. Furthermore, my goal as a designer-researcher in the transdisciplinary domain was mainly to explore service design for new value propositions for **maternal healthcare services** in the selected research context.

The focus for healthcare service design in this research revolved around health education and information services in underserved communities in sub-Saharan Afrika. In health education services, one cannot rule out the provision of relevant information during information communication between health information service providers and recipients. Health intermediaries often interact with their patients through interpersonal communication as a continuous process where they share and exchange information with each other in health education activities. In many instances, there is an inadequacy in the availability of information to educate and improve the quality of health in many underserved contexts in sub-Saharan Afrika. Hence, quality information plays an integral role in improving the health and wellness in a society. The goal of the investigation was to explore health information service design that could facilitate information sharing and exchange in underserved communities in two selected sub-regions in Afrika.

The main research case was based in the Western Cape Province in South Africa. Kumasi municipality in Ghana was the second research case to pre-test some aspects of outcomes obtained in the main research case (South Africa). Service design methods were explored to gain new insights into context and to propose new value propositions for health information services. Through the service design strategies, new insights were gained into the circumstances surrounding the health education activities of health intermediaries in the Western Cape, South Africa. Additionally, some of the available information objects, sources, and services in the South African healthcare system were discovered.

In the process of inquiry, the information needs and sources of health intermediaries and patients were identified in the main research contexts of the study, located in Grabouw in the Western Cape, South Africa. Furthermore, some of the possible factors that undermine health information communication practices from the perspective of health information service providers such as health intermediaries in Grabouw were identified. Insights derived from understanding context informed the prototyping of technology-enabled health information service solutions that could facilitate health education activities in the selected underserved communities in sub-Saharan Afrika.

Accordingly, the study comprises of literature review and theoretical perspectives that formed the basis for gathering information and identifying which major concepts to draw from the various transdisciplinary domains and thus shape the study of service design research. The investigation comprises a detailed discussion of service design research activities that led to prototyping new service solutions for future use in an underserved context of the study.

Other significant issues outlined in this introductory **Chapter (One)** of the study include the *background to the research problem*, *problem statement, purpose,* and *importance* of the study. A *conceptual framework* is presented to give an idea of basic elements, which formed the foundation of the study. Other relevant issues discussed in this section are the *research questions, assumptions, delineation, research context, rationale*, *research design,* and *organisation of the rest of the stu*dy. Nonetheless, information and insights presented in this study are context specific and might not be generalisable to other contexts in sub-Saharan Afrika. However, insights derived through the study contribute to knowledge, generating discussion that could be further interrogated for envisioning and shaping health information services in similar underserved communities in sub-Saharan Afrika.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

According to the United Nations (UN) report on the Millennium Development Goals (MDGs), most women in sub-Saharan Afrika do not have equal access to education, healthcare and decision making (Africa Progress Panel, 2010:10-11; United Nations [UN] Report, 2012:3). The UN report on the MDGs goes on to state that mothers in underserved communities in developing regions are mostly under-educated. As such, they do not have easy access to adequate information on maternal healthcare and thereby increase their chances of morbidity and mortality. Thus, women with education are most likely to access healthcare and that increases their chances of survival as well as the chances of their children under five years old (United Nations [UN] Report, 2012:28; Kalembo *et al.,* 2013:32-33; Weitzman, 2017:1).

In this study, the phenomenon being researched revolves around MDGs three (3) to five (5) that ended in 2015 (World Health Organisation [WHO], 2015:2-3). The MDGs are now translated into United Nations (UN) Sustainable Development Goals (UN SDGs) which started from 2015 and are expected to be achieved by 2030 (Matte *et al.,* 2015:5). MDGs three (3) to five (5) are now UN SDGs three (3) to five (5), all seeking to improve the quality of life of women including health and wellbeing for everyone (Pisano *et al.,* 2015:15-16). In this research case, the probing is essentially aimed at MDGs 4 and 5 – Reduce child mortality (MDG 4) and Improve maternal health (MDG 5), which is now translated as UN SDG 3 – **"Ensure healthy lives and promote wellbeing for all ages"** (Matte *et al*., 2015:14).

1.2.1 Maternal Healthcare Services – Afrikan Sub-Regions

In Afrikan sub-regions, there are many determinants of maternal morbidity and mortality in underserved communities. Maternal mortality as indicated by health officers is mostly caused by obstetric haemorrhage, eclampsia, sepsis, unsafe abortion, obstructed labour, pregnancy-induced hypertension and indirect causes, such as malaria and HIV (Kock *et al*., 2012:3-4; United Nations [UN] Report, 2012:38-41). Furthermore, the lack of skilled health intermediaries (birth attendants) is negatively associated with both maternal and infant mortality in underserved communities in sub-Saharan Afrika. Maternal healthcare providers such as midwives are unwilling to work in underserved communities in Afrikan sub-regions due to lack of incentives to motivate them to work and the fear of limited access to training programmes to improve their professional development (Lori *et al.,* 2012:5-7).

Additionally, in some Afrikan sub-regions there are disparities in information communication between health intermediaries such as nurses, traditional birth attendants, and their patients in underserved communities. Despite the professional training of some nurses in underserved communities, they appear to have turned traditional birth attendants into "messengers" rather than seeing them as key stakeholders in helping pregnant women within their local communities (Yakong *et al.,* 2010:2435). Also, it is evidenced that there is lack of affirmative communication between health intermediaries and women in some underserved communities in Afrika. This situation might pose challenges for women before, during and after pregnancy as it may increase complications and put women at risk during childbirth (Madula *et al.*, 2018:1-2). Affective communication is critical to maternal health services to minimise any complications that might lead to maternal morbidity and mortality in Afrikan communities.

Therefore, there is a need to bridge gaps in health information communication that may exist between health information service providers such as intermediaries and their patients. Other discrepancies affecting health education and work practices need to be resolved to enhance health literacy among women in underserved communities in Afrikan sub-regions.

1.2.2 Reducing Maternal and New-Born Morbidity and Mortality in Selected Afrikan Sub-Regions

In many Afrikan sub-regions such as South Africa and Ghana, progress to global health goals such as the MDGs has been slow despite many health initiatives to reduce maternal morbidity and mortality (United Nations [UN] Report, 2012:33; Thompson & Evans-Klock, 2015:39-40; Deaton & Tortora, 2015:519-522). Some of the regional reports obtained on maternal and newborn morbidity and mortality in sub-Saharan Afrika are described in this section for Ghana and South Africa since these locations form the research contexts.

1.2.3 Reducing Maternal Mortality in Ghana

In Ghana, for example, there are no available midwives and skilled birth attendants within a reasonable distance to offer maternal care services to women living in underserved communities (Prosser *et al.,* 2006:8-9; Darko, 2015:13-14). For instance, in 2011, there were 3780 midwives practicing in Ghana, representing 5 midwives per 1000 live births or 84 midwives per 100 000 people. It is estimated that 65% of all births in the cities and 35% of births in rural areas are attended by midwives. This puts Ghana in fourth position in the sub-Saharan Afrikan regions suffering from a shortage of maternal health intermediaries (Lori *et al.,* 2012:2). The Ghana Demographic Health Survey [GDH] 2008 Report indicates that mothers in underserved communities rely on traditional birth attendants for information on maternal and newborn health care (Ghana Statistical Service [GSS] *et al.,* 2009:8). Although traditional birth attendants are very helpful to patients in terms of relational care, they may not be equipped with modern health service delivery strategies to assist their patients in underserved communities. This implies that pregnant women may not have equal survival chances across the country (Lori *et al.,* 2012:6; Darko 2015:18-25).

1.2.4 Reducing Maternal Mortality in South Africa

In South Africa, it was identified in a report based on 2015 healthcare initiatives that the maternal and child mortality ratio was high. As part of the projections on the MDGs 4 and 5 in 2015, the maternal mortality ratio in South Africa was 400 deaths per 100 000 live births, whereas perinatal mortality was estimated at 31.1 deaths in 100 births, which is still on the high side as compared to countries with similar socio-economic status. Despite efforts in reducing the maternal mortality ratio, South African audit reports indicate that there are over 260 maternal and child mortalities recorded daily due to persistent health conditions such as pregnancy and childbirth complications, malnutrition, HIV and Aids (Day *et al.,* 2011:9-10).

Consequently, achieving MDGs five (5) has been a challenge because of the lack of all the determinants of quality maternal healthcare standards such as skilled health intermediaries to educate patients in underserved communities in Afrikan-sub-regions. Although there have been some gains in the improvement of maternal health in sub-Saharan Afrika over the last decade, pregnancy still remains a major health risk in these countries (United Nations [UN] Report, 2012:27-29). The achievement of MDGs 5, which aims at improving maternal health by 2015, has been difficult to achieve due to some of these persistent challenges, which continue to slow the progress (United Nations [UN] Report, 2012:32-36). Meanwhile, the UN SDGs are to be achieved globally by 2030 and as such all countries are expected to make efforts to meet these stipulated goals (World Health Organisation [WHO], 2015:2; Matte *et al.,* 2015:4-6). So in order to meet these global health goals timeously, there is a need to propose more health initiatives and to encourage continuous effort through public health education campaigns towards reducing maternal morbidity and mortality in sub-Saharan Afrika.

1.2.5 Health Education in Afrika

Health education campaigns in Afrikan sub-regions, help in equipping people to improve upon their health behaviour (Kalembo *et al.,* 2013:32-33). In health education activities, health communication plays a major role in public health campaigns (Sood *et al.,* 2014:83; Domnariu, 2014:161; Lederman *et al.,* 2017:3-4). Some of the strategies that have proven to be effective and affective in Afrikan sub-regions such as Ghana include using an integrated community-based approach to public health campaigns in underserved communities. During health education activities, information is presented through culturally appropriate media and is transmitted through personal contact which has proven to be an effective information communication tool (Butler, 2000; Prilutski, 2010:51; Schroeder, 2016:1-2). Health education is mostly provided by health intermediaries such as midwives, nurses, doctors, community health workers and traditional birth attendants in many underserved communities in sub-Saharan Afrika. These health intermediaries help in managing complications that may arise during pregnancy and refer their patients to other specialised health facilities if the need arises (Lori *et al.,* 2012:6; United Nations [UN] Report, 2012:31). Most often when dealing with patients, they are confronted with challenges that undermine the information communication processes to mothers with low literacy (Karlsen *et al.,* 2011:1-2). The lack of equitable access to health information for mothers with low literacy levels is always a challenge in underserved communities in sub-Saharan Afrikan countries (United Nations [UN] Report, 2012:3-5; Adanri, 2017:3-4). Education is key in reducing maternal morbidity and mortality in underserved communities in Afrikan sub-regions (Kock *et al.*, 2012:1; Kalembo *et al.*, 2013:33).

In health education activities, much of the health information occurs as posters written in English with few images. Such health information communication objects are not that helpful to mothers in underserved communities who may not be able to read or may in fact only speak their own local language and have limited knowledge of English (National centre for Biotechnology Information [NCBI], 2008:para 3; Madula *et al.*, 2018:1-2). On the other hand, many individuals in urban areas in Afrikan sub-regions may have equitable access to relevant health information due to their level of education and could be perceived as health literate. Nonetheless, when it comes to disseminating relevant health information to individuals, a few questions remain: *What happens to the majority of low literate populations (females) who are living in underserved communities in Afrikan-sub regions during health education activities? How can relevant health information be disseminated to low literate populations (females) at a relatively lower cost, but in a more efficient and faster manner? What appropriate media is required to facilitate interaction between health information service providers and patients during health education activities in underserved contexts in Afrikan sub-regions?*

1.2.6 Health and Information Literacy

Multimedia technology, beyond a reasonable doubt, provides healthcare educators with tools that could facilitate information dissemination through effective communication channels (O'Mara, 2012:para 1-7). Multimedia technology provides the opportunity to combine audio and visuals for information communication in acceptable formats to target audiences (Deborah, 2015:6-7). A combination of visual and text-based information facilitated by multimedia technology has been identified as a viable means for information communication (Avila *et al.*, 2016:1-2). This makes it a very good platform to consider when developing strategies to enhance health education for mothers in underserved communities. For example, a TV campaign on "life choices" (a family planning advert in Ghana) was targeted at women.

Results from a survey taken in urban areas of the country showed that 89% of the target audience were aware of the "Life Choices" campaign and the messages within the campaign (Prilutski, 2010:55). No results from rural areas were provided. "Although the campaign used both interpersonal and electronic methods of message dissemination, mass media was cited to be the most effective form of communication in this particular campaign" (Johns Hopkins, 2005, cited in Prilutski, 2010:56).

1.2.7 Health Information Technology (HIT)

Information and Communication Technologies (ICTs) have become an integral part of teaching and learning today and can facilitate health literacy (Braun *et al.*, 2013:1-2; Deborah, 2015:6-7; Avila *et al.*, 2016:1-4). Health literacy is seen as the "cognitive and social skills that determine the motivation and ability of individuals to gain access to, understand and use information in ways that promote and maintain good health" (Wang *et al.,* 2012:4). Medical experts indicate that almost half of their patients cannot comprehend basic healthcare information and this has a negative impact on treatment increasing the chances of medical miscalculations (Walsh *et al.,* 2013:1405). Interventions such as the use of visuals supported by interpersonal contact or in other words, "teach back" mechanisms with healthcare providers have improved the health behaviour of people with low health literacy. Health intermediaries indicate that low health literacy is a determinant of most health problems and therefore needs to be addressed (Center for Healthcare Strategies (CHCS), 2010:2-8; Speer, 2017:15-17).

Furthermore most mothers living in underserved communities in sub-Saharan Afrika continue to have difficulties in accessing education (United Nations [UN] Report, 2012:3-5; Adanri, 2017:2-7). The lack of literacy affects the ability of women to access maternal health information and thereby increasing their chances of morbidity and mortality (Karlsen *et al.,* 2011:1-4). Providing health information to individuals with low literacy levels in underserved communities is a challenge in most sub-Saharan Afrikan countries such as South Africa and Ghana (Prilutski, 2010:52; Smith-Greenaway, 2015:14-18). *Thus, the problem underlying this study is to: explore alternative ways of integrating visual media (health information communication objects) as part of the continuing professional development for health intermediaries to use when educating and informing their patients in underserved communities.*

1.3 RESEARCH PROBLEM

Mothers in many Afrikan sub-regions do not have equitable access to education which could result in low literacy in underserved communities (United Nations [UN] Report, 2012:3-5). Illiteracy is perceived as the ***focal feature,*** which deprives the capabilities of persons and is the forerunner of social injustice. Literacy on the other hand is the determinant of poverty reduction and wellbeing of persons (Basu *et al.,* 2009:1). Educated women are able to make informed choices and be more mindful about healthy lifestyles to improve their health (Arthur, 2012:3). Therefore, the lack of equitable education in Afrika, negatively affects the ability of mothers to access health information services in underserved contexts.

Mothers in these Afrikan communities who are less educated, remain in the state of "literacy parsimony" (illiteracy), leading to low health literacy and that increases ill health. Ill health is both a cause and consequence of poverty. Hence, improvement of health is important for poverty reduction (Arthur, 2012:1) in many underserved communities in Afrika such as Ghana and South Africa. Health literacy is the ability to read, comprehend and act on health information and other related healthcare services to successfully function as a patient (Center for Healthcare Strategies [CHCS] Inc. 2010:1-3).

Health education serves as a critical component to improve the quality of life of individuals through improved health behaviour (Rissel, 2005:156-158; World Health Organisation [WHO], 2005:1-4; Le *et al.,* 2009:116) The literacy levels of individuals will influence the success of health education activities in underserved communities. In health education activities, only a few information communication objects are provided to mothers in underserved contexts. The available information communication objects are literacy dependent, which limits information use for affective health behaviour. Moreover, the limited health information objects mothers receive are often text dominated making it difficult to **read, understand** and **act** upon (National centre for Biotechnology Information [NCBI], 2008:para 3).

The inconsistencies associated with health information, reduces information quality provided to women with low literacy, which could deepen ill health. So the absence of quality information in health education activities might affect basic treatment offered to patients, increasing the chances of medical miscalculations (Walsh *et al.*, 2013:1405) that could compound a mothers' ill health. Therefore, health education activities without relevant health information might put low literate mothers at risk, **before, during,** and **after pregnancy**, increasing their chances of morbidity and mortality in underserved contexts in Afrika.

Consequently, the disparities with education and other determinants of maternal morbidity and mortality continue to jeopardise the health of women in Sub-Saharan Afrika. Therefore, a "mothers' education remains a powerful determinant to improve the quality of health education services in Afrikan sub-regions. Therefore, health education needs to be extended to mothers in underserved contexts in Afrika. Equitable access to quality healthcare is an essential pre-requisite towards achieving UN SDGs 3 milestones by 2030.

Thus, the need to conduct this research to explore health information service design, which could facilitate information sharing and exchange (interaction) between health intermediaries and mothers in underserved contexts (see Figure 1.3 on the next page). Improved healthcare services in underserved contexts would accelerate the attainment of UN SDGs by 2030 in sub-Saharan Afrika.

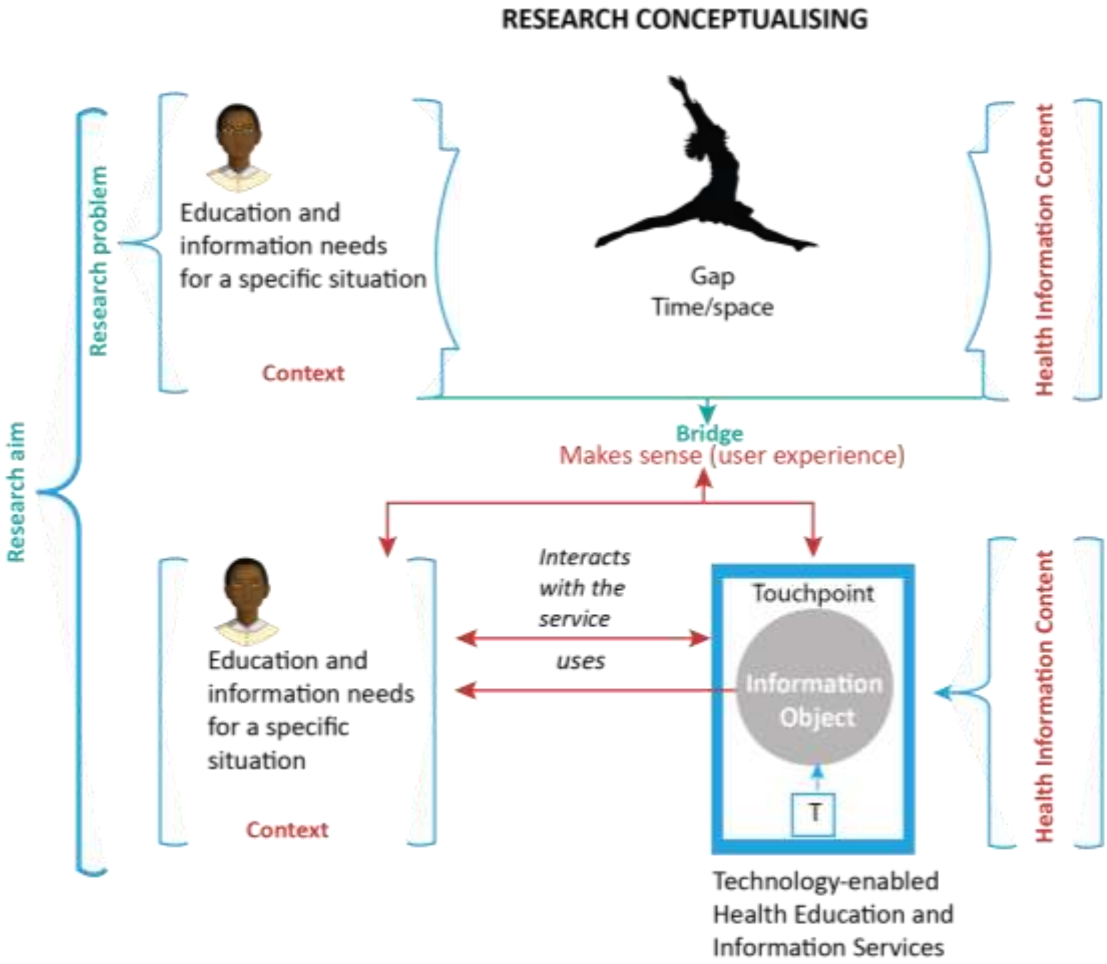


Figure 1.3: Research conceptualisation in the study

1.4 AIM AND RATIONALE OF THIS RESEARCH

The aim of this research is to determine how visual media and enabling-technologies could improve health information service delivery in response to the specific health education and information needs of health intermediaries and pregnant women in underserved contexts. Service design is explored as a strategy to gain new insights, make sense of context, and identify possibilities that could serve as new value propositions that could improve health information service delivery in underserved communities.

1.4.1 Sub-Research Aims

The sub-research aims of this study are to:

- Identify the health education and information sensemaking preferences of intermediaries involved in public health education and promotion activities in underserved contexts.
- Establish how public and private health service providers currently consider the health education and promotion needs of intermediaries and pregnant women.

- Determine how intermediaries and pregnant women make sense of technology–enabled visual information objects to be educated and informed about maternal healthcare matters using design processes.
- Explore different design processes and tools to obtain an understanding of how intermediaries and pregnant women make sense of health information based on their needs in an underserved context.

1.4.2 Rationale

The lack of education among young girls and women in sub-Saharan Afrika is high (United Nations [UN] Report, 2012:3-5). According to global reports by the UN, most expectant mothers can barely read and understand information (United Nations [UN] Report, 2012:18; Kalembo *et al*., 2013:32-33). Thus, the available health information services provided by health intermediaries are perceived to be literacy dependent. As such, women may find it difficult to act on healthcare information provided at healthcare centres. Visuals have the power to facilitate information communication more effectively between patients and health information service providers. Thus, the researcher explored the possibilities of integrating visual media (information communication objects) as part of the continuing professional development of maternal health intermediaries to educate their patients (mothers). The provision of relevant health information could enhance the health literacy rate amongst mothers in underserved communities. An improvement in maternal healthcare services, will reduce maternal morbidity and mortality and thus assist towards achieving global-health goals such as MDGs 4 and 5 which is now translated into UN SDGs 3 (United Nations Economic Commission for Africa [UNECA], 2015:VII-VIII; Pisano, *et al.,* 2015:15-16).

1.5 RESEARCH QUESTION, SUB-QUESTIONS AND OBJECTIVES

Table 1.1: Aligning research questions, methods and objectives

Research Problem (Summary)

Most mothers in underserved communities in the sub-regions of Afrika do not have equitable access to formal education, which has increased illiteracy among young girls and women (United Nations [UN] Report, 2012:3). The lack of literacy deprives a mothers' easy access to health information, which could result in low health literacy. Low health literacy may deepen ill-health in underserved communities in Afrika (Paasche-Orlow *et al*., 2005:175; Arthur, 2012:1). Moreover, there are few health information objects for patient education in these underserved communities in Afrikan sub-regions. The available health information objects for education are text dominated making it difficult to read, understand and act upon healthcare information (National centre for Biotechnology Information [NCBI], 2008:para 3; Madula *et al.*, 2018:1-2).

Furthermore, due to the low literacy level of information recipients, there are disparities in information communication between health intermediaries and their patients (mothers). These inconsistencies, among other determinants of quality healthcare, put mothers at risk before, during, and after pregnancy. This increases their chances of morbidity and mortality in underserved contexts in sub-Saharan Afrika (United Nations [UN] Report, 2011:26-29).

Research Questions
• What are the characteristics of technology–enabled health education and information services that could facilitate the ability of health intermediaries and pregnant women to make sense of health information relevant to their needs in underserved contexts? • How could technology-enabled health (education) information services be designed using visual media to facilitate interaction between intermediaries and pregnant women in underserved contexts?

Research Question	**Sub-Research Question**	**Research Objective**
1. What are the characteristics of technology-enabled health education and information services that could facilitate the ability of health intermediaries and pregnant women to make sense of health information relevant to their needs in underserved contexts?	**1.1** What are the alternative ways of assisting health intermediaries in disseminating information to support pregnant women in making informed decisions during prenatal, antenatal, neonatal, and postnatal periods?	To identify the health education and information sensemaking preferences of intermediaries involved in public health education and promotion activities in underserved contexts.
	1.2 How does the circumstance of health intermediaries and patients in underserved contexts affect the dissemination of relevant health information services?	To establish how public and private health service providers currently consider the health education and promotion needs of intermediaries and pregnant women.
2. How could technology-enabled health (education) information services be designed using visual media to facilitate interaction between intermediaries and pregnant women in underserved contexts?	**2.1** How can health information communication services be designed to meet the education and information needs of patients (women) with low literacy levels?	To determine how intermediaries and pregnant women make sense of technology – enabled visual information objects to be educated and informed about maternal healthcare matters using design processes.
	2.2 What are the available service design research processes and tools that could be explored to design health information services in underserved contexts?	To explore different design processes and tools to obtain an understanding of how intermediaries and pregnant women make sense of health information based on their needs in an underserved context.
• **Why do healthcare providers have difficulties in communicating health information to mothers in underserved contexts?**	Literature analysis; Informal interviews/ conversation Service user surveys (Opinionnaires/ questionnaires) (Elicitations based on feedback from informal interviews with health intermediaries)	To identify possible barriers to information communication between health intermediaries when informing and educating their patients

- **How can health intermediaries improve health literacy among pregnant women in underserved contexts?**	Literature analysis Service design activities such as co-design workshops, observations Informal interviews/ conversations	To explore ways of designing health information services and objects with health intermediaries in underserved context
- **What basic health information needs to be transferred by health information providers in support of mothers during the prenatal, antenatal, and postnatal period?**	Literature analysis Service design activities (co-design workshops, observations, informal interviews/conversations etc.)	To identify the available health education materials (information objects) used to support mothers before, during, and after pregnancy
- **How do mothers access relevant health information during the prenatal, antenatal and postnatal, periods?**	Literature analysis Service design activities (co-design workshops, observations, informal interviews/conversations etc.)	To ascertain the availability of relevant maternal health information for mothers, before, during and after pregnancy
- **What modes of communication are employed during health education interactions with mothers in underserved communities?**	Literature analysis Service design activities (co-design workshops, observations, informal interviews conversations etc.) Service user surveys (Opinionnaires/ questionnaires)	To identify information objects used for interaction between health intermediaries and women during health education activities
- **How can information objects (visual media) be developed as a non-literacy dependent tool for effective maternal health information communication?**	Literature analysis Service design activities (co-design workshops, observations, informal interviews/conversations etc.)	To explore ways of integrating information objects (visual media) as part of health information services to facilitate interaction between health information providers and mothers during health education activities

1.6 ASSUMPTIONS

Global statistical reports show that there are fewer women who have attained basic education than males (World Health Organisation [WHO], 2010:15-16). It is envisaged that, the minority of females in underserved communities in Sub-Saharan Afrika are educated (UNESCO, 2013:1; UNESCO, 2015:2-3; Pons-Duran *et al.,* 2016:32-34). For instance, in sub-Saharan countries such as South Africa and Ghana, there are more males who have obtained basic education, than females. In a report by Statistics South Africa (SSA) on education in 2016, a large proportion of females (55.3%) had no education as compared to their male (44.7%) counterparts. In the same report by

Statistics South Africa, there are similar disparities in relation to equity in schooling across all levels of education which favoured males over females (Statistics South Africa [SSA], 2017:16; Statistics South Africa [SSA], 2018:13-15).

Secondly, according to the Ghana Statistical Service (GSS) 2010, Census report, the percentage illiteracy rate for males 11 years and above is 19.8% whereas 31.5% of females of the same age group, are illiterate (Ghana Statistical Service [GSS], 2012:41). These global statistical reports on education imply that most of the uneducated population within Afrikan sub-regions are predominantly females. Notably, in many countries, once girls have access to education, they are able to perform better than boys (UNESCO, 2008:4-5). Nelson Mandela indicated, "*Education is the most powerful weapon which you can use to change the world*". As such, providing equitable access to education could make a difference in sub-Saharan Afrikan countries (Humphreys, 2010:XVII-XX). An increase in the literacy ratio among females could reduce poverty and ill-health (Pons-Duran *et al.,* 2016:51; Speer, 2017:15-16).

Although efforts are being made to increase the literacy ratio in sub-Saharan Afrika, challenges still exist in underserved communities where there is limited access to education. This in turn, undermines access to quality healthcare (UNESCO,2015:2-3). Even so, healthcare service providers are exploring available mass media to send health information to women in underserved communities to promote quality healthcare. Knowing that the majority of the less educated population in sub-Saharan Afrika are women (UNESCO, 2008:4; UNESCO, 2015:2-3) there is a need for health educators to provide relevant health information to mothers with low literacy. The provision of relevant health information during health education in underserved communities could promote a health-literate society. Health literacy is a necessary currency required to improve the health of society (Paasche-Orlow *et al.,* 2005:175) such as reducing maternal morbidity and mortality in sub-Saharan Afrika. An improvement in education and healthcare services to global standards particularly in maternal healthcare will go a long way in contributing to a healthy society (UNESCO, 2013: 2-3; Pons-Duran *et al.,* 2016:32). An educated and healthy society could accelerate sub-Saharan Afrika's progress towards meeting global health-related goals such as UN SDGs three (3) (Pons-Duran *et al.,* 2016:51-52; United Nations [UN] Report, 2018:7).

1.7 DELINEATION AND RESEARCH CONTEXT

The main research case for the study was situated in the Western Cape Province of South Africa. The study was predominantly conducted in the Grabouw area and other locations in the Western Cape Province. The choice for selecting this particular research case is because the investigation is being conducted through one of CPUT Living Labs for education and research —Kujali Innovative Incubation Hub (Kujali Lab). The Grabouw case was selected as the main research context as part of on-going Kujali Lab initiatives to explore technology–enabled innovative solutions in the Western Cape Province of South Africa. The Kujali Lab initiatives align with the phenomenon being researched in this study, which served as one of the motivations for selecting the Grabouw case in South Africa.

Furthermore, some of the research outcomes were also tested in the Kumasi Metropolis in Ghana as the replication case. The rationale for this replication design is to predict similar or contrasting results from both cases (Yin, 2009:54) in a similar underserved context in sub-Saharan Afrika. The research context and motivation for selection is detailed further in **Chapters Four (4) and Five (5)** of the study.

The research domain was in maternal health information services provided by health intermediaries when educating patients. The focus of the study was on basic health information needs of health intermediaries for educating mothers before, during, and after pregnancy stages in maternal healthcare service delivery. In this research case, the investigation was not extended further to cover practical processes of childbearing during maternal healthcare services. Thus, the scope of the study revolves around how health intermediaries disseminate health information to women based on their needs considering their literacy levels in underserved communities in Afrika.

1.8 RESEARCH DESIGN

Research design allows researchers to plan their study at the forefront of the investigation. A carefully planned study will make is easier to collect data and analyse the data. An overview of the research design and process for this study is shown in Figure 1.4. A description of the methodological, philosophical, and theoretical perspectives as well as the data analysis and findings are detailed in subsequent **Chapters (Two – Nine)** of the study.

Figure 1.4: Research design – indicating the major stages in this study

The research design for this study originated from the **research idea**, which started from the **research topic** under investigation. The **literature review** was obtained from primary, secondary, and tertiary sources, which provided relevant information to guide this study. The literature covered two broad categories in **healthcare** and **service design**. Additionally, theoretical and philosophical perspectives in line with **interpretive research**, **service design,** and **sensemaking theories** were studied which formed the foundations of the research. This study was conducted through service design research methodology, which is qualitative in nature. Service design tools and processes were used during data collection. **Data analysis** for this study was organised into two major categories and analysed through an inductive approach. The data obtained in **Phase I** (service design activities) of the study was based on **service design activities**, which was analysed inductively as **category one**. Secondly, data obtained from **Phase II** was derived from the **service user surveys** (opinionnaires), which were analysed as a **second category of information obtained in the research.** In this case, qualitative data obtained through the open sections of the user surveys was grouped into themes and analysed. The responses obtained from the closed sections were quantified and analysed through an inductive approach using descriptive analysis. **Sensemaking** and **service design theories** were explored through adjustable theoretical lenses to analyse the data obtained for this study. A detailed discussion on service design and sensemaking theories and how they were used for data collection is further discussed in subsequent **Chapters (Four – Nine)** of this study**.** Some of the research outputs obtained from this study have been shared in reputable conferences and journals related to healthcare and service design.

1.9 SIGNIFICANCE OF THE RESEARCH

Firstly, the research is significant because it brings out the role and contribution of service design to healthcare services in sub-Saharan Afrika regions such as South Africa and Ghana. In this research, outcomes obtained will serve as reference material and body of knowledge for researchers in **Health Science, Information Science, Communication Science, Education Science, Information Communication Technology** (ICT) and **Design Science**. In addition, the results of the study could inform and serve as a useful reference to relevant institutions in sub-Saharan Afrika when drawing up strategies for maternal health education in underserved communities. The research findings obtained could inform maternal health intermediaries to identify ways of closing possible health information dissemination discrepancies during interaction with their patients (mothers). Projections are that the outcomes of this study will serve as a basis to provide relevant information that could improve maternal health literacy in underserved communities in South Africa and Ghana.

Secondly, this study serves as an example of health information service design, which could be replicated in similar underserved contexts in Afrikan sub-regions. In this study, a **service design** and **sensemaking** framework is proposed that could be explored by future researchers as analytical lenses when designing health information services in underserved contexts. Additionally, one of the practical solutions of this study is a proposed technology-enabled health information service solution with **multimodal functions.** The prototyped **multimodal healthcare system** is designed as a feasible health information service solution to facilitate interaction between health intermediaries and mothers. The multimodal health information system will consist of visual media components that could facilitate information sharing and exchange during health education activities in underserved contexts.

Thirdly, it is envisioned that the introduction of technology-enabled health information service solutions could provide equitable access to relevant information to mothers in far-to-reach areas in Afrikan sub-regions. The availability of quality information during health education activities could increase health literacy and reduce maternal morbidity and mortality in underserved contexts. Also, an improved health information system to educate mothers will accelerate the attainment of health related goals as indicated in the MDGs 3, which has now been translated into UN SDGs 3 - "**Ensure healthy lives and promote wellbeing for all ages"** (Pisano *et al.*, 2015; United Nations [UN] Report, 2018:7). The proposed multimodal system will contribute to improving maternal healthcare services and propel indicators of UN SDGs 3 for the socio-economic development in Afrikan sub-regions such as South Africa and Ghana.

1.10 CONCEPTUAL MODEL FOR INTERACTION

The conceptual model indicated in this section is a combination of the main concepts in this study to give readers an idea of the main concepts being discussed. The diagram shows the information communication process (interaction) between health information service providers such as health intermediaries and their patients (Figure 1.5). The basic underlying concepts in the diagram were drawn from interpersonal communication model and this research.

The emerging conceptual model for interaction represented as Figure 1.5 is modelled after Cleary's *et al*. (2008:3) interpersonal communication model. Interpersonal communication is a process of creating meaning between people through the process of interaction (Stewart,1999:28; Scheming, 2012:3; Hartley, 2014:5-9). The diagram (Figure 1.5) shows a continuous process in which each element has an impact on the outcome of the entire information communication process. The elements in the conceptual model (Figure 1.5) are described in relation to the perceived interaction between health information service providers and patients in the context of this study. The diagram (Figure 1.5) illustrates interaction between health intermediaries and patients during health education activities in an underserved context of this study. The broken lines show the possible discrepancies that may occur during health information communication between health intermediaries and their patients.

Secondly, the diagram shows the potential sources of information, which is labelled as health **information service providers** in Figure 1.5. **Health information service providers include health intermediaries** who provide health education and information services to patients. The **health information** (messages) transmitted is in the form of **codes**, which is influenced by the context of information senders and recipients (audiences). Thus, the research revolves around gaining insights about context, the information communication gaps and exploring the integration of technology-enabled health information service solutions (information communication objects). It is envisioned that the healthcare service solution with relevant information objects could facilitate interaction between health intermediaries and patients during health education activities in underserved contexts.

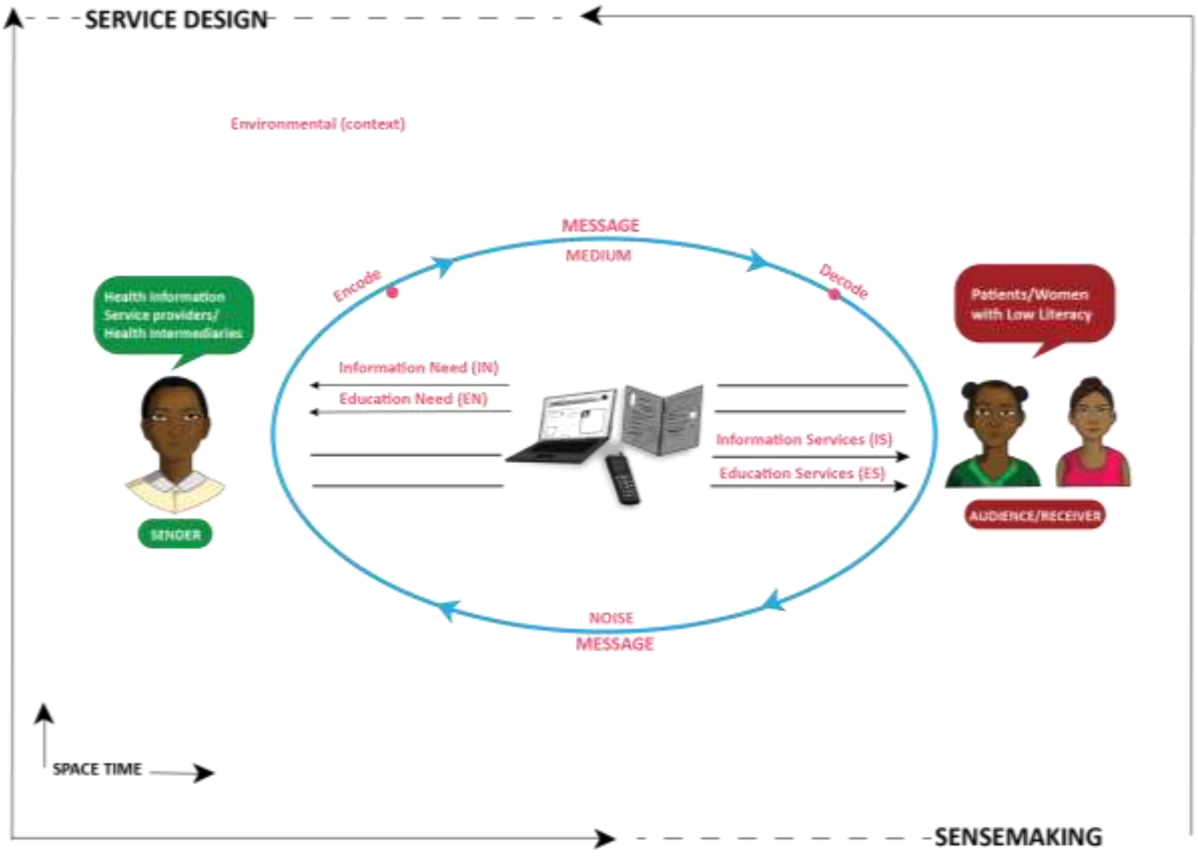


Figure 1.5: Conceptual model for interaction
(The model shows possible interpersonal communication between health information senders and receivers as well as sources of health information. The conceptual model is based on an interpersonal communication model)
(Source: adapted from Cleary *et al.*, 2008:3)

1.10.1 Basic Elements in the Conceptual Interaction Model

- **Sender:** is the originator of the information that is presented in a form of code also referred to as the **encoder** or communicator of the information. It refers to the individual who often initiates the conversation (Cleary, 2008:3; Hartley, 2014: 5-9). In this case, the communication is viewed as a continuous process and therefore, the **sender** could be both the health intermediaries and patients since they exchange information in a given interaction during health education activities

- **Audience**: is the recipient of the information. The information is often directed to specific individuals who might benefit from the information (Stewart, 1999:7; Cleary, 2008:7). In this study, the recipients of the information are mainly mothers in underserved contexts. Some of the women in these underserved contexts may possess some amount of literacy while others may not have sufficient literacy to comprehend health information

- **Medium:** is the means, channel or form in which the information is transferred to the audiences (receivers) (Stewart,1999:7; Cleary, 2008:6). In the context of this study, the medium is also referred to as **health information communication objects**
- **Message:** is the encoded information, which is actually sent to the audiences (information recipients). The receiver ***decodes*** the information by interpreting the information received from the sender (Stewart,1999:7; Cleary, 2008:7)
- **Decoding:** in a communication process refers to receiving, interpretation and comprehending information by the audiences. In this context it refers to the how mothers or patients (audiences/recipients) interpret health information they receive from senders (Stewart,1999:7; Cleary, 2008:7)
- **Feedback:** is the responses obtained from the audiences (recipients) based on information received from senders in a given context (Stewart,1999:7; Cleary, 2008:7). For example, health intermediaries (senders) will expect to see some feedback from patients (information recipients) such as improved health behaviour after consistent health education activities in underserved communities
- **Noise:** refers to anything that interferes with the information being transmitted from source (sender) to the audience (recipient) and vice versa, such as language differences and other physiological issues (Stewart,1999:7). The presence of noise may create discrepancies that represent the gaps in the continuous flow of information communication process within a given environment
- **Context/Environment:** refers to the context in which the communication is taking place which impacts the outcome of the communication (Stewart,1999:8). The context is the main situation, which is being explored in this research case to unearth complexities surrounding health information and health education activities in underserved contexts. The context of **information recipients** is being researched to gain new insights about information needs of health information intermediaries that could be **encoded** to facilitate **interaction** between them and their **audiences** (patients) to obtain the desired **feedback**
- **Health Information Need (HIN):** refers to the information needs and wants by audiences (patients) in this research context
- **Health Education Need (HEN):** the need for patients to receive relevant information to satisfy their educational need in this research context
- **Health Education Service (HES):** health education services provided to audiences (patients) to meet their education needs

- **Health Information Services (HIS):** refers to health information services provided to audiences (patients) to meet their desired information needs in underserved contexts

- **Sensemaking:** is the theory being explored as analytical lenses to understand the context for change making in future health education activities in an underserved context of this study (Dervin ,1998:36)

- **Service design:** refers to the methodological (designerly) approach used to explore health information service design in the selected research context in space and time (Mager, 2006:6)

1.11 STRUCTURE OF THE THESIS

This thesis is essentially structured into **nine chapters** to make it easier for readers to follow major research procedures and discussions sequentially as outlined in the study**. Chapter One** covers the overview of the study. The thesis opens with a description of the research conducted which serves as an **introduction** to the study. The introductory section of the research problem and its setting are described in the said **Chapter (One).** The background of the research problem is based on the literature analysis that supported the subject under investigation. Therefore, **Chapter One,** deals with the research case and gives a background to maternal health education and the provision of healthcare services in sub-Saharan Afrika. Other significant issues presented here include objectives, basic assumptions, research questions, rationale, and the significance of this study. The chapter is concluded with the research design of the study.

1.11.1 Subsequent Chapters of the Thesis

The subsequent chapters of this thesis are described as follows:

- **Chapter Two** covers the literature analysis of this study, which was conducted using hermeneutics as an approach to analysing and interpreting information obtained. This section represented **Phase I** of the literature obtained which placed the study in **healthcare** as the research domain**.** Some of the major topics reviewed were *healthcare services, health education services, health information services, healthcare service providers and recipients*. These health- related topics were aligned to maternal healthcare services in underserved contexts in Afrikan sub-regions. The literature analysis provided a holistic view of education and its impact on maternal healthcare services in sub-Saharan Afrika, which set out the direction of the research

- **Chapter Three** serves as **Phase II** of the literature review, which positions the study in design and service design research. In this chapter, available service design processes and tools for designing are described. These provided a context for the study in design. Literature analysis supporting the design of healthcare services and available cases where service design has been applied is documented in this section. The chapter concludes with available cases in healthcare services where innovative solutions have been proposed through service design methods

- **Chapter Four** presents a further exploration of available theories that could serve as adjustable analytical lenses for the service design activities in the research context. Sensemaking Theory was identified as a suitable theory for analysis in this service design research. In this chapter, a further investigation of the sensemaking process has been described, which serves as a theoretical framework for the analysis and discussion in this study. The chapter concludes with a description of the strategies for the data analysis in this research case

- **Chapter Five** addresses the service design research methodology that was explored for data collection in this research case. The data collection was organised into two major Phases. The design processes, tools and data collection procedures in **Phase I** and **Phase II** of this study are indicated in this section. In addition, philosophical perspectives, emerging theoretical frameworks and service design ethea are documented in this chapter. The chapter concludes with a description of ethical considerations used for the data collection in the context of this study

- **Chapter Six** describes how service design activities were conducted in various research contexts. The service design interventions such as co-design activities, which were explored with participants, are elaborated in this section. In addition, the processes involved in prototyping the multimodal health information system are described. Furthermore, an emerging design process model is suggested to inform future research activities in similar contexts. The chapter ends with the researcher's reflections and implications for further research

- **Chapter Seven** is a compilation and interpretation of data obtained from service user surveys (opinionnaires) administered to health intermediaries and mothers in the various research contexts. The chapter concludes with a summary of insights derived and implications for further research in South Africa, Ghana and other sub-regions in Afrika

- **Chapter Eight** details the discussion of the research findings obtained in this study. Information obtained from using service design and sensemaking theories (adopted as analytical lenses) are presented in this section. The chapter concludes with a summary, highlighting outcomes of this study and implications for future design and development of health information services in underserved contexts

- **Chapter Nine** is allocated as the conclusions and recommendations section. The summaries of the major chapters are briefly described and reflections from the researcher's perspectives are indicated. The chapter ends with a description of the **knowledge, practical, methodological** and **theoretical contributions** of this study. These are aligned to the findings of the study and recommendations for further research are suggested. Furthermore, challenges that limited the study are indicated in this section. The chapter ends with a summary of this entire study with suggestions and implications for further research in similar settings in sub-Saharan Afrika

- **Appendices –** the final section of the thesis is made up of the **Appendices**, which is a compilation of all supporting documents and other relevant information in relation to this study. Included, are the researchers reflections from this service design research and experiences from the entire study (see Figure 1.6 on the next page)

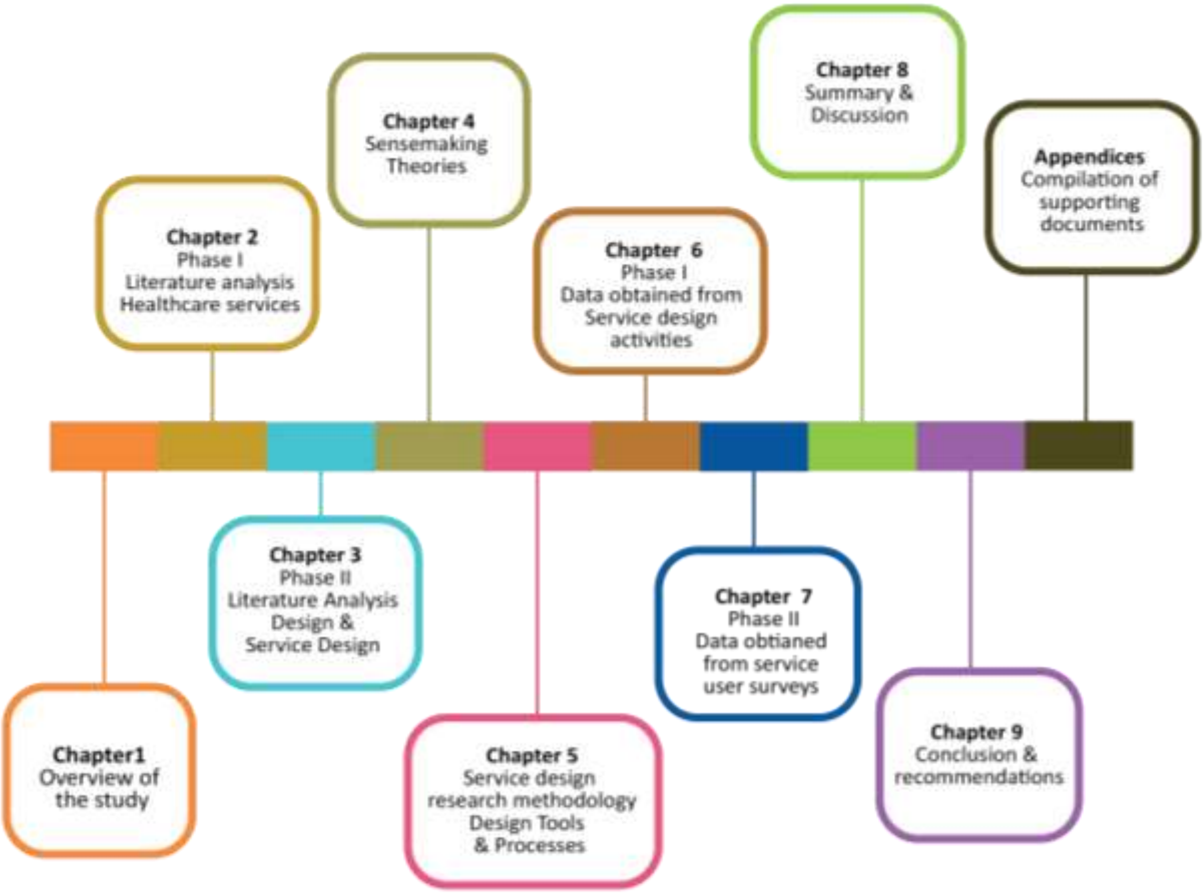


Figure 1.6: Organisation of chapters in the study

CHAPTER TWO: REVIEW OF RELATED LITERATURE – PHASE I

SITUATING THE STUDY IN HEALTHCARE SERVICES

“If design fails to offer something positive to society then design fails” – Sam Livingstone

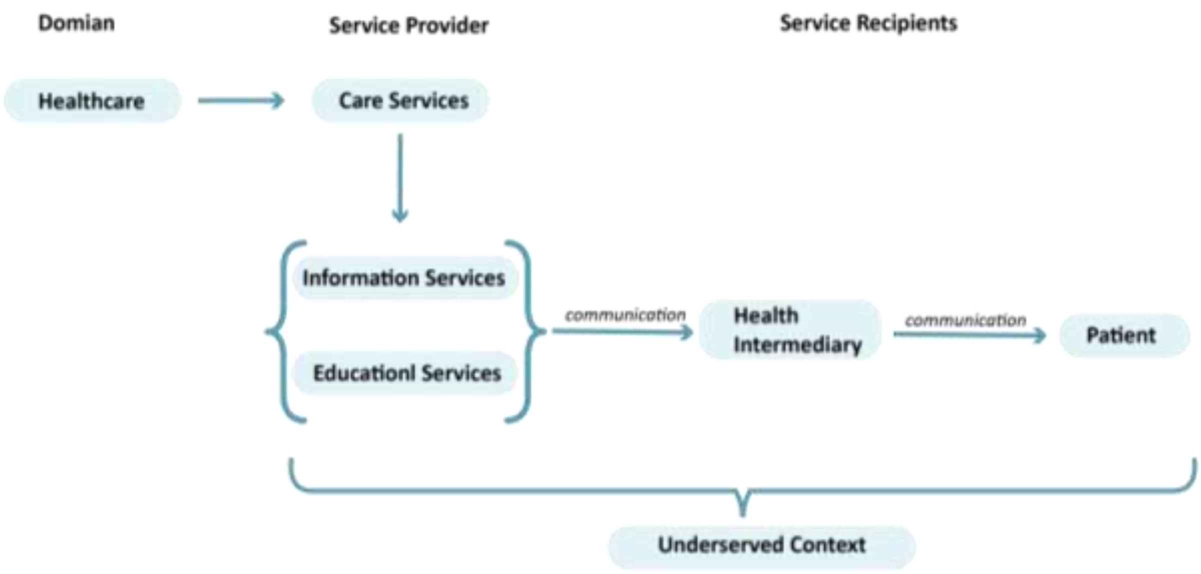


Figure 2.1: Main concepts discussed in Chapter Two

2.1 INTRODUCTION

This chapter is the *first phase* of the *literature review* and situates this study in *healthcare services* (Figure 2.1). Hermeneutics was used in this case as a methodological approach for the literature review. The hermeneutics process of literature offered a better way of interpreting and understanding the text identified. Information presented in this section was obtained from **primary**, **secondary,** and **tertiary** sources. In the search for information, key terms such as **healthcare, health education, care services, and health information** were used to guide the search. The primary sources of information were mainly from unpublished documents such as government reports and theses. Data obtained from secondary sources included books, reports and newsletters. The tertiary sources were mainly from the internet using search engines such as Google Scholar, ScienceDirect, EBSCOhost, and Jstor. Through the assistance of Mendeley referencing software, the information obtained from the various sources were categorised to facilitate the referencing processes (Figure 2.2). The data obtained from the review have been discussed in relation to maternal healthcare services in the Afrikan context.

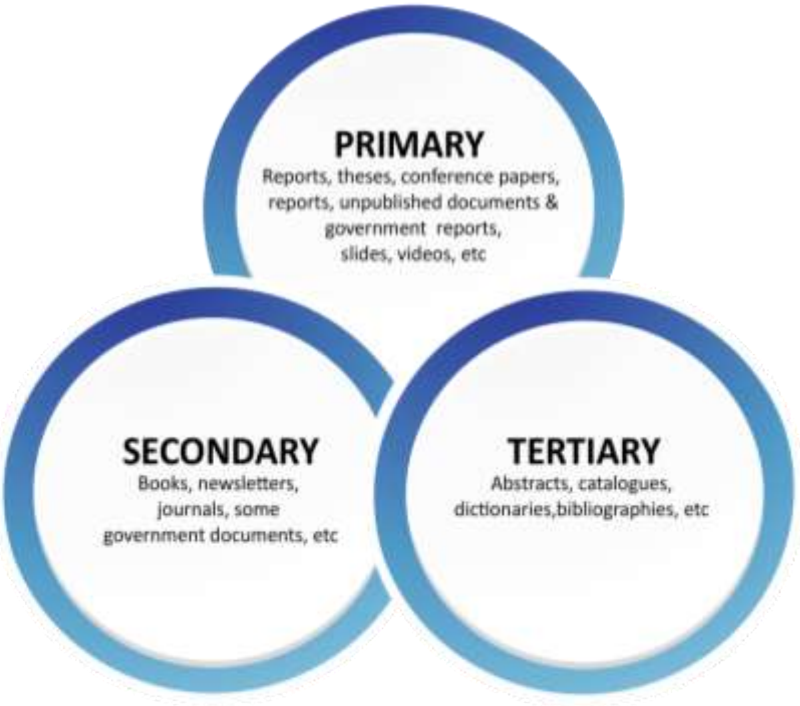


Figure 2.2: Sources of literature for the study

The search for relevant information for this study covered topics such as: **services, healthcare, healthcare service providers (health intermediaries)** and **healthcare service recipients (patients)**. In addition to these areas, topics such as **health information**, **visual information** and **health information services** were reviewed. Other significant topics that were studied included the following: **education, health education, information for educational purposes,** and **visual information for educational purposes**. The literature review provided an insight into what the field looks like in terms of providing healthcare services in underserved contexts. In the process of the literature review, some of the gaps that exist within healthcare services were identified. These gaps pertain to providing equitable health information services in underserved communities.

This study has not been written from the viewpoint of a professional health scientist, information technologist or information scientist. Instead, it has been written from the perspective of a designer-researcher within a transdisciplinary research domain. In this section, attempts have been made from a designer's lens to establish some of the relevant concepts in healthcare. Navigating through these key concepts in healthcare services provided an insight into the main disciplines. Information obtained through the literature was obtained through the process of **identifying, understanding,** and **analysing** relevant information. The information obtained served as a baseline to uncover global views about healthcare services and maternal healthcare in Afrika.

Also, the literature review provided an overview of how the different multidisciplinary fields in healthcare are interrelated in this study. However, in the process of generating knowledge in this research, efforts have been made not to compromise major concepts in the various disciplines that are being discussed. This study is predominantly focused on **health information** and **education services** in an underserved context. Therefore, in this case, the interpretation and analysis of the information obtained, focused on the communication aspects of providing information and educational services to potential recipients in an underserved context. Since information is very relevant in communication, there was a need to look at the literacy levels of recipients and also how they make sense of information and education they receive as a service. The knowledge obtained from the literature in the sphere of healthcare services in underserved communities, could serve as a starting point for other researchers in fields such as design, healthcare, information technology and information science.

2.2 HEALTHCARE

Healthcare is one of the fields where humans are at the centre of the services provided. The provision of sustainable healthcare services in various communities across the globe is critical to improve the health and wellbeing of persons. For instance, in many developing and less developed countries, Maternal and Child Health is a major concern since it has direct implications on the socio-economic development of these countries (Humphreys, 2010:XV-XVI). Afrikan countries such as *Nigeria, Ghana* and *South Africa* are making constant efforts to reduce maternal morbidity and mortality (Olayinka *et al.,* 2014:10). However, countries within the Afrikan regions have many challenges and these have delayed their progress in meeting global health goals. Some of these challenges include education, poverty reduction and other indicators needed to be addressed in order to accelerate the pace to meet these global health goals. Strategic plans such as the Millennium Development Goals (MDGs) and United Nation (UN) Sustainable Development Goals (UN SDGs) (Figure 2.3) need to be contextualised to meet the specific needs of the selected countries (Matte *et al.,* 2015:15). However, with assistance from countries located within developing regions and support from international organisations, some of these health goals can be met (Osborn *et al.,* 2015:3).

Figure 2.3: United Nations (UN) Sustainable Development Goals (SDGs)
(Source: Google images)

2.2.1 GLOBAL HEALTH RELATED GOALS

This study revolves mainly around MDGs which have now been translated into UN SDGs 3, 4 and 5 (World Health Organisation [WHO], 2015:4-5). Although, the MDGs have elapsed, they have been well translated into the UN SDGs as indicated in Table 2.1. For instance, MDGs 3 and SDGs 4 and 5 all seek to promote equitable access to education and to empower women (Appendix 17: click to watch UN SDGs – [**[17H]** **SDGs|17 goals**]). Whereas MDG 4 and 5 are translated into UN SDG 3 (Pisano *et al.,* 2015:15-16; United Nations [UN] Report, 2018:7). As such, the literature is dominated with global views as indicated in the *"then"* MDGs which have been translated into the UN SDGs *"now"* (Figure 2.3). Occasionally, the UN SDGs have been mentioned in the text to position it within emerging global views on health and wellness (Appendix 17: click to watch UN SDGs on maternal health **–** [[**17 I**] **UN SDGs**]). Thus, this study is an effort aimed at meeting UN **SDG 3** – "***ensure healthy lives and promote wellbeing for all ages*"** (Pisano, *et al.,* 2015:15-16).

Table 2.1: Comparing UN SDGs and MDGs (Source: Pisano, *et al.,* 2015:15-16)

Millennium Development Goals (MDG) (ended in 2015)		**United Nations (UN) Sustainable Development Goals (UN SDGs - starts in 2015 and ends in 2030)**	
MDG3	Promote gender and equity and empower women	**Ensure healthy lives and promote wellbeing for all ages**	**SDG 3**
MDG4	Reduce child mortality	Ensure inclusive and equitable quality education and promote lifelong learning for all	**SDG4**
MDG 5	**Improve maternal health**	Achieve gender equality and empower all women and girls	**SDG5**

2.2.2 Maternal Healthcare

Maternal health plays a vital role in the development of countries. As such, countries continue to strive for strategies to improve maternal healthcare services. The MDG 5 aimed at reducing maternal morbidity and mortality by three quarters by 2015 (United Nations [UN] Report, 2011:4; World Health Organisation [WHO], 2015:5). Therefore, providing equitable healthcare services to women reduces the morbidity and mortality ratio which will lead to a healthier happier nation and eventually reduce poverty (Humphreys, 2010:53; Pons-Duran *et al.,* 2016:94). For example, the Ghana Poverty Reduction Strategy (GPRS) indicate that there is a causal relationship between poverty and ill health. Ill health is both a cause and consequence of poverty. Hence, improvement of health is important for poverty reduction in many developing countries (Arthur, 2012:1; Pons-Duran *et al.*, 2016:12).

In most developing economies, it is evident that women form the greater part of the population. This makes it crucial for their health to be taken seriously. According to the UN reports on the MDGs, there are great disparities among Afrikan nations in terms of basic coverage of maternal health interventions such as antenatal and postnatal care. In 2010, UN reports indicated that **South African countries** made considerable progress in providing universal coverage in healthcare (as indicated in Figure 2.4). *However,* the statistics showed that, most women in the rest of sub-Saharan Afrika did not receive Antenatal Care (ANC) visits during the year, 2010 (United Nations [UN] Report, 2012:34).

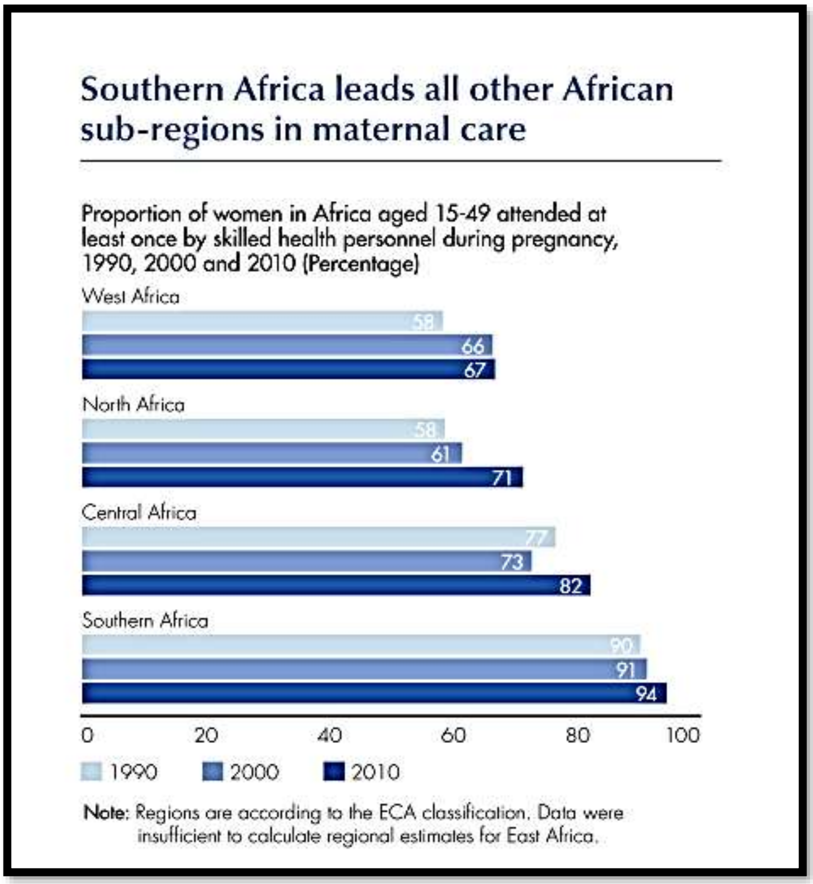


Figure 2.4: Afrikan regions making progress in (MDG 5) maternal health (Source: United Nations [UN] Report, 2012:32)

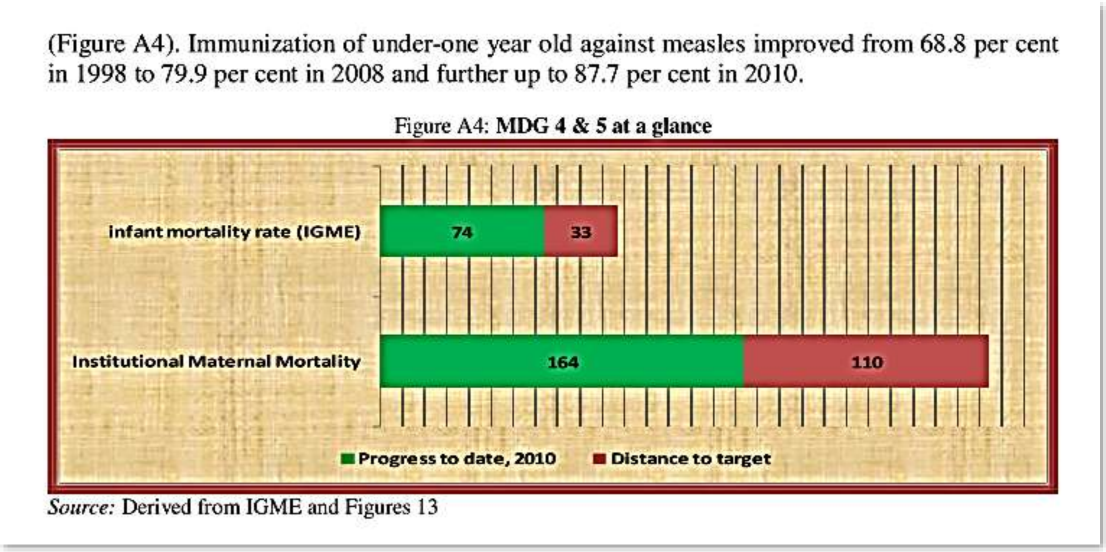
2.2.3 Maternal Care: South Africa

Maternal healthcare as the global health report states has improved in sub-Saharan Africa (World Health Organisation [WHO], 2015:5) and in particular South Africa over the years (Figure 2.3). As compared to many sub-Saharan Afrikan countries, South Africa has made considerable progress in maternal healthcare (United Nations [UN] Report, 2012:32; United Nations [UN] Report, 2018:3). The prevalence of HIV and AIDs in South Africa increased morbidity and mortality ratio in the year 1990 (Statistics South Africa [SSA], 2015:1). However, this gap was reduced in the mortality ratio of 40% between the years 2006–2010. South Africa has intensified its health programmes to include more health promotion and prevention mechanisms to address maternal and child mortality holistically. Some of these interventions include intensifying immunization, encouraging breastfeeding and increasing the availability of HIV/AIDs and TB programmes (Statistics South Africa [SSA], 2015:4; United Nations Economic Commission for Africa [UNECA], 2015:27-27).

However, it is suggested by policy makers that having a good surveillance system in place can potentially provide actual data to reflect the situation at the grassroots level in the communities (Statistics South Africa [SSA], 2015:3). The actual statistics obtained at grassroots level will facilitate the implementation of practical solutions that can practically reduce maternal morbidity and mortality (Statistics South Africa [SSA], 2015:26).

2.2.4 Maternal Care: Ghana

Maternal health in Ghana, just as in many other Afrikan countries, is of great concern to nations. The health of mothers and children serves as part of the determinants for the socio-economic development of countries towards improving the quality of life of its populace. In Ghana, maternal healthcare has been improving over the past 20 years. According to UNDP, a report on Ghana (Figure 2.4) indicates that, "Institutional maternal mortality rate has reduced from 216 per 100,000 live births in 1990 to 164 per 100,000 live births in 2010. The remaining distance to the MDGs was 110 to the target of 54 per 100,000 live births by 2015" (UNDP Ghana, 2012:19). However, in a recent report by the Ghana Demographic and Health Survey in 2014, maternal mortality ratio has declined to 60 deaths per 1000 which is a considerable improvement towards meeting the MDGs in 2015 (Figure 2.5). Moreover, there are many children who are not immunised by their first birthday and mothers still do not have equal access to antenatal care (Thompson & Evans-Klock, 2015:39-40). Therefore, efforts need to be channelled into healthcare programmes to improve healthcare services for women, in order to reduce maternal morbidity and mortality in developing regions such as Ghana.



(Figure A4). Immunization of under-one year old against measles improved from 68.8 per cent in 1998 to 79.9 per cent in 2008 and further up to 87.7 per cent in 2010.

Figure A4: **MDG 4 & 5 at a glance**

Source: Derived from IGME and Figures 13

Figure 2.5: MDG 5 progress so far in Ghana
(Source: UNDP Ghana, 2012:19)

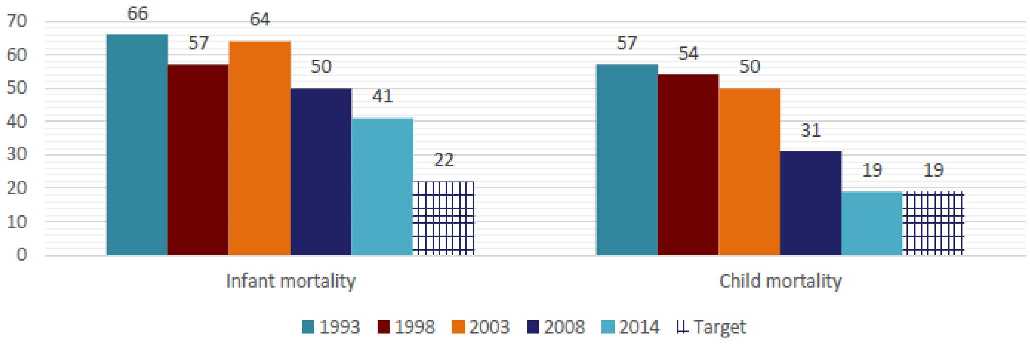


Figure 2.6: Infant and child mortality rate, 1993-2014
(Source: Thompson & Evans-Klock, 2015:40)

2.3 SERVICES

Services as an income-generating avenue have contributed enormously to many economic developing countries. Services have now developed from manual to automated systems towards improving customer satisfaction (Sethi & Gott, 2017:1-8). Services such as education, healthcare, banking, transport, tourism, housing, and many others are some of the examples of income-generating services across the world. Most often, these services are designed for customers to utilize and satisfy their pressing needs. An example of a working service is the UBER transport service (Uber, 2015:1-9; Matherne & O'Toole, 2017:561-564), which has been rolled out in some parts of Afrikan countries. This service is and it is very practicable in countries such as South Africa and other parts of the world (Figure 2.6). The success rate so far with UBER transport has largely been due to customer satisfaction and reward systems (Qorbani *et al.*, 2017:2; Africa Renewal, [https://goo.gl/d7pUK3], 2017:para 1-3).

Figure 2.7: Uber Services
(Source: Uber, 2015:23; Africa Renewal, [https://goo.gl/d7pUK3], 2017:para 1-3])

Other small-scale services such as barbering, laundry services, and printing services may not require complex strategies to improve as compared to complex businesses. Complex services such as airline businesses, restaurants, education facilities, shipping services and many others all require constant improvement to enhance customer satisfaction, hence the need for service design to improve these services. An example of a complex service system where improvements are being made in Afrika is in healthcare. Healthcare providers have instituted online booking systems for their clients in order to ease the delays at the clinics. In other contexts, systems have been put in place such as mobile applications to inform pharmacists and doctors, ahead of time of prescribed medications to avoid delays at the dispensary and clinics. In South Africa, some of these systems are in place and have proven to enhance healthcare service delivery to patients. An example of a healthcare system is the **Hello Doctor** application (Figure 2.7). This system is aimed at providing primary healthcare services to people (Van Niekerk, 2014:84). It is not designed to replace face-to-face consultation or emergencies but to provide health information to promote preventive healthcare (Momentum, 2017:1; Hello Doctor, [www.hellodoctor. co.za], 2019:1).

Figure 2.8: Hello doctor App
(Source: Hello Doctor, [www.hellodoctor. co.za], 2019:1)

However, the case is different when some of these services have to be extended to people in underserved contexts to provide equitable access to healthcare. In most cases, populations living in underserved contexts are not privileged to access all the quality services that are available in the major cities. Some of these limitations are due to educational and economic reasons. In this research context, the majority of the people living within the selected communities are low-income earners and their educational levels are low. As such, to provide equitable healthcare services in such a context, requires designers to explore bottom-up approaches that can improve patient care (Fuad-Luke, 2011:89; Manzini, 2015:175; Cipolla & Reynoso, 2017:147-148).

2.3.1 Healthcare Services

In developing economies such as Afrika, healthcare services are mainly situated in the major towns and cities. Although some of these services are readily available in most Afrikan communities, studies have shown that very few women living in low-income areas and communities access these healthcare services. In a related study conducted by Olayinka *et al.* (2014:10-15) in Nigeria, one of the contributing factors of the poor utilisation of available health services is due to inadequate advertising of such services to mothers.

Also, the poor attitude of health intermediaries – difficult accessibility, availability to information, family influences, and socio-cultural factors—are some of the determinants that have undermined the patronage of these services by women in developing communities in sub-Saharan Africa (Olayinka *et al.,* 2014:10; Pons-Duran *et al.,* 2016:12), hence the need to design healthcare services that can cater for the literacy levels of women in these such situations in Afrikan communities. These Contextualised healthcare services can be provided through health education programmes to provide relevant information to women to improve their health (Humphreys, 2010:53; Pons-Duran *et al.,* 2016:51).

2.3.2 Community Healthcare Services

Maternal healthcare services such as home visits on a regular basis by health intermediaries have been proven a viable way of improving maternal healthcare. The strategy of home-visits has been used globally to address issues of access to healthcare services, maternal and child healthcare, safe home environments and parenting skills (Skeen *et al.,* 2010:628; Ogunmefun *et al.,* 2011:1; Meghea *et al.,* 2013:441). Also, home-visits are beneficial to high risk and low-income earning populations who are unable to utilise all the healthcare services available in major towns and cities in their localities (Meghea *et al.,* 2013:441; Tomlinson *et al.,* 2016:937-938). These home-visits are usually provided by Community Healthcare Workers in low and middle-income countries to patients in remote areas. Home visitation programmes targeted at mothers with infant children are evidenced to have improved prenatal and postnatal care (Meghea *et al*., 2013:447; Cockcroft *et al.,* 2018:1-2). For instance, health intermediaries (community healthcare workers) have contributed enormously to the reduction of maternal and infant mortality in the Eastern, Southern and Western Afrikan countries (Humphreys: 2010:67; United Nations Economic Commission for Africa [UNECA], 2015:70; Faal *et al.,* 2015:2-3).

Community healthcare workers such as home-based carers (caregivers) are the pioneers in providing these services (home visits) in South Africa. The introduction of caregivers in the South African healthcare strategy has proven to be very effective (Akintola, 2004:1-2; Marshall, 2014:1-2; Tomlinson *et al.,* 2016:937). Home-based care has been a very cost effective way of showing compassion and care to people living with chronic diseases such as HIV and Aids (Ogunmefun *et al.,* 2011:1; Daviaud *et al.,* 2017:53-54). In South Africa, the services of caregivers are very useful in providing healthcare services in underserved communities. The involvement of caregivers in providing healthcare services is part of government initiatives to extend healthcare services to patients at home to complement services that are provided in major hospitals (Akintola, 2006:237-238; Marshall, 2014:1-2; Debrah, Bhebe *et al.,* 2014:97). These strategies have been successfully applied in different parts of Afrika to extend healthcare services to women in remote areas.

The provision of other government initiatives such as health insurance policies has facilitated regular access to maternal healthcare services during antenatal periods in many countries in Afrika such as South Africa (Lassi & Bhutta, 2016:264-265; Daviaud, *et al.,* 2017:53-54). All of these services have been provided in order to accelerate the reduction of maternal morbidity and mortality in underserved communities in these Afrikan regions.

2.3.3 Antenatal Care Services

The provision of maternal healthcare during antenatal periods is very important to the health of the mother. Challenges that may occur during delivery and poor health conditions of the child may be detected and managed when mothers are encouraged to visit hospitals regularly (Daviaud *et al.,* 2017:53-55). During this period, expectant mothers receive advice on nutrition and other healthcare tips to support them and to ensure a safe delivery of their babies (United Nations [UN] Report 2011:31; Arthur, 2012:1-2; Cockcroft *et al.,* 2018:1-2). Health professionals have advised that mothers need to be in good health, before, during, and after pregnancy. “This should be the target of maternal and child health units in order to attain safe motherhood” (Leiss & Kotch, 2010:4). Also, Global health organisations such as the WHO, UNICEF and the United Nations recommend that expectant mothers should see professional healthcare providers at least four times during pregnancy (United Nations [UN] Report, 2010:34; United Nations [UN] Report, 2011:31; World Health Organisation [WHO], 2015:35; Pons-Duran *et al*. 2016:50).

However, in developing countries, less than half of expectant mothers meet this requirement. The situation is even worse in rural areas where it is reported that less than a third of pregnant women meet this requirement (United Nations [UN] Report, 2010:31-34; World Health Organisation [WHO], 2015:7-8). Although plenty of intervention has been carried out to improve maternal health, challenges in antenatal services still remain in most developing countries (Ornella *et al.,* 2009:52-54; Ogundairo & Jegede, 2016: 2-4). The MDG report indicated that there has been slow progress towards achieving its goals in relation to maternal health. Although there was a slight improvement in the maternal mortality ratio, more effort was still required to achieve the recently ended MDG targets by 2015 (United Nations [UN] Report, 2011:29; United Nations Economic Commission for Africa [UNECA], 2015:VII-VIII). At the moment not all the MDGs have been met and it has now been translated into the UN SDGs (Pisano *et al.,* 2015:16). More effort needs to be made to sustain the already achieved MDG goals that also should be accelerated in the context of UN SDGs, particularly within the context of Afrika (United Nations [UN] Report, 2018:3).

2.4 HEALTHCARE SERVICE PROVIDERS

2.4.1 Health Intermediaries

Professional health intermediaries in local communities such as traditional birth attendants and midwives have been identified as major stakeholders in reducing maternal deaths. Midwives and traditional birth attendants contributed enormously to this course by working directly with women, families and communities to promote health (World Health Organisation [WHO], 2011:5; Darko,2015:9-10; Lassi & Bhutta, 2016:267-274). They provide health education, counselling and manage life-threatening complications that may arise during pregnancy (United Nations [UN] Report, 2011:3, 4-5; Apanga & Awoonor-Williams, 2017:1060-1061). These health intermediaries provide care for women during Pre-Natal Care (PNC), Antenatal Care, and Post-Natal Care. Among all of these stages Antenatal Care has been identified as a critical period for women to receive care in order to reduce maternal and infant morbidity and mortality (Chubike & Idam, 2013:139; Adanri, 2017: 3-4).

These visits are expected to be accompanied by a healthy lifestyle which is largely dependent on the availability of some of these trained health intermediaries (Arthur, 2012:1-2; Daviaud, *et al.,* 2017:54-55). Health intermediaries communicate with pregnant women to inform and educate them about health related topics. Global statistics indicate that the lack of adequate health intermediaries has contributed to the high rates of maternal deaths in sub-Saharan Afrika (United Nations [UN] Report, 2010:7; Cockcroft *et al.,* 2018:2-3). The deployment and availability of adequate health intermediaries will reduce maternal morbidity and mortality in many regions where there is a critical shortage of healthcare service providers (Darko, 2015:1-5; Kyei-Nimakoh *et al.,* 2017:10-11). Furthermore, it is anticipated that, the implementation of efficient **health education, health promotion** and **prevention programmes** in underserved contexts will go a long way to reduce maternal morbidity and mortality in Afrika.

2.5 HEALTH EDUCATION AND INFORMATION SERVICES

2.5.1 Health Education and its Impact on Maternal Healthcare Services

Education is one of the avenues through which maternal and child health can be improved (UNESCO, 2013:2-3; Weitzman, 2017:para 1). It also determines how women can be more effective and make use of healthcare services. Education enables women to make informed choices and be more mindful about healthy lifestyles to improve their health (Humphreys 2010:79; Arthur, 2012:3; Pons-Duran *et al.,* 2016:51). The MDG 3 indicated that mothers in developing countries with some level of education, are at a lower risk of maternal morbidity and mortality as compared to those who are poorly educated (United Nations [UN] Report, 2011:31; Lassi & Bhutta, 2016:263; Adanri, 2017:3-4). However, over the years, there have been improvements towards educating young girls to enable them to make informed decisions on their health and to make better life choices (United Nations Economic Commission for Africa [UNECA], 2015: XIV-XV; World Health Organisation [WHO], 2015:3-4). The United Nations (UN) reports over the years indicate that a vast majority of adolescent mothers in sub-Saharan Afrika lack education (United Nations [UN] Report, 2011:5; UNESCO, 2013:1-2; United Nations [UN] Report, 2018:5-6). As shown in Figure 2.9, there are more girls out of school than boys. Consequently, it has affected the birth rates amongst adolescents. Those in the rural areas have recorded two times higher birth rates than those of urban areas. The birth rates amongst girls with no education are four times higher (United Nations [UN] Report, 2010:37; Smith-Greenaway, 2015:para1).

The challenge with education and the other determinants of maternal morbidity and mortality continues to jeopardize the health of young girls in sub-Saharan Afrika (United Nations [UN] Report, 2010:5; Speer, 2017:15-16). “Mothers’ education remains a powerful determinant of inequity. Children of educated mothers–even mothers with only primary schooling—are more likely to survive than children of mothers with no education" (United Nations [UN] Report, 2011:26;United Nations [UN] Report, 2012: 28; Pons-Duran *et al.,* 2016:51).

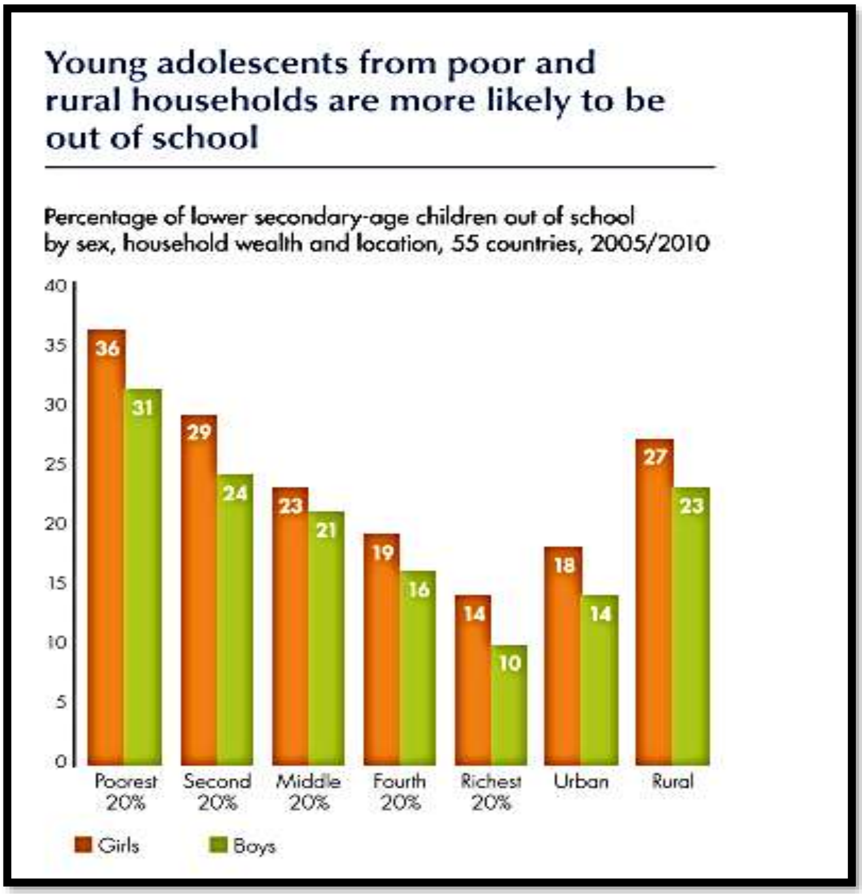


Figure 2.9: Young girls and boys who are likely to be out of school (Source: United Nations Report [UN], 2012:18)

2.5.2 Health Education Services

Health education as indicated by WHO and experts in this field (Bangkok Charter, 2005:1-4), is an essential element to better the quality of people's behaviour towards health (Rissel, 2005:156-158; Le *et al.,* 2009:116). The literacy of people will influence the success of health education and promotion activities. Literacy levels among young girls could reduce barriers in accessing health information tools and give them more possibilities for social and economic development (United Nations [UN] Report, 2010:5; Speer, 2017:15-16). An exploration into strategies to identify the most effective modalities of health communication among maternal healthcare providers is a significant element towards improving maternal health literacy (Le *et al.,* 2009:116). Also, education provides opportunities that can minimise social determinants that affect the health of young girls in less developed countries (Cohen & Syme, 2013:1). Through education, people are empowered which can potentially facilitate improved health outcomes.

Education can create pathways for mothers to easily access health information from multiple sources of information (Pons-Duran *et al.,* 2016:51; UNESCO Institute for

Statistics, 2017:9-10). Some pathways to health such as good literacy skills will enhance readability and comprehension of health instructions to avoid medical miscalculations. Some of the pathways as noted by Cohen & Syme (2013:2) that can improve health behaviours leading to improved quality of life are indicated in Figure 2.10.

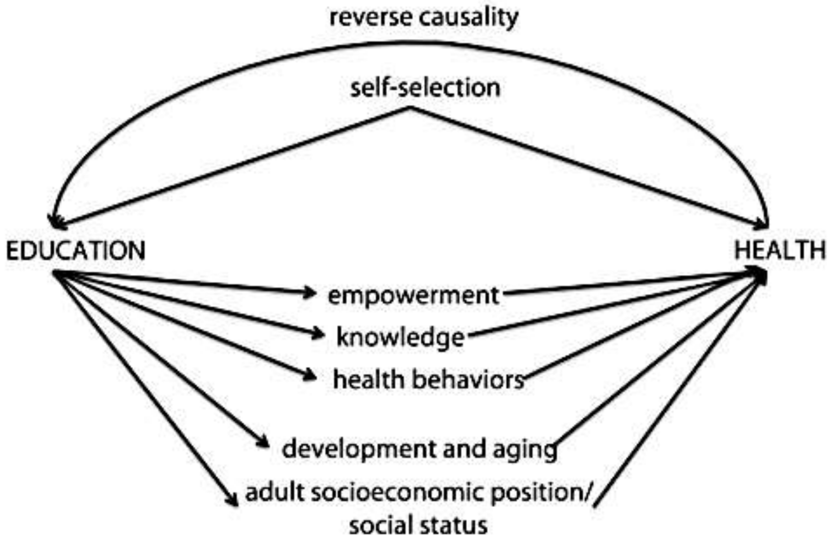


Figure 2.10: Potential pathways through which education may affect health (Source: Cohen & Syme, 2013:2)

2.5.3 Health Information Services

In any given health education programme, information is relevant to provide knowledge about a particular subject (Butler, 2000). Information is perceived as a result of human social interaction to portray a common meaning within a particular socio-cultural context (Andrade & Urquhart, 2010:4; Adami, 2016:1; Singh & Sittig, 2016:226-227). When information is shared or exchanged, the recipients of this information have become knowledgeable about particular information may help them continue with their lives (Srivastava *et al.,* 2015:7-8). The communication of information to information seekers does not imply that they will become knowledgeable, since knowledge largely depends on the knower (Wilson, 2000:50; Esmaeilzadeh & Sambasivan, 2016:75-76). In the context of healthcare, health intermediaries will not be in a position to educate patients with relevant health information if they do not know anything about the topic. Hence, they become knowledgeable based on the understanding they have obtained in their professional training and practice (Ammenwerth, 2015:298). The knowledge they would have acquired through this process will then be the basis from which they provide information to pregnant women or patients (Wahoush & Ban, 2014:213). As such, acquired health information knowledge will largely depend on the literacy levels of information receivers within a particular context (Wilson, 2000:50; Janks, 2014:349; Speer, 2017:16).

Ontologically, information exists but will only have meaning once people use it for some purpose (Andrade & Urquhart, 2010:4). Information is exchanged between people as messages from the one person as sender to another person as receiver (Esmaeilzadeh & Sambasivan, 2016:75-76). The sender has a purpose for which they think the information will be relevant but receivers can only find it valuable if they are able to attach meaning to it, i.e. it makes sense for the purpose for which they need the information (Hartley, 2014:4-9). Information obtained with an exchange process through human interaction, enables people to close the knowledge gaps that they might have in a given situation. Once people acquire information, they are able to navigate through different spaces in time to move on with their lives (Dervin, 1977, cited in Andrade & Urquhart, 2010:4; Adami, 2016:1-2). Knowers will seek information that is within their social-cultural context to create their own knowledge. Providers of information are usually interested in how information is being used by information seekers and not what information seekers require (Tan & Goonawardene, 2017:para 3).

However, this study investigates the information needs of health intermediaries and patients. The focus is on investigating the information required by health intermediaries to educate women on how to make informed decisions about their health and wellbeing. The hope is that health information service providers within the research context will gain insight about the perceived information needs of women and health intermediaries within the context of South Africa and Ghana.

Information can be perceived on three levels, **knowing**, **doing,** and **being.** For the purposes of this research, the focus is only on the **knowing** part. Within the **knowing** context, attention is given to **information sharing**, **exchange** and **interpretation** as it may pertain to the knower, e.g. Interaction between health intermediaries and pregnant women. Health information seekers in the process of knowing will go through one of these many processes to access available health information through an iterative process. These processes include concepts such as **information behaviour, information searching behaviour, information seeking behaviour and information use behaviour** (Wilson, 2000:50). The information seekers will then make meaning out of the information acquired through the process of sensemaking and use information for particular purposes. Information sensemaking involves the process of making sense out of complex data in order to facilitate meaning to the information seeker (Dervin, 1998:39; Agarwal, 2012:2-3).

Furthermore, education particularly in the area of healthcare requires **relevant information** tailored towards the needs of health information seekers. Information relevancy is considered as providing the **right information,** at the **right place, the right time** and through the **right medium** (De la Harpe *et al.,* 2014:139). The information ought to be designed such that patients can comprehend messages to make informed choices. However, the question still remains: **"What are the health information needs of health intermediaries and mothers**? **How should this information be designed to address the information needs of health seekers to make informed choices?"** Answers to these questions are being explored as part of this study, in order to provide relevant health information to pregnant women during future health education activities in the Afrikan context.

2.5.4 Health Information

Health information is usually the exchange of information in the form of messages from the person in the role as sender to another person in the role of receiver. If the receiving persons are able to attach meaning to the information, then they can make informed choices about their health behaviour (Esmaeilzadeh & Sambasivan, 2016:75-76). These messages are usually disseminated in the form of print and electronic media. The exchanged information is usually enhanced with verbal communication between the sender and the receiver (Hartley, 2014:8-9; Politi *et al.,* 2014:212-213; Adami, 2016:1-2).

Health information behaviour can be described as the purposive seeking of information to make informed choices about one's health (Halder *et al.,* 2010:42-43). Thus, the knower in the process of information seeking will interact with information objects such as brochures, posters, leaflets, and pamphlets as obtained from hospitals and clinics in their community. People may also interact with computer-mediated systems such as the internet to obtain relevant health information (Wilson, 2000:39; Yeo *et al.,* 2015:173-175; Kelly & Barker, 2016:111-114).

However, the advent of ICTs has influenced the nature of health information access for individuals (Rowley *et al.,* 2015:316-317). This has permitted women to communicate and receive information alerts from their health providers outside consultation sessions (Ammenwerth, 2015:298-299; Singh & Sittig, 2016: 226-227; Tan & Goonawardene, 2017:1-2). Through this constant communication, mothers sometimes receive health alerts in the form of instant messages or images to inform them to act on particular health instruction (Sayakhot & Carolan-Olah, 2016:1-2; Barron *et al.*, 2018:1-3). The challenge over the years has been how to provide health information access in remote areas not having constant connectivity. Mobile Health (mHealth) initiatives have facilitated access to healthcare in many communities (Crul & Diop, 2014:3-4; Sondaal *et al.,* 2016:2). As such many healthcare professionals are prescribing Apps for patient care via their mobile devices to check their health status such as blood pressure and other health related matters (Miah *et al.,* 2017:1-3). An example of these mHealth Apps can be found in popular brands such as Apple range of products. These Apps are usually complemented by mobile devices and other wearable technologies for healthcare that are suitable for the user. However, there is a need to extend these services to low and middle income areas to promote equitable access to internet-based health information (Chandra-Mouli *et al.,* 2015:333-334; Adepoju *et al.,* 2017: para 1-2).

2.5.5 Health Information Services and Access

The information needs of health information seekers vary from one person to another. In providing equitable access to health information, the information needs to be aligned to the needs of information seekers (Paige *et al.,* 2017:53). In order to facilitate this, special attention needs to be given to information seekers such as mothers with special needs. For example, adolescent school-going-mothers and mothers with children in critical conditions will require different information needs and support from those with less critical conditions (Pillay, 2018:15-18; Jacobs *et al.*, 2019:1-2). Also, due to the educational levels of mothers in underserved contexts, information needs to be designed from their perspective to provide equitable access to healthcare. The possibilities that ICTs offer needs to be extended to mothers in underserved contexts in order to facilitate equitable access to healthcare (Cunningham *et al.*, 2016:666-674). This is because in this 21st century, mothers seek information through internet sources where they obtain information about how to care for their unborn, newly born and sometimes critically ill children (Slomian *et al.*, 2017:46; Huh *et al.*, 2018:146-147). The availability of educational materials on the internet provides some amount of basic information that mothers can use to care for their children (Guerra-Reyes *et al.*, 2016:13-14; Thon & Jucks, 2017:828).

However, the information on the internet is not often trustworthy (Mendes *et al.*, 2017:1076; Obasola & Agunbiade, 2016:1-2). Health information providers need to direct their patients to the relevant websites to enable them to obtain the right and quality information (Kanthawala *et al.*, 2016:95; Slomian *et al.*, 2017:46). Furthermore, in providing information to mothers, health intermediaries often need to find out what patients already know about their health. This will enable them find gaps during the information sharing and exchange that need to be filled. This could alleviate any misconceptions about information already acquired because people have their own ways of finding information (Paige *et al.,* 2017:53-65). Thus, if these are done as a two-way communication process between the information provider and seeker, the mother (knower) becomes emancipated and can better care for herself and her children (McGrath, 2008:118-119).

2.5.6 Health Literacy

Health literacy according to Healthy People 2010, can be defined as "the degree to which individuals have the capacity to *obtain, process* and *understand basic* health information and *services* needed to make appropriate health decisions". It is defined more precisely by the AMA Council of Scientific Affairs as "the ability to *read* and *comprehend prescription bottles, appointment slips* and other essential health-related materials required to successfully function as a *patient*" (centre for HealthCare Strategies [CHCS], 2010:1-3; Friis *et al.*, 2016:1-3). Health literacy is considered as the *currency for refining the quality of health* of a society (Paasche-Orlow *et al.,* 2005:175). Health literacy is perceived by the Institute of Medicine (IOM) (2004) as the "Prescription to end confusion" (Lawrence, 2010:11) in healthcare services. Studies of over 300 published articles have shown that most health related information is *text dominated* and requires competent reading *from people*. Most often, the materials are beyond the understanding of health seekers and this places their health at risk and increases their chances of hospitalisation (Paasche-Orlow *et al.,* 2005:175). Health literacy is a serious concern for vulnerable populations (Speer, 2017:15). As indicated by the MDG 2, most girls in sub-Saharan Afrika are not educated (Figure 2.9) and are therefore most likely to have low-functional health literacy, which might negatively affect their health behaviour. The UN reports on the MDGs states that,

> *"In 2010, there were still 122 million people between 15 and 24 years of age—74 million women and 48 million men—who were unable to read and write a short, simple statement about their everyday life"* (United Nations Report [UN], 2012:19).

As stated above, it could be inferred that mothers in sub-Saharan Afrika will most probably find it difficult to understand health information, since they have low-functional health literacy due to the educational inequalities that persist in these regions. However, healthcare providers must create a more convenient environment for consumers with low literacy to access healthcare information, without the fear of being branded by members of their community (Centre for Healthcare Strategies [CHCS], 2010:9; Cohen & Syme, 2013:1-2). In order to advance health literacy, there is a need for health institutions to collaborate and organise literacy programme that can benefit health information seekers and providers, particularly in underserved contexts (Lawrence, 2010:29). In organising these programmes, emphasis must be placed on health education and practices, which are vital to create better conditions of privacy to address the health needs of women. These would in turn improve the services offered to women and deepen the relationship between stakeholders of maternal healthcare (Yakong *et al.,* 2010:2431).

2.5.7 Health Information Objects

Mothers in less developed communities in sub-Saharan Afrika are less educated (United Nations [UN] Report, 2012:19). Therefore, communicating information from healthcare providers to patients sometimes presents challenges, due to the low literacy levels of patients in such developing contexts. This situation calls for a collaborative effort between health service providers and information seekers in order to facilitate access to health information. Collaborative and effective communication mediums have a deep effect on a patient's health (Beutler *et al.*, 2016:100-101; Leal-Costa *et al.*, 2016:76-77). For example, in a study conducted by (Walters *et al.,* 2012:114) graphic tools were developed to facilitate easy navigation in maternity care. This was meant to improve the professional development of nurses and to educate and inform patients about their health status. The study proved to be successful by enhancing healthcare service delivery due to the collaborative efforts from health intermediaries and patients.

Also, it has been identified that collaborative public health campaigns and inter–personal contacts by maternal healthcare providers are effective ways of communicating health information in Afrikan communities such as Ghana (Prilutski, 2010:51). The information is presented in mass media such as posters, flyers, billboards, TV, radio and other available electronic means of communication through ICTs. Some of these ICTs present a good platform for teaching, learning and suitable for mHealth initiatives from High to Low income regions (World Health Organisation [WHO], 2011:16-17). The availability of these mass media information objects provides limitless opportunities to health intermediaries; to make information easily accessible to patients. These are usually practicable when interconnectivity is readily available between information providers and information seekers.

2.5.8 Challenges with Health Information Objects

Health information objects are useful in providing relevant information to patients. Some of these educational materials come with some challenges such as legibility, suitability, and readability. Sometimes they are dominated with text or images do not align with the context of the information being presented. Printed materials that require high reading levels may present a challenge to patients with low literacy skills. This may sometimes misinform users of the health information which might result in the misunderstanding of health messages (Shieh & Hosei, 2008:74). Therefore, there is a need for these images to be designed to suit the socio-cultural context of the users. Although the internet and other available technologies facilitate information access to many, the content needs to be moderated to ensure that relevant information is provided online for users (Sayakhot & Carolan-Olah, 2016:1-3). In the process, people will obtain relevant information and minimise medical complications. Thus, this will affect their health and wellness positively.

2.5.9 Health Information Sharing in Underserved Contexts

Public health educators continue to make efforts to promote maternal healthcare in underserved contexts for countries such as South Africa. However, there are still communication discrepancies between healthcare providers and their patients due to the disparity in the low literacy levels of young girls and women in such underserved contexts (Smith-Greenaway, 2012; Barron & Padarath, 2017:78-83). The health education campaigns are usually accompanied by information objects in the form of printed educational materials or audio-visual materials. These health education materials are often inadequate in terms of availability and accessibility to women in hard-to-reach areas. The education materials are designed in the form of posters, fliers, billboards and other forms of print media. These types of materials tend to flood the media landscape in the major towns and cities in South Africa and Ghana. An elaborated version of these health information materials are placed in the form of outdoor advertising such as (still/electronic) billboards. These forms of visual information are mostly situated around areas with pedestrian traffic since people spend more time with these images than people in moving cars would (Mcdonnell, 2010:1823). Although some of these promotional materials in such outdoor advertising is partially visual, the accompanying messages are often literacy dependent. This makes it difficult for low-literate populations to comprehend some of this information.

Despite all of these available means of health information sources, there are still inequities in addressing the health needs of women in Afrikan countries such as in South Africa and Ghana. There are still challenges with the relationship and communication between maternal healthcare providers and their patients. As such, maternal healthcare services must be designed from the perspective of women and healthcare providers in order to improve these services (Yakong *et al.*, 2010:2431-2439). The information should be provided in a form that is easily accessible to expectant mothers. Furthermore, since most women in developing contexts are largely uneducated, information on treatment and healthcare should be tailored towards their needs in a culturally acceptable format with no language barriers (National Centre for Biotechnology Information [NCBI], 2008:para 3-9). However, alternative ways of including visual media as a means of information communication between healthcare providers and mothers must be studied to promote health literacy among women in developing contexts. The information quality is important because giving pregnant women relevant information to allow them to make an informed decision remains a challenge to all healthcare professionals in underserved contexts (Smith-Greenaway, 2012:1-2). The use of media other than leaflets needs to be systematically studied, and the current available evidence is limited (National centre for Biotechnology Information [NCBI], 2008:para 155). Ultimately, there is a need to redesign and repurpose health information which could be facilitated by ICTs to meet the needs of mothers in underserved communities (Hawkins & Carlos, 2018:133-134; Huh *et al.*, 2018:152). Thus, this study explores how enabling technologies and information objects could improve health information service delivery in an underserved context.

2.6 INFORMATION COMMUNICATION TECHNOLOGIES (ICTs) IN HEALTHCARE

The advent of ICTs over the last ten years has increased hyper-connectivity globally. The internet has created a platform where people, machineries, businesses and organisations can instantly connect and communicate with each other (Dawson, 2017:10). This has positively contributed in the improvement of economies and societies globally (Bara-Slupski, 2016:1-2; Silver & Johnson, 2018:3-4). Afrika has been identified as one of the fastest growing economies with about 500 million mobile phone customers (Dutta & Bilbao-Osorio, 2012:5-7). Statistics from the International Telecommunication Union (ITU) indicate that 70% of the over 5 billion wireless subscribers worldwide, are in developing countries (World Health Organisation [WHO], 2011:1; Betjeman *et al.,* 2013:1-2; Guerriero, 2015:1-6; International Telecommunication Union [ITU], 2017:3-220). The use of mobile phones as a tool for communication has increased considerably among people in Afrikan regions, not only in the area of healthcare, but for other purposes such as business and education. The introduction of mobile technologies has proven to increase access and communication to people living in hard-to-reach areas (Chhanabhai & Holt 2010:195-198; Ariani *et al.,* 2017:15-17; Adepoju *et al.*, 2017:1-3).

2.6.1 Mobile Technologies in Healthcare

Mobile phones are potential platforms that can be used to communicate information to enhance maternal healthcare. ICTs such as mobile phones may present challenges with confidentiality and privacy issues in communicating health information (Noordam *et al.,* 2011:622). Although these disadvantages of ICTs are prevalent, it still has the potential to make information easily accessible to many people in a more efficient and faster manner. Thus services such as mHealth could achieve health objectives at a relatively low cost (World Health Organisation [WHO], 2011:9-77; Silver & Johnson, 2018: 1-4).

Mobile technology can be strategically positioned to make healthcare information easily accessible to every cell phone owner. This is achievable in sub-Saharan Afrika if an effective system is established to enable maternal health intermediaries offer better services to their patients (World Health Organisation [WHO], 2011:77; Ojo, 2018:1-6). Health information must be designed from the perspective of women and maternal healthcare providers to facilitate easy accessibility and thus effective health communication (Yakong *et al.,* 2010:2431). For instance, women with low-income returns may prefer information through mails (print-media) whereas high-income earners would opt for internet or digital media to receive healthcare services (Walker *et al.,* 2012:1). Therefore, low-income earners in marginalised contexts may prefer different sources of information due to their educational levels and economic status (De Brouwere *et al.,* 2010:902-903).

Mass communication presents a wide variety of communication channels, through which information can be disseminated to consumers. These may either be in print or digital media. The use of media with interpersonal contact between healthcare providers and mothers, facilitates health communication (Prilutski, 2010:53). Since global indicators show that mothers in some parts of low and middle-income areas are not literate, information must be designed in such a way that it will be easily understood. This will make it easy for women to access and act on healthcare services provided through ICT platforms to improve their health. Some of these available ICT initiatives, which are mainly mHealth solutions within Afrika, are presented in Table 2.2. Currently, some of these mHealth initiatives are still available in countries, such as South Africa, Ghana, Uganda and Malawi. Some of these mHealth initiatives are designed to give reminders to patients to take their medicines. Others simply provide text messages to patients to remind them about their next appointments (Table 2.2). These services are usually made accessible through mobile technologies, and sometimes customised ICT-enabled devices are used in areas where coverage is available. Some of the mHealth initiatives in Afrika are the following:

- **mHealth initiatives in Afrika**

  The mHealth initiatives represented as Figures 2.11–2.12 and described in Table 2.2 are a few examples of interventions that are being implemented to bridge the health information divide and to facilitate information access to women in an underserved context in Afrika. Further details of these mHealth initiatives are compiled in Table 2.2.

Figure 2.11: mHealth initiatives in Afrika – SIMpill (South Africa – Top Left)
(Source: Google images [click to view – SIMpill])

Figure 2.12: mHealth initiatives in Africa – FrontlineSMS (Malawi – Top Right)
(Source: Google images [click to view – FrontlineSMS])

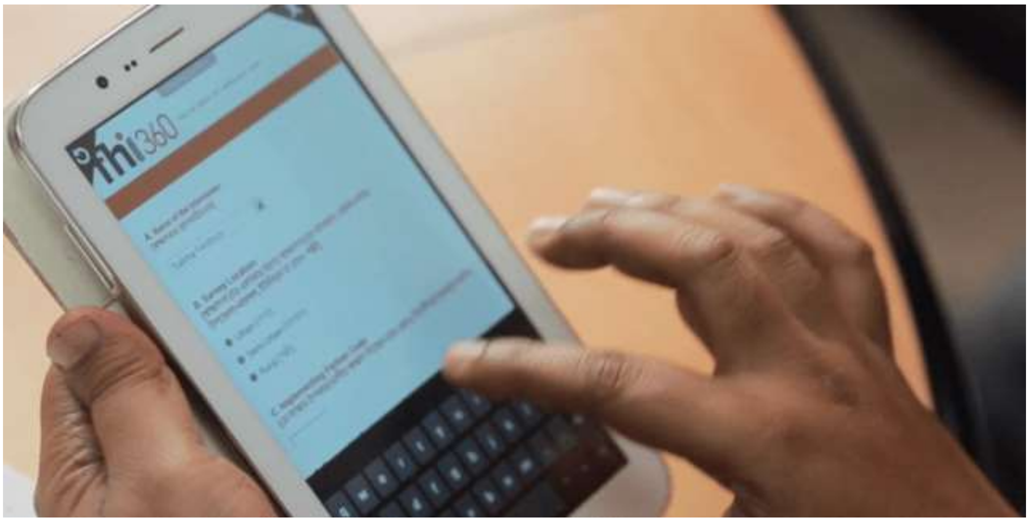


Figure 2.13: mHealth initiatives in Afrika – MOTECH (Ghana - Top)
(Source: Google images [click to view – MOTECH|Ghana])

Figure 2.14: mHealth initiatives in Afrika – SATELLIFE (Uganda - Bottom)
(Source: Google images [click to view – SATELLIFE])

Table 2.2: Identified mHealth initiatives in Afrika
(Source: Authors' own construct based on Google search)

Consideration	mHealth Solution 1	mHealth Solution 2	mHealth Solution 3	mHealth Solution 3
Country of origin	South Africa SIMpill	Malawi FrontlineSMS	Uganda SATELLIFE	Ghana MOTECH
Health problem addressed	Monitor the intake of medication and serves as a reminder to patients and caregivers	Health workers are able to record patient data more accurately and in real time using mobile technology	Helped in information dissemination and data collection	Mobile Midwife An application that prompts women about their health through technology; no language barriers
Target: End user	Patients, caregivers	Patients, community, health workers	Health workers	Community Healthcare Workers (CHWs) and women

Consideration	**mHealth Solution 1**	**mHealth Solution 2**	**mHealth Solution 3**	**mHealth Solution 3**
Context of use	Medication and reminders of medication intake in real time	Patient medical records can be accessed and updated remotely	Provides unprecedented opportunities to move information to where it is needed most	Reminders, and medications and prompts on nutrition and vitamin A
Environment of use: Setting	Home and public spaces	Clinics and hospitals	Hospitals	Health facilities
Environment of use: Requirements	Mobile phone, SIMpill device, PC	Central PC, mobile phones	PC, PDA, mobile phones	Mobile phones
Need for connectivity	Yes	Yes	Yes	Yes

2.7 VISUAL MEDIA AND COMMUNICATION

There are different modes of presenting information for communication. Some of these modes are either through "visual" means only, "text" only or a combination of both with audio (D'Angelo, 2017:1-5). The information is then facilitated through verbal communication and sometimes supported by ICT tools and other available information objects which are related to visual communication (Bolognesi, 2017:525-527; Tseronis, 2018:41-42; Meyer *et al.*, 2018:392-393).

Visual communication (design) is the process of communicating through visual means. These may include graphic elements such as text, images, audio which are manipulated in a creative way to convey a message (Ambrose & Harris, 2009:10). Furthermore, visual communication can be presented in many forms such as a product or system; it also covers other activities that occur within a product-service system. Product-service systems, refers to services which have been designed integrating products and services to meet user needs without causing any adverse effects to the environment in a particular context. These services are to be marketable and satisfy user expectations (Boehm & Thomas, 2013:245; Manzini & Meroni, 2014:372; Foglieni, *et al.*, 2018:7-9).

Visual communication designers work in these contexts and design information objects or systems to facilitate communication. Information objects required for communication in such services, highly depends on the purpose and user needs in a particular environment. Also, information objects used in such services may come with attributes such as ***genre, format, medium, form and mode*** which determines the information relevant to users in a particular context. These information objects can be acquired by people or delivered to users by an identified service provider (Gorichanaz, 2016:7-8; Pluye *et al.*, 2019:11). The information delivered or acquired may be supported by multimedia messages to facilitate the communication process in a given environment or setting (Hobbs *et al.,* 2017:I-III; Raaphorst *et al.*, 2017:120-123).

In visual communication, the information is either presented in print or electronic media formats. The print media formats include: posters, flyers, leaflets, billboards and so on. Whereas the electronic media includes videos, animations, interactive multimedia messages and social media. These are some of the information objects, which are used to facilitate communication in a given environment and are viable means for health information sharing and exchange (Hobbs *et al.,* 2017:1-10; Chan *et al.*, 2018:146-146-147; Hawkins & Carlos, 2018:133-134). These types of information objects can be explored to provide relevant information to women or patients to make informed decisions for them in underserved contexts.

2.7.1 The Power of Visual Information

Images are powerful mediums used to facilitate information communication. A picture is often said to be worth a thousand words. People read pictures or images as they read words (Hobbs *et al.,* 2017:1-10). Right from prehistoric times, pictures or images were used in the form of pictographs and ideographs to communicate information (Alshenqeeti, 2016:64). In present times, images are used to communicate complex information to people who cannot read words (Bogdashina, 2017:1-6). In visual communication, images are largely used to facilitate communication. Designers communicate their messages to people, using both text and images (Mafundikwa, 2004:XV-XVI). As such, when these images are well designed, it is anticipated that it will communicate more effectively to the information recipient. Visualisation helps in breaking down complex information into simple communicable information, which is usually presented graphically. However, with the advent of information technology, information can be presented in multimedia formats (Adi-Dako *et al.,* 2013:26-28). These modes of communication are usually supported by images and sound, making it easier for information receivers to derive meaning from available messages (Hobbs *et al.,* 2017:10).

2.7.2 Visualising Health Information

In healthcare, visuals are used in a variety of ways to facilitate information communication. For instance, with the advent of technology, health intermediaries are trained using audio visual materials (Hawkins & Carlos, 2018:134). In the information technology era, nurses are required to possess informatics skills to enable them to work better in this digital world (Chan *et al.*, 2018:142-143). As such, technologies facilitated by visual-based materials are used as part of the training of health intermediaries (Darvish *et al.,* 2014:11). Also, some of these materials are presented in the form of instructional media for educational purposes. There are quite a number of health instructions designed for patient education, which are used by the health intermediaries to facilitate communication. Health information tailored towards the needs of recipients is easier to comprehend. This way recipients become knowledgeable about their health and they make informed choices that can facilitate behavioural change (Holt *et al*., 2001:265). Health information presented in multimedia formats is usually presented in the form of short films or animations for the purpose of education. Descriptions of some of these formats are described as follows:

- **Animated films**: animated films are usually a series of drawings put together in one sequence to make a story. Animations are most often accompanied by sound in the form of voice over or music. The introduction of sound brings life to the characters involved in the story. Health information presented in these formats may be in the form of instructional media or simply short stories to address an information need (Hobbs *et al.,* 2017:10; Herhuth & Frank, 2016:23-25).

- **Videos:** videos or motion pictures are usually recorded as live action activities which are put together through the process of editing as one sequential movie (Parry *et al.,* 2016:1272-1273; Whitehill & Seltzer, 2017:157-159; Karubanga *et al.*, 2017:2-5). With the advent of interactive multimedia technology, these materials are readily available online for health intermediaries and patients alike to satisfy their specific information needs.

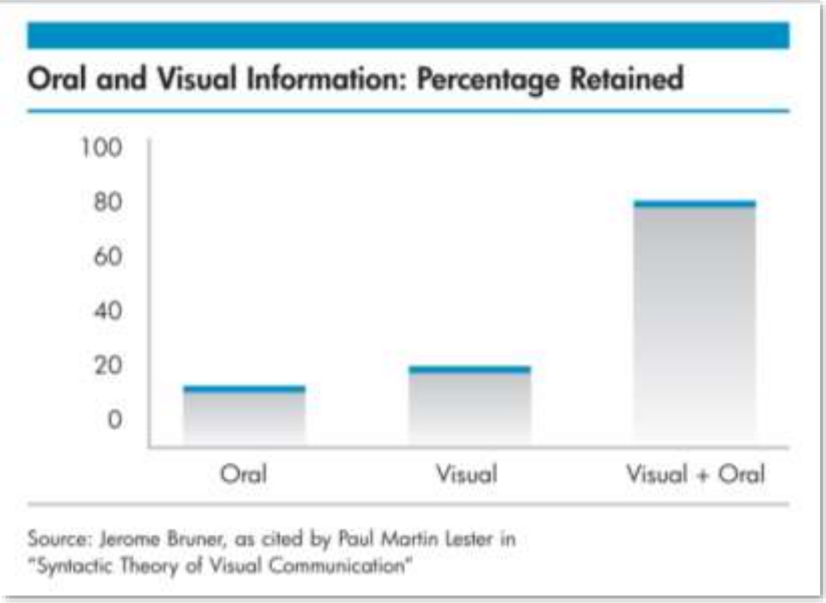
2.7.3 The Role of Visual Media in Healthcare

The integration of visual arts as a means of communication in the field of medicine, provides a better understanding of “hard” information which would have been difficult to comprehend by verbal means only (Adi-Dako *et al.,* 2013:24; Debrah *et al.*, 2014:422-423). For instance, the illustrations of parts of the human anatomy such as the ear, heart, throat, digestive system and many others gives people a picturesque idea of what those parts look like in the human body. The description of the human anatomy through verbal or text-based information only might make it difficult to understand. Studies by Dolev, *et al.,* (2001:1020) and Kirklin *et al.,* (2007:1-5) used visual arts as part of the professional education of health intermediaries. The results indicated that participants in the art-based educational course had higher grades on the post-test for accurate and precise descriptions of medical and dermatological disorders (Pellico & Friedlaender, 2009:648; Frei *et al.,* 2010:673).

Most often, health intermediaries are the main actors providing health information services in developing regions in Afrika. They provide information to women to support them especially during antenatal periods and extend these services to them in their homes. The practice of training health intermediaries for example, nursing, is described as having its foundation in the sciences and humanities of liberal education. This field of healthcare seeks to combine art and sciences in the nursing education. Yet less art is integrated into the nursing education (Frei *et al.,* 2010: 672). An art-based approach to the nursing education has the tendency to enhance, better inform, and prepare these specialised health intermediaries for professional practice. In instances such as health education, health intermediaries can use relevant visual objects to facilitate health communication with patients.

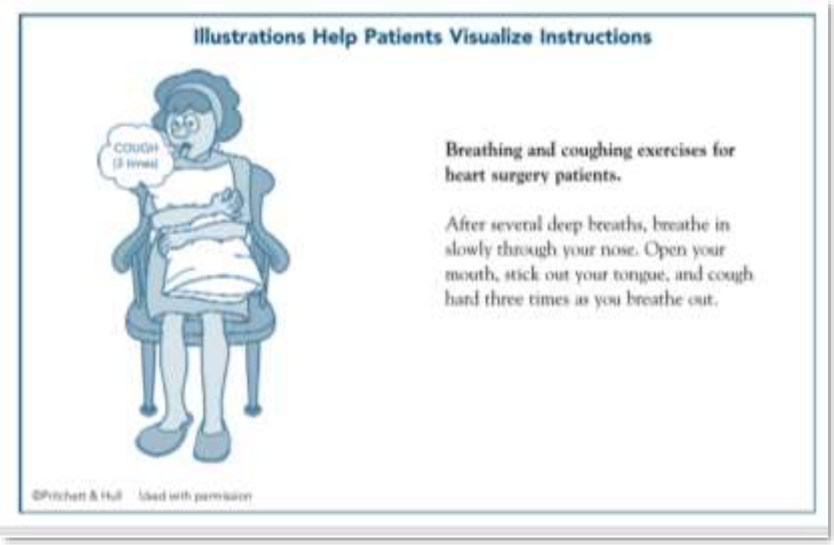
2.7.4 Oral versus Visual Information

Visuals have been identified as a powerful tool for communication (Figure 2.14). The statement suggests that people learn and retain information much better than what is presented to them via oral or verbal means only (Lester, 2004:1). Visuals can help in fostering effective information communication between health intermediaries and health information seekers. However, some patients with low health literacy, tend to have difficulties in reading, and understanding verbal facts on their health (Shieh & Hosei, 2008:76). Healthcare service providers can incorporate visuals as part of verbal communication with their patients as they inform and educate them. Patients, respond better to information designed to promote patient action and motivation. In order to promote patient action, health information needs to be contextualised by factoring the socio-cultural elements into the design of the health information. Visual tools such as pictures, illustrations (Figure 2.15), audio visuals and interactive user-friendly computer instructions can increase a patient's rate of learning and understanding health information (Center for Healthcare Strategies [CHCS], 2010:10). The integration of these visual tools in educating mothers in underserved contexts could eventually lead to a health-literate society.



Source: Jerome Bruner, as cited by Paul Martin Lester in "Syntactic Theory of Visual Communication"

Figure 2.15: Oral and visual information
(A graph showing a comparison between visual plus oral communication
[Source: Lester, 2004:2])



Illustrations Help Patients Visualize Instructions

Breathing and coughing exercises for heart surgery patients.

After several deep breaths, breathe in slowly through your nose. Open your mouth, stick out your tongue, and cough hard three times as you breathe out.

©Pritchett & Hull Used with permission

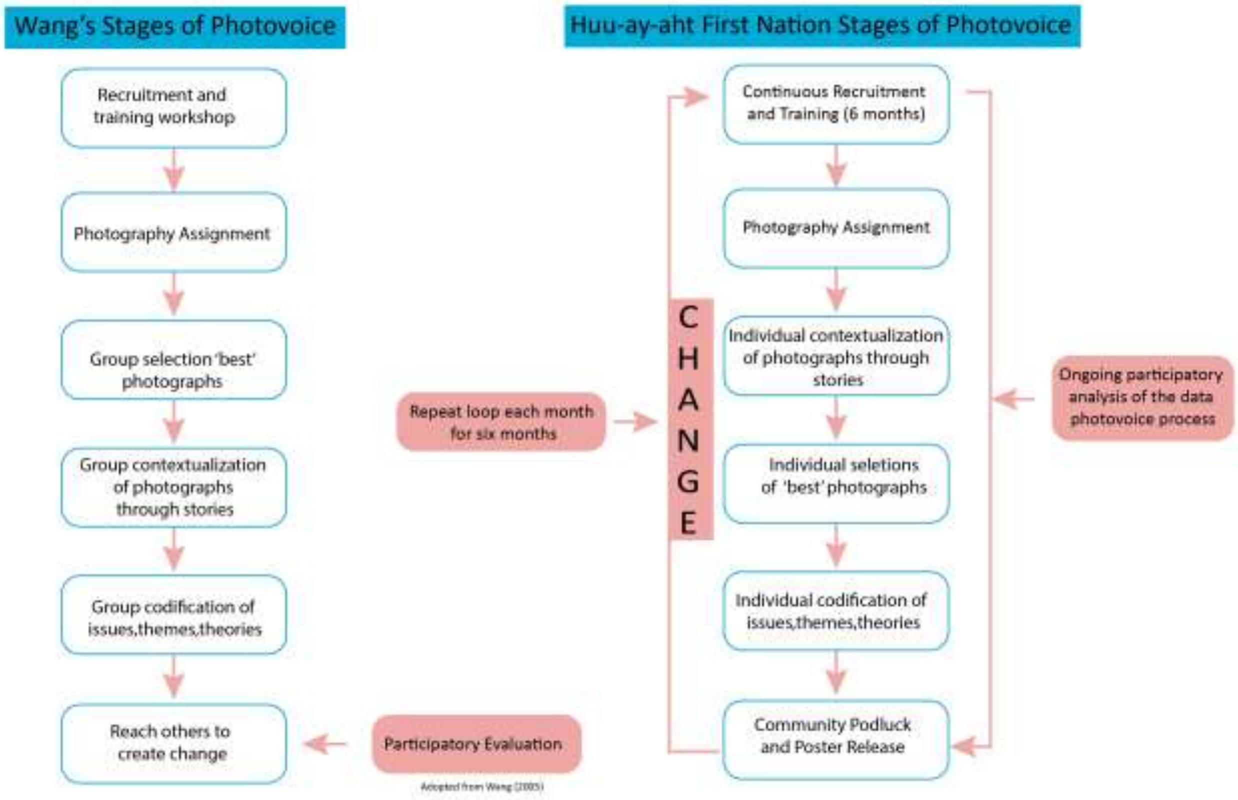
Figure 2.16: Illustration for patient education
(Sample of illustration to help patients follow health instructions)
(Source: Centre for Healthcare Strategies [CHCS], 2010:10)

2.7.5 Visual Media: A Source of Health Information

Visuals, such as photographs, are another easy channel to provide additional information to support verbal communication. Visuals can be made through a community-participatory approach to create a sense of ownership and to inform patients in communities about their health status. An analysis from a study that used participant-employed photography (Figure 2.17) found that this—created trust, power and a sense of ownership among participants (Castleden & Garvin, 2008:1393).

Photo-voice is a potentially good platform to promote health education among mothers with low literacy in underserved contexts. Photo-voice is a digital storytelling method (using stills and video cameras) presents a promising method to health education. Photo-voice can be used to reinforce cultural identity to enhance the wellbeing of vulnerable populations in society (Wexler *et al.,* 2013:622).

In another study conducted by Pies *et al.* (2012:650-651), photos taken by community residents were used to provide detailed in-depth discussions about Family Maternal and Child Health (FMCH) programme within their communities. These photos were used to inform participants about how they should improve healthcare within their communities. Photo-voice can be used for health education to help women in underserved contexts to improve their health behaviour.



Adopted from Wang (2005)

Figure 2.17: Stages of photo-voice
(Comparing approaches of Photo-voice)
(Source: Castleden & Garvin, 2008:1402)

2.8 SOCIAL MEDIA: A SOURCE OF HEALTH INFORMATION

Social media is another viable medium in providing access to healthcare services to many at once. Although social media has its limitations, it provides a good platform to share multimedia health information. Platforms such as **Facebook, Flickr, YouTube** and **Vimeo** are some of the channels through which health information can be promoted using multimedia information (Kite *et al.*, 2016:1-3; Chan *et al.*, 2018:142-146; Hawkins & Carlos, 2018:133-134). The integration of ICTs in health information communication includes highly visual online interfaces that guide users to navigate information sources online. Given that these ICT-enabled communication channels are combined with face-to-face communication without language barriers, it can be used to promote maternal healthcare (O'Mara, 2012:1). The online information platforms may include digital storytelling and other relevant multimedia information that promote health and wellness. Although social media is a viable medium for health education, factors such as the literacy levels of users' have to be considered into the design and development of such health information platforms. Also, the availability of access and constant interconnectivity of health information providers and receivers needs to be integrated into the design of online health information services (Huh *et al.*, 2018:152-153). A hybrid approach is suggested when using digital technology to integrate "online" and "offline" participation to provide health information services to more people.

2.9 SUMMARY

In this section of the study, the literature review was conducted hermeneutically, which made it possible to analyse and interpret information obtained. Information obtained through the literature review in this chapter, covered topics such as *healthcare, healthcare services, health education, health information, health literacy,* and *visual information.* Also in the literature review process, answers to the following questions in relation to the study were obtained.

- What are the global health goals on maternal and child healthcare?
- How does education facilitate equitable access to healthcare in Afrikan sub-regions?
- What are the challenges confronting health intermediaries during information communication to mothers in underserved contexts?
- What role do health intermediaries play in promoting maternal health literacy in underserved contexts?
- What are the available sources of health information in underserved contexts?
- How do visual media facilitate health information communication?
- What are some of the challenges with health information communication objects that affect information quality?

Additionally, information obtained through the literature review illuminated the need for health information services and visual media for patient education in underserved contexts. Health information objects designed in the form of visual media have been used in a variety of ways for health education. Visual media is used as a mediator between patients and health intermediaries. Furthermore, it is used as instructional media to train health intermediaries. Visual instructions could promote health literacy during health information communication to information receivers in underserved contexts. A well-designed ICT solution for health information services could facilitate effective interaction between healthcare providers and patients. Health information needs to be contextualised to meet the needs of low- literate mothers in order to improve information quality for effective health education.

The data obtained from the literature search, showed that there are persistent educational gaps between young women and girls. Inequality in education has created a disparity in providing equitable access to healthcare in underserved communities in Afrika. The situation calls for a collaborative effort from policy makers and stakeholders in healthcare to investigate alternative ways of facilitating access to relevant health information in underserved contexts. Acquiring relevant health information, will in turn, promote a health-literate society that could accelerate the attainment of UN SDG 3 by 2030.

Further research is suggested into **information seeking behaviour, information use behaviour and information searching behaviour** of health intermediaries and information seekers. Research into these areas of information sciences could provide a holistic view of information needs and sources of health providers and recipients in underserved contexts.

CHAPTER THREE

REVIEW OF RELATED LITERATURE – PHASE II

SITUATING THIS STUDY IN DESIGN AND SERVICE DESIGN

> *"By championing a socially conscious design ethos, our noble profession can contribute towards a more empathic, inclusive and participative society by promoting social equity and cohesion for all" – Mugendi K. M'Rithaa (2016)*

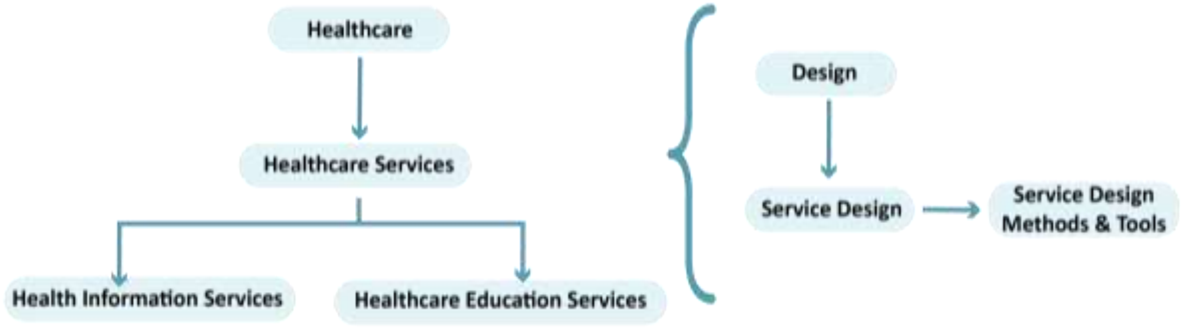


Figure 3.1: Major concepts in Chapter Three

3.1 INTRODUCTION

The second phase of the literature review focuses on **design** and **service design**. Information described in this section, covers topics such as emergence of service design, available design models, tools, design ethics, and case examples of healthcare service design. In addition, Afrikan philosophies (in line with *service design ethos)* have been described giving insights as to how collaborative design is perceived in Afrikan settings.

3.2 DESIGN

Design began over 2.5 million years ago, when early man in the prehistoric era made their first tools. The making of tools is part of human existence, which has contributed to our development today. We make things and design systems that satisfy and meet our present-day demands (Manzini, 2015:VII). Our quest in making things to satisfy our needs has led to the various specialisations in the field of design. Design has many specialised areas, ranging from architectural design, product design, typography, communication design, systems design, and service design. Design in all of these fields means many things. However, it can be described as the process one goes through to satisfy a goal. In all of these activities designers act as service providers where the result of their work meet human needs (Simonsen *et al.*, 2014:VIII). Designers work on the physical level, generate a built environment, and satisfy a need. Designers assume these roles during the process of designing services (Manzini, 2015: VIII). Design as a service has emerged as a specialised field, where services are purposefully designed to satisfy the needs of service users. Service design provides a collaborative space where several disciplines come together to find solutions to address human needs (Foglieni *et al.,* 2018:5-11; Miettinen, 2013:6-10; Kuosa & Westerlund, 2013:5-6).

3.2.1 SERVICE DESIGN

Service design aims at *designing services* to meet customer satisfaction. Service design explores the designing of efficient and desirable services that are useful, usable and desirable (Mager & Sung, 2011:1; Jones, 2013:140-142). Service design has emerged as a multidisciplinary platform of expertise (Figure 3.2). It creates a space where people can bring together their various expertise and skills for a common goal. Service design fosters relationships which facilitates collaborative design processes for sustainable solutions (Moritz, 2005:40; Cipolla, 2009:4-5; Gloppen, 2012;50-52; Blomkvist, 2014:9-10; Foglieni *et al.,* 2018:5-14). Through these avenues the boundaries of various disciplines that join may be transcended and in the process, newer disciplines, frameworks and methods can be formed (Bernstein, 2014:242). Some of the fields where service design is being explored is in the field of healthcare (Cargo & Flores, 2014:3-5; Van Zyl & Pennanen, 2013:1-4).

Designing services in healthcare on one level is a business-oriented service. On another level, it seeks to improve the health and wellness of persons. Services of this nature will call for the collective expertise of the various professionals and stakeholders to work together, in order to improve the quality of such services for patient care (Jäppinen, 2015:1-4; Vennik *et al.*, 2016). Delivering quality healthcare services will require the expertise of different disciplines to explore methods, such as service design, towards enhancing customer (patient) satisfaction (Donetto *et al.,* Fucile *et al.,* 2017:53-55; Clarke *et al.*, 2017:1-2).

Notable design firms such as the IDEO provide tools that can be used for designing to improve the quality of customer service. Generally, most companies periodically try to improve their services to satisfy the needs of their customers. However, the difference in using a service design method is that customer satisfaction is explored from the perspective of users through design thinking strategies (Brown, 2009:1-5; IDEO, 2012:1-7; Manzini, 2015:155-156; Sirendi & Taveter, 2016:222-223). Design thinking explores visual methods such as video, illustrations, drawings, role play, storyboarding and storytelling to engage with users and stakeholders in a collaborative manner (Bjögvinsson *et al.,* 2012:101-102; Carney, 2014:5-15; Heather & Walters, 2016:40-42). These visual modalities serve as a boundary object for participants during design activities. They also serve to generate and share ideas for new services (Kimbell & Julier, 2012:8; Mulgan, 2014:1-6).

In service design methods, expertise from various disciplines such as ethnography, communication, product development, and experience design come together to address particular issues or needs. Design then becomes the driver of change in such collaborative situations (Madden & Andrew, 2016:41-43).

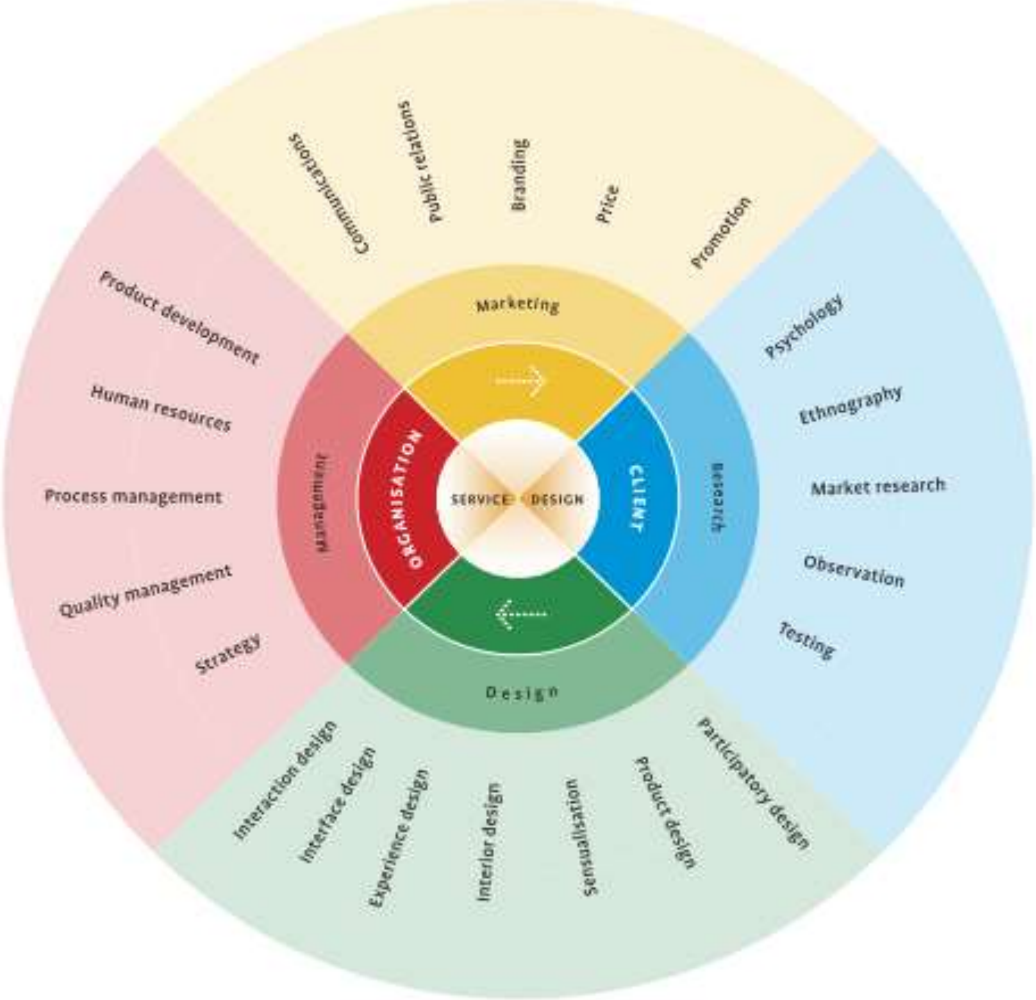


Figure 3.2: Multidisciplinary context of service design
(Source: Moritz, 2005:49)

3.2.2 Service Design Foundations

The foundations of both design and service design can be found in the arts and crafts and within the domain of organised planning. Other sub-disciplines in the arts and crafts such as jewellery design, sculpture, and architecture emerged in the early stages of design as a specialised field. This was followed by service business development, service marketing and industrial design (Kuosa & Westerlund, 2013:5). Service design has evolved and established itself as an academic discipline in various design institutions (Debrah, De la Harpe *et al.*, 2014:423-424; Mulgan, 2014:3; Miettinen, 2013:6; Foglieni *et al.*, 2018:14-17).

Newer courses in design and service design are being offered from short courses, undergraduate levels to postgraduate levels in various notable design schools across the world such as the Stanford University (d.school:https://dschool.stanford.edu), Philips Design (www.philips.com) and the University of Cape Town (d-school: www.dschool.uct.ac.za) (Ambole, 2020:9-10). Furthermore, service design is concerned with the world as it is and the near future. Service design is an imminent movement which proposes design research methods to address issues (Miettinen, 2009:10-25; Fritsche, 2011:13-16). It employs touch points as a way of generating ideas to shape user experiences (Sanders & Stappers, 2014:12). However, one of the challenges confronting the discipline is the lack of a common theoretical framework for all the elements from the different disciplines (Miettinen, 2013:6-9). Service design relates to many theoretical frameworks due to its multidisciplinary nature of addressing problems. As such, researchers continue to explore their discipline according to theoretical methods that suit their particular discipline. Perhaps a more transdisciplinary theoretical framework is required to establish a common ground or space to include all disciplines (Bernstein, 2014:241-242).

Design networks such as DESIS Labs (see https://www.desisnetwork.org) propose service design methodologies as an advanced approach for designing that integrates many other disciplines (Manzini & Staszowski, 2013:II-III, Manzini, 2014:57). Service design frameworks could be explored as theoretical frameworks to guide research activities and analyses. Other design research methods include ethnography and design ethnography. In all of these activities, the designer's role is critical. The designer's role as a facilitator and communicator cannot be ignored in this process (Nova, 2015:13-14; Baskerville & Myers, 2015:23-27). Designers work through visual methods to collaboratively imagine with participants and then communicate the propositions in a given design situation (Knight, 2013:170-171).

In essence, service design advocates the need for users to intensively participate in design activities which is referred to as co-designing (Sanders & Stappers, 2014:12; Madden & Andrew, 2016:41). Co-designing and design thinking are two related concepts from which service design was developed. These three concepts in design are deeply rooted in ideation, design management, analytics and participatory design (Kuosa & Westerlund, 2013:5-7; Bjögvinsson *et al.,* 2012:101). Co-design and design thinking have greatly influenced design research over the last two decades and particularly in the field of Service Design (Foglieni *et al.,* 2018:19-20).

3.3 CO-DESIGNING

Co-design is a process of collective creativity. In co-design activities, participants work together towards a common goal. Co-designing is a specific incident of co-creation (Sanders & Stappers, 2008:6) where both trained and untrained designers work together in a design and development process (Miettinen, 2013:12-13; Manzini, 2015:157-158). Co-design is used when designing for users or with users (Figure 2). During co-design activities, participants co-create ideas using visual methods such as photos, illustrations and visual dairies to generate ideas to solve particular problems in a given context (Mager, 2009:38-39). Through this process, the service blueprint of an organisation or a particular event is created to inform future design and development experiences. A service blueprint is one of the contributions that service design has contributed to visual-based methods in design research (Davies & Wilson, 2013:9-10). Service blueprints reveal the complexities in a particular service and show how these activities are related in a particular service system (Sanders & Stappers, 2014:12). It provides a visualised format of how the system operates, and the touch points where the customer engages with the system can be seen in a service blueprint. In the co-design process, the designer often plays the role as a facilitator and communicator of the design activities (Furze, 2014:4-9). Designers visualise the ideas in the co-design processes and help in simplifying complex ideas to facilitate the communication process from an expert designers' point of view. Co-design serves as one of the common grounds for users to co-create ideas to solve emerging problems. Co-design is used in both egocentric and ecocentric design activities (Figure 3.3). Co-design is synonymous with service design (Young, 2013:91; Debrah, De la Harpe & M'Rithaa, 2015:67-68). Service design as an emerging field (shown in Figure 3.3) lies in the right section of the diagram. Service design and social design have an intention of serving people. Whereas the other disciplines in the middle, seek to engage people. The left hand side of the diagram reveals critical design interventions aimed at provoking design intervention (Sanders & Stappers 2014:13).

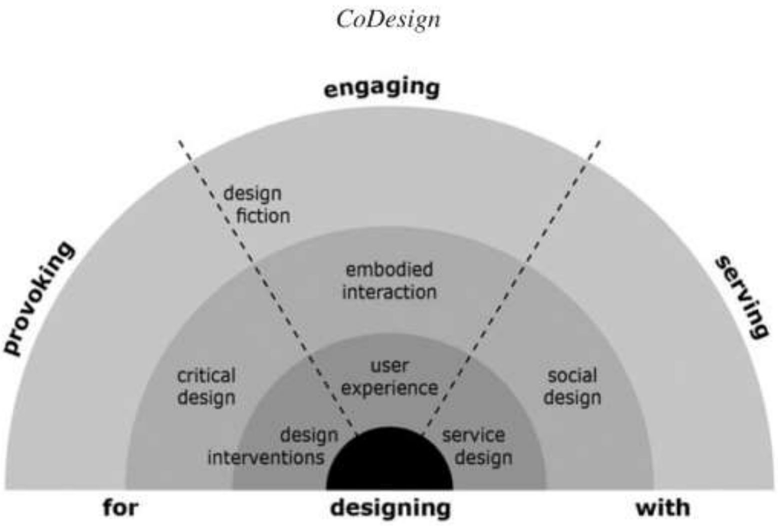


Figure 3.3: Movements of design are emerging across time scales (The world as it is [inner ring], the near future [middle ring] and the speculative future [outer ring]) (Source: Sanders & Stappers, 2014:13)

3.4 PARTICIPATORY DESIGN

Participatory design as a design practice has emerged since the 1970s to the present. Participatory design has its in traditions from Scandinavia and has become an integral part in the field of service design. The ideologies of participatory design simply evolved from a standpoint that those affected by the outcome of the design need to be involved in the design process (Holmlid, 2009:1-4; Bjögvinsson *et al.*, 2012:101-103). Participatory design involves user participation and involvement in the design process. Participatory and co-operative design movements aim at exploring bottom-up approaches to foster change and emancipating users. These two methods are well-developed techniques and are similar to inclusive design ideologies (Franqueira, 2007:1-3; Holmlid, 2009:4). Service design methodological approaches combine these techniques as part of the ideation processes (Bowen *et al.*, 2010:155-158). The communication of ideas in service design engagements are enabled using visual methods when working with stakeholders (Madden & Andrew, 2016:42-43; Edman *et al.*, 2013:14).

Early participatory design traditions were concerned with designing solutions with users. However the contemporary design movement calls for a paradigm shift in using traditional participatory design approaches (Edeholt & Mainsah, 2014:77;

Frauenberger *et al.*, 2015:93-95). Designers must not only aim at exploring the design of things with stakeholders as engraved in the traditional design process, but to explore ways to support stakeholders to (be emancipated to) design (Futerman, 2015:7-8; Cruickshank *et al.*, 2017:42-43; Kraff, 2018:45-49). Participatory design and co-design have become new additions in design education and these concepts are being translated into professional practice (Sanders & Stappers, 2008:5-8; Bjögvinsson *et al.,* 2012:101-102). The design profession and in particular service design is increasingly becoming a participatory design process where service providers, customers and all the stakeholders in a service, work together from the beginning of a project to the end (Kuosa & Westerlund, 2013:24; Foglieni *et al.* 2018:16-19). Designers are expected to possess skills in the design-thinking field for their professional practice (Debrah, Stassen *et al.,* 2019:14-15). Designers require these skills because participatory and co-design methods have evolved as contemporary ways of design thinking.

3.5 DESIGN THINKING

Design thinking has become central in contemporary design discourse and rhetoric. This creative approach to ideation — *design thinking* is perceived as an innovative way of *solving complex* or *wicked problems* where humans are the focus of the design process (Cross,1982:224-225; Bjögvinsson *et al.,* 2012:101; Carlgen, *et al.*, 2014403-406; Head & Xiang, 2016:4). The process is often referred to as the Human-Centred Design (HCD) due to the human role in the design. The approach explores the use of visual methods such as design probes and toolkits to identify the needs of people and explore the possibilities of integrating technology as well as providing the requirements for successful businesses (Mattelmäki, 2006:208; IDEO, 2012:6-7; Edman *et al.*, 2013:10-12; Sirendi & Taveter, 2016:223-224; Ambole, 2020:7-10). In the past, designers focused on product development and less on designing services and other socially responsive design (Sanders & Stappers, 2008:6-8). Tim Brown, the CEO of IDEO (an award winning design innovation) advocates some of the following paradigm shifts for the design community:

- Designers should be involved in socially innovative design and should be open to participation from grassroots level
- Design is a collaborative effort and all stakeholders should be part of the design process from start to finish
- Ideas have to be visualised, prototyped and characterised by human centeredness, empathy and optimism (Brown, 2009:2; Bjögvinsson *et al.,* 2012:101)

Most recently, design thinking has become an integral part in many companies to improve their services. Design principles are not only applied to products but also to consumer experiences, interaction, and production of products and services (Manzini & Debrah, 2014:1-8). Also, the process is used to improve existing products and services or simply make them functional. Companies embraced design thinking concepts as innovative ways of improving their services (Brown, 2009:2; Carney, 2014:5; Debrah, Chisin *et al.,* 2019:1). Providing better services and systems revolves around the designing of the future experiences of customers. Research and innovation in the past has been done in isolation without considering designing thinking. However, the emergence of design thinking as a way of developing and improving services has provided companies with a foresight of what design can achieve (Carlgren *et al.*, 2014:405-407; Manzini, 2015:34).

Nowadays, with a projection of *what design can do* by the design community, many multinational companies have set up creative units within their organisations. Some international companies that have creative units to innovate and develop new ideas include companies such as Virgin *Atlantic, Xerox, Microsoft,* and *Whirlpool* (Design Council, 2007:2-3). Service design has opened doors for designers and non-designers to explore design as a problem solving activity. Companies are acknowledging the role of design thinking and employ designers to harness innovative ideas (Moritz, 2005:25; Cruickshank *et al.*, 2017:49). Designers tend to envision futuristic designs of products, systems, and services to improve customer experiences.

3.6 SERVICE DESIGN MODELS

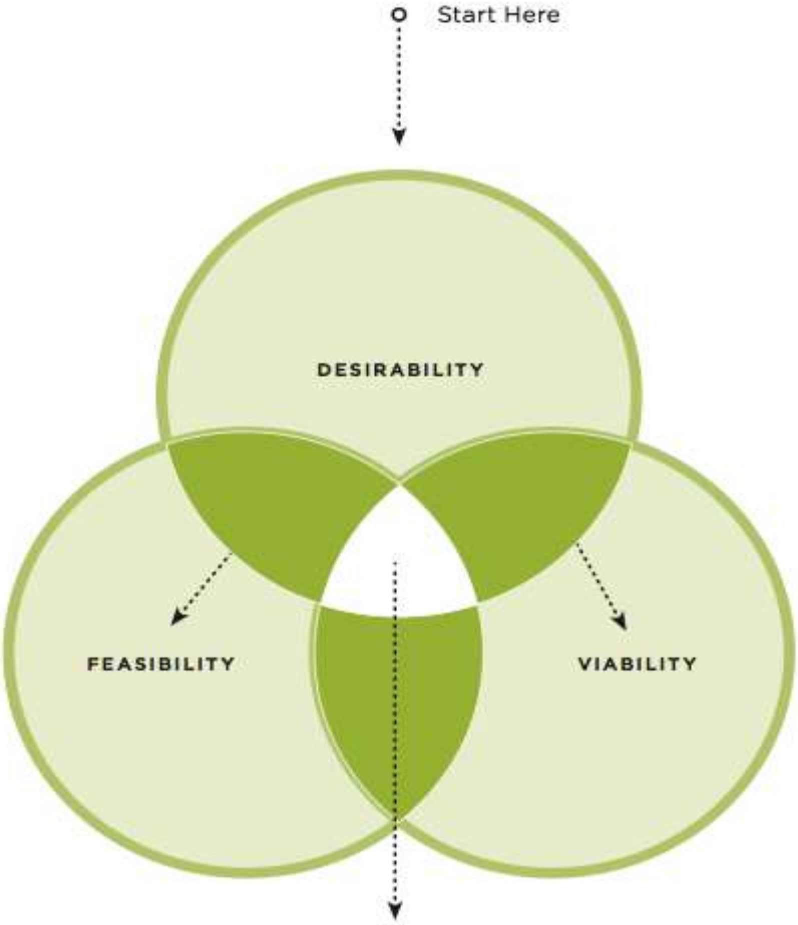
Service design has evolved as a viable design research methodological approach to find innovative solutions. Service design offers many visual tools and methods to obtain data in many different ways. These methods are used to obtain rich qualitative data from participants. Because of these processes, methodological frameworks to guide the design thinking processes continue to emerge from different organisations, design schools, and institutions such as IDEO, Philips Design, and the Design Council. Some of the notable design methods are the HCD (IDEO, 2012:7), Double Diamond (Design Council, 2007:10), Philips Co-create Design (Carney, 2014:14) and many others. Most of these models are used to guide the design thinking processes of a product, service or a system and the user is at the heart of the design process. The fundamental feature among all of these models is that, they all follow the basic design principles such as: **discove**r, **define**, **develop** and **deliver** (Davies & Wilson, 2013:7). These processes promote empathy and enable design researchers to obtain data from the perspective of the users who will be affected by the outcome of the designed solutions (Mattelmäki *et al.*, 2014:71). Several toolkits have been developed to make it easy for both expert and non-expert designers to explore and innovate their own solutions. Examples of the toolkits are the Development Impact You (DIY) by NESTA in the UK and the HCD by IDEO. They are easy to use and easily adoptable for busy people who are not expert designers (Manzini, 2015:155).

3.6.1 Human-Centred Design (HCD) model

HCD approach allows organisations to connect with the people they serve (IDEO, 2012:4). The process allows designers to innovate ideas that best meet the needs of their clients. HCD methods are not expected to solve problems but to give humans the voice to be the expert-designers since they know what will be the best solutions to their problems. The HCD process goes through three main phases. The design process begins with the **desirability**, **feasibility** and **viability** of concepts with humans as the starting point and centre (IDEO, 2012:6-7). The framework of the HCD approach is shown in Figure 3.4. The HCD toolkits allow designers to **Hear** (empathise), **Create** (ideate) and **Deliver** (realise solutions) with the beneficiaries of design solutions.

These design processes are briefly expounded as follows:

- **Hear phase**: At this stage, the design team will collect stories and get inspiration from people to guide the design work
- **Create phase**: at this phase, the design team work together with people in workshop formats to create ideas from abstract to concrete
- **Deliver phase**: The deliver phase is the stage where the team will begin to realise solutions through rapid revenue and cost modelling (IDEO, 2012:8-9)



"The solutions that emerge at the end of the Human-centred Design should hit the overlap of these three lenses; they need to be Desirable, Feasible and Viable

Figure 3.4: Three lenses of HCD
(Source: IDEO, 2012:7)

3.6.2 Philips Co-create Design Model

Philips University have developed a set of toolkits that can be adopted to facilitate the design thinking process (Figure 3.5). The tools are visual-based and referred to as the co-create tools. These toolkits are used during design thinking activities to facilitate conversations and develop innovative ideas (Carney, 2014:5). The co-create process usually goes through four major phases which are **discover, frame, ideate** and **build.** The co-create design processes are described as follows.

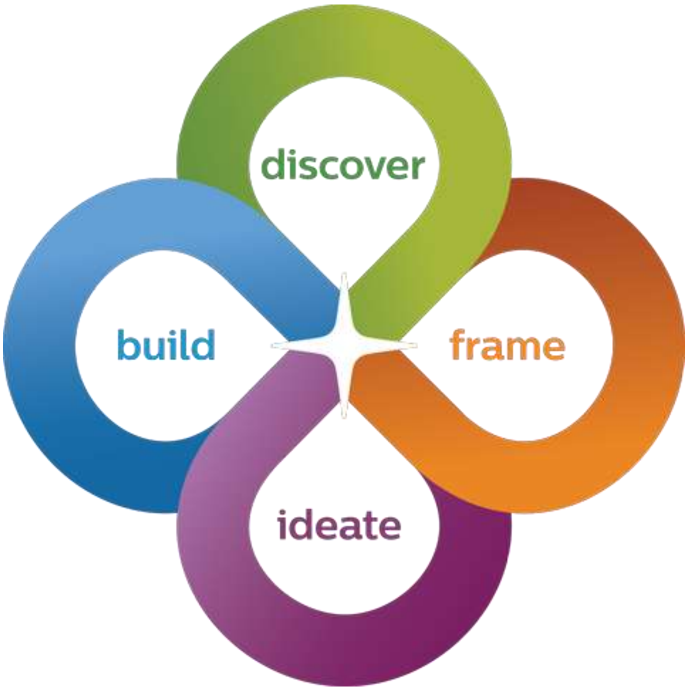


Figure 3.5: Philips Co-create Design Thinking model
(Source: Carney, 2014:14)

- **Discover phase:** The research and design thinking process starts at this stage. Visual-based design tools such as personas, experience flow charts, stakeholder maps, and empathy maps are used to gain insight about the context of users

- **Frame phase:** This is the stage where the challenge is framed. The opportunity is defined and what it should look like in the future. Here the framing canvas is very useful to the ideation process. This helps to identify the specific needs of the users

- **Ideate phase:** At this stage, team members use creative thinking to explore many ideas to concretise their ideas. They explore brainstorming and creative techniques for idea generation. This creates a shared understanding in the design process

- **Build phase:** This phase is characterised by concretising the ideas generated, testing of the prototypes, and testing the hypothesis. The prototypes of proposed solutions, which are usually showcased to investors, are presented at this stage. Here, the tools such as storytelling, drama, role-play, video and other visually engaging tools are used to tell stories about future scenarios. This is where the designers get the buy-in from investors on the innovative ideas proposed (Carney, 2014:3; Debrah *et al.,* 2014:1).

3.6.3 Double Diamond Design Process

Designers often use different approaches to meet their goals. These processes vary from person to person as well as from one organisation to the other. However, a commonality runs through these design processes. The UK design council have segmented these into four major phases known as the Double Diamond Design Process (click to view: **Double Diamond**). This features four major phases: **discover, define, develop,** and **deliver** that illustrate the common thinking that runs through design processes (Figure 3.6). The Double Diamond Process maps out the design process from the beginning, when it is a broad idea, to the stage when it is completely narrowed down to concrete ideas (Davies & Wilson, 2013:6-7).

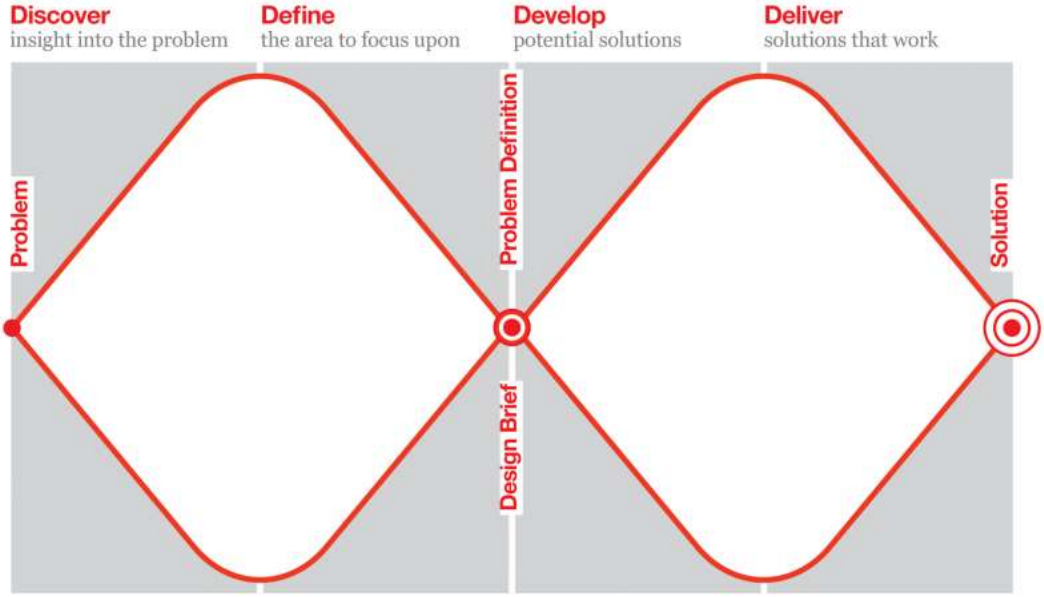


Figure 3.6: Double Diamond Design Model
(Source: Design Council, 2007:6; Davies & Wilson, 2013:6)

- **Discovery phase**: Designers usually look at the world with fresh eyes at this stage to gain insights about user needs and to identify new ideas
- **Define phase**: Designers try to make sense out of all the identified possibilities at the discovery phase
- **Develop phase:** The stage where innovative solutions are developed and prototyped. It is an iterative process where designers work through much trial and error to arrive at the desired solution
- **Deliver phase:** The final stage where all the ideas are launched. This involves testing, evaluation and feedback loops to improve the designed solution (Davies & Wilson, 2013:7)

The description of the major phases in the design processes in the IDEO, Double Diamond, and the Philips Co-create models clearly have many similarities. Comparing all three design approaches, it is evident that the processes from IDEO and Philips are similar to the **Double Diamond Design** process. Although, each of the identified models has slight variations in their form, the processes follow the fundamental design processes found in the Double Diamond framework. Hence, the Double Diamond Design Process was selected as the methodological framework for the data collection processes which is detailed in **Chapter Five.**

3.7 SERVICE DESIGN TOOLS

In service design research, a variety of design probes and toolkits are employed to facilitate the ideation process during co-design activities. Design probes and toolkits enable designers to empathise with the people they are designing for or with. As a result of the process, designers are able to propose useful, useable and efficient products and services that meet their needs (Sanders & Stappers, 2008:6-8). Also, probes are useful in many other ways. When probes are well designed, they can be used to demonstrate and report research activities in a visually interesting way. This facilitates the communication of ideas. Design probes fosters a relationship between the designer and the individual to achieve empathy (Mattelmäki, 2006:50). Design empathy means obtaining a deeper understanding of the people you are designing for (Mattelmäki & Battarbee, 2002:266; IDEO, 2012:89; Sustar & Mattelmäki, 2017). Hence, through the use of design probes and toolkits, participants are able to generate a broad range of possibilities rather than focusing on simply generating the right idea (Sanders & Stappers, 2014:7; Debrah *et al.*, 2017:2121).

Several toolkits can be explored to envision possibilities when designing services. The IDEO, Philips Co-Create, and Double Diamond Design methods provide some customised tools to facilitate the ideation and achieve empathy as part of the design process. All of these tools from the various companies, in my observation, are aimed at facilitating the externalisation of ideas (Kolko, 2010:5). Although they are similar, these tools could be modified for different purposes. A few of these service design tools that align with the Double Diamond Design Process have been complied in Table 3.1. The Double Diamond Design processes and tools were selected as it is one of the best known general design processes (Yu & Sangiorgi, 2014:194-195). In addition, service design activities are characterised by many of coloured sticky notes, toys, Lego pieces, and illustrations. Other visual-based tools include role-play, music, context mapping, performing art, photos and video recordings. All of these visual techniques facilitate the design thinking process in service design (Kimbell & Julier, 2012:52; Southern *et al.*, 2014:133-134; Debrah, De la Harpe & M'Rithaa, 2015:71-72).

Table 3.1: Service design tools and methods as outlined by the Design Council (Davies & Wilson, 2013:10-22)

BRIEF DESCRIPTION OF SERVICE DESIGN TOOLS AND METHODS	
User Journey Mapping	A user map is a visual representation of the user's journey through a service. It takes the user's point of view and explains the user's actual journey through a service.
User Diaries	User diaries are a way of allowing users to record their experiences in a dairy away from researchers. It is a qualitative way of obtaining data. User diaries are based on the specifications of the project, and the time span can vary from a few days to a couple of

BRIEF DESCRIPTION OF SERVICE DESIGN TOOLS AND METHODS	
	months.
Service Safari	Service safari is another service design research method where researchers on the field experience the services first hand. Service safari is very useful at the beginning of research activities.
User Shadowing	User shadowing is a research method to understand how people interact with the world around them. In other words, the researcher steps into their shoes to experience their real world.
User Personas	User personas are usually characters that embody a particular research. It can be a set of characters representing different kinds of people. They are very useful in service design activities as it helps in identifying particular groups of people that a particular service is aimed at.
Brainstorming	This is an ideation technique to generate many possibilities during design thinking activities. It provides new ways of looking at things and helps to breakthrough boundaries.
Design Brief	The design brief is usually the clear statement or fundamental challenges to be addressed. It provides the details for the challenge. This serves as a reference point for the challenge.
Service Blueprinting	The service blueprint is the detailed visual representation of the service over time. It shows how the service works in the front end and back end of the service. It also shows the different touch points, channels and all the people involved in the service.
Experience Prototyping	This is a way of testing the newly developed service ideas. Participants communicate their ideas to the design team and this allows the design team to test or refine their solutions. Also, it is a way of getting the buy- in of stakeholders.
Business Model Canvas	This visual tool is used for developing and describing business models. It helps to communicate ideas and to test whether the business ideas meet the specific user needs.
Design Scenarios	These are mainly stories, which describe a potential future or set of futures of a service. They are mainly in the form of storytelling or narratives that are used to communicate ideas.

3.8 DESIGN ETHICS

Designing health and wellness solutions requires ethical considerations to inform the design processes particularly for technology-enabled solutions in underserved contexts when dealing with vulnerable targets such as expectant mothers. This study is user-centred and thus explores "*phronesis*" a concept from Aristotelian virtue on ethics, which is relevant for designing technology-enabled healthcare services. Also, phronesis can be described as the ethical value, which is informed by ones wisdom, and judgement acquired through lived experiences in specific environments (Barry *et al.*, 2017:2708-2709). In other words, *phronesis* is about how to *live a good life*. *Also, it refers to the application of wisdom in practical situations and the outcome* might differ from different contexts (Van Niekerk & Nortjé, 2013:2; Liang, 2017:2). In research activities, phronesis is critical as it contributes to practical situations and helps address complex issues when working with vulnerable populations who might be beneficiaries of service solutions. Thus, the study was designed reflecting on phronesis, which necessitated the inclusion of potential service users in the design process so that the solutions would be beneficial to them. Service design methodology was deemed suitable for this study since it fosters user participation and inclusion in the design processes.

Further, the study of service design methods is characterised by co-design activities. Co-design is central to social design where designers aim at designing for social good. Having goodwill in design is in line with ethics (Young, 2013:90). Designers are perceived to be behaving ethically when they do the thing that they intend to do which is morally right (enkratic). Being enkratic should be based on the right reasons that are morally right. Enkratic norms usually hold the view from the **local** perspective of the individual and not from **global** views (Coates, 2011:321-322). However, being enkratic as a designer should be for the collective good and the whole of society. Perhaps to be deemed rational in designing for social good, designers should not just be **local** in their enkratic views but imbibe **global** *enkratic* perspectives. Thus, designers who behave ethically can be perceived as "glocalised *enkratic designers*"—a term I have proposed for socially responsive designers in an Afrikan context.

On the other hand, when they do not act against their better judgment, they are perceived to be exhibiting **Akrasia**. **Akrasia** is when one acts against his or her rational judgment and it does not imitate the truth (Young, 2013:90-91; Debrah, De la Harpe & M'Rithaa, 2015:70-71). For example, we access a huge amount of information on the internet, blogs, magazines, and so on and these are often based on the things we are to avoid so that we do not negatively impact on society and the next generation. Whenever designers are aware of such situations and still act contrary to that, and know that their actions will still impact on the present and future generation, then they are exhibiting **Akrasia** or incontinent behaviour (Inácio & Gerardo, 2006:2). Service design activities such as co-design and participatory design methods that characterise design thinking methods led by design researchers are to be conducted with **glocal** enkratic viewpoints. This way design ethics will not be seen only from the designer's standpoint **(local)** but considerations on how design solutions will impact positively on present and future generations **(global).** These ethics are to be considered as core values in the design process.

3.8.1 AFRIKAN DESIGN ETHOS

In research activities, ethics is perceived as the codification of institutional values and norms that govern a particular scientific research (Georgia & Marianna, 2011:3-5). As a design-researcher, living in Afrika, there was a need to learn from indigenous systems in order to explore Afrikan philosophies that could be applicable in this study. In the Afrikan context, the closest to ethics in research activities are philosophies such as **Ubuntu** (isiZulu, South Africa), **Noboa** (Akan, Ghana]) and **n'out** (Igbo, Nigeria) (M'Rithaa *et al.*, 2008:62; Geber & Keane, 2013:8-9). These can be translated quite broadly as togetherness or unity within the Afrikan context.

Popular among these Afrikan philosophies is Ubuntu which is now a buzzword in Afrikan societies (Lutz, 2009:1-5; Tomaselli, 2016:1-3; Manasoe, 2016:1-3). The Ubuntu phrase is defined in isiZulu as *Umuntu ngumuntu ngabantu – this means a person is a person through other people* (Geber & Keane, 2017:501-502; M'Rithaa & Jamie, 2017:1-2; Qually, 2018:186-187). The Ubuntu philosophies are not founded on empirical analysis (Boon, 2007:26, cited in Van Niekerk & M'Rithaa, 2009:153). However, it exists among people, based on their common understanding to support one another for the common good of humanity. People work collaboratively and express compassion, kindness, care and in the process empathy is achieved towards one another for development (Van Niekerk & M'Rithaa, 2009:153; Chmela-Jones, 2015:42-43). These Afrikan philosophies align with some of the service design ethos that encourage eco-centric design with users (Debrah, De la Harpe & M'Rithaa, 2015:70-71). These Afrikan ethos were explored as part of the service design processes in order to understand context to inform future service solutions in healthcare.

3.9 DESIGN INNOVATION IN HEALTHCARE – CASE STUDIES

Innovation drives development whereas design and technology serve as a means to provide limitless opportunities to improve healthcare services (Vennik *et al.*, 2016: 151-153; Ariani *et al.,* 2017:41-48). Designers work within organisations and propose design methods to improve healthcare services or work from outside agencies to provide innovative solutions (Freire & Sangiorgi, 2010:2-3).

There is a wide range of opportunities in healthcare service for investment. Some these opportunities are: *medication management, ageing with vitality, vital signs monitoring, care navigation, emergency detection and response, physical fitness, diet* and *nutrition, social engagement* and *behavioural* and *emotional health* (AARP, 2014:7). All of these areas will require the provision of health information and education services in order to better educate and inform patients for healthy living. For example, there are persistent challenges that undermine the provision of equitable healthcare services in underserved contexts in Sub-Saharan Afrika. Some of these areas in healthcare where challenges persist include the provision of health information and educating patients in underserved communities (Van Niekerk & Bonnici, 2014:2-3).

All of these areas in healthcare provide avenues where service design can be explored to find innovative ideas and solutions. Designers can explore these areas using design thinking strategies to find innovative ideas to improve healthcare services, hence the need for this research. A few case examples of "*what design can do*" to simplify healthcare services in both present and futuristic services are described subsequently. The case examples presented here covers both global and Afrikan perspectives ranging from systems to product design in healthcare.

3.9.1 CASE EXAMPLES – GLOBAL

Case 1 – Giving Control Back to Paralysed Patients

A Philips innovation, created a wearable technology to give control back to paralysed patients (Figure 3.7). The concept is a wearable technology and shows how patients in such conditions can control their environment by simply using brain commands and wearable technologies (Philips, 2015b:para 2).

Figure 3.7: Futuristic design innovation in healthcare
(Source: Philips, 2015b:para 2)

Case 2 – Google Glass and IntelliVue Solutions

This design solution is an innovative device (Figure 3.8) that allows doctors to monitor the patient's vital signs without having to take their eyes off the process or the patient (Philips, 2015a:33).

Figure 3.8: Futuristic design innovation in healthcare
(Source: Philips, 2015a:43)

Case 3 – Fight Malnutrition

These mid-up arm measuring straps were developed collaboratively between NGOs and local stakeholders (Figure 3.9). These child-friendly straps, called Trunky and Monkey were developed to assist healthcare workers to assess malnutrition more efficiently. They were designed for children so that they will co-operate with healthcare workers (Philips, 2015a:35).

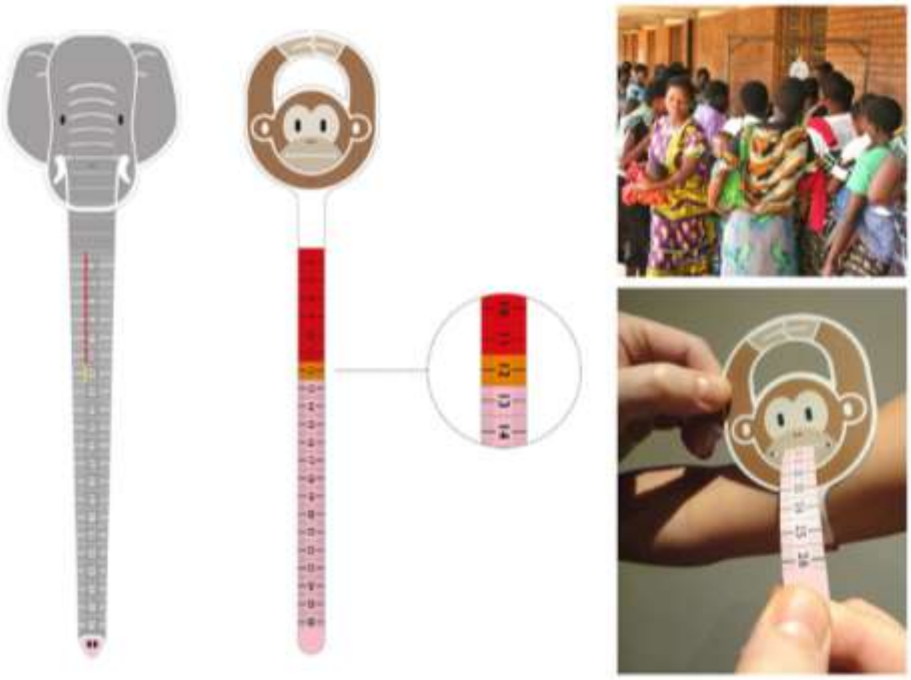


Figure 3.9: Fight Malnutrition
(Source: Philips, 2015a:35)

3.9.2 CASE EXAMPLES – AFRIKA

Case 4 – All-inclusive Healthcare Innovation Initiative

In Cape Town, design is being explored in a public hospital to improve services. One such case is in the Groote Schuur hospital, which is one of the largest and busiest public hospitals in Cape Town. The all-inclusive Healthcare Innovation Initiative (i-HUB) is positioned at the Groote Schuur hospital. The Groote Schuur health initiative is aimed at providing an innovative approach to improve healthcare service delivery in Afrikan settings (see www.inclusivehealth.co.za).

Some of the projects include: **a)** Project Flamingo – an innovative way to cut down waiting periods for breast cancer patients at the hospital. **b)** Emergency Triage Tool—designed to replace the paper-based system of booking emergency cases. **c)** Breast Wellness Programme—this intervention was a set of tools and resources that could relieve patient anxiety and empower them to look after themselves. Some of these case examples are presented as Figures 3.10–3.12. **d)** ComaCARE—is an initiative to provide bedside care and counselling for patients and families who have survived brain injuries. The ComaCARE organisation is a non-profit organisation offering these services in and out of the hospital. It has become an integral part of the neurosurgery unit at the Groote Schuur unit, which has been very effective (Van Loggerenberg, 2014:8-16).

Case examples from Groote Schuur inclusive Healthcare Innovation initiatives

Figure 3.10: Emergency surgery triage system (Top Left)
(Source: Van Loggerenberg, 2014:8-16)
Figure 3.11: Breast wellness programme (Top Right)
(Source: Van Loggerenberg, 2014:8-16)
Figure 3.12: ComCARE
(Source: Van Loggerenberg, 2014:8-16)

Case 5: Ikhwezi Clinic in Nomzamo, Cape Town

A second example is the Ikhwezi Clinic project in Nomzamo, Cape Town (click to view: http://www.ccdi.org.za). This is one of the busiest clinics in Cape Town. Service design methods were used to re-engineer the systems and processes in the healthcare sector (Figure 3.13). Service design was used to identify key challenges at the clinic such as flow, waiting time, cleanliness, and privacy. Design initiatives were proposed to help address each challenge (Cape Craft Design Institute [CCDI], 2015:para 1).

Figure 3.13: Designing healthcare services in Ikhwezi Clinic (Source: Cape Craft Design Institute [CCDI], 2015:para 1)

Case 6: The Guide Pillbox

This example was developed in South Africa by designers and healthcare workers in the Groote Schuur hospital. The Guide Pillbox (Figure 3.14) was proposed as a result of constant complaints from doctors that patients did not understand healthcare instructions especially when to take medications. Often, patients do not understand what time they should take their medications. The designed solution is a tool to assist patients and doctors to have better conversations about their conditions and medications (Van Niekerk, 2015:1).

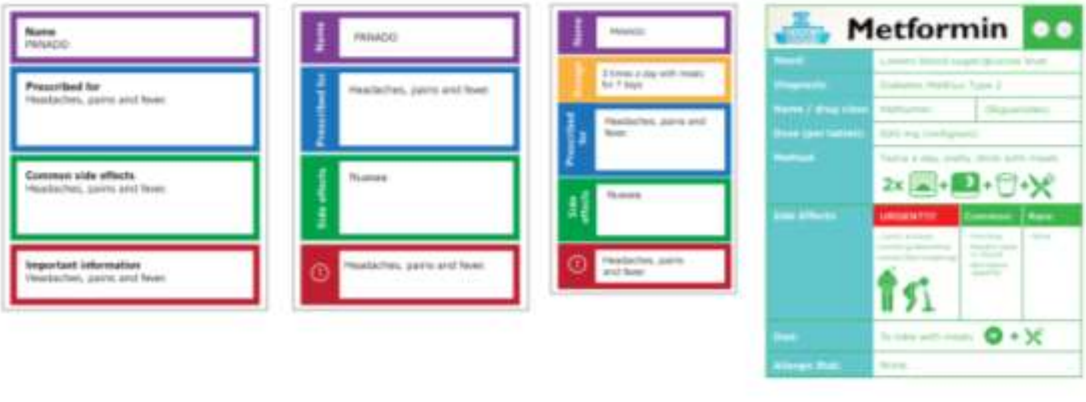


Figure 3.14: Spreadsheet of health instructions in the Guide pillbox (Source: Schaefer, 2016:12)

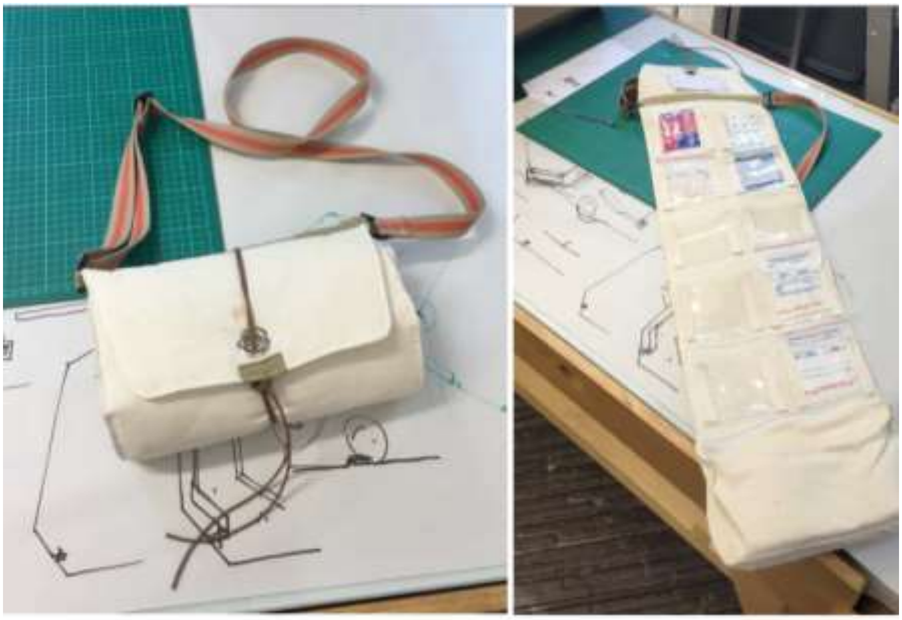


Figure 3.15: Pillbox Carrier bag
(Source: Schaefer, 2016:11)

Case 7: eBoard

The eBoard is a proposed concept aimed at improving the communication process in South African hospital wards with regard to patient's status. Often, patient information and records are paper based which makes it difficult to monitor patient records. The proposed solution is an electronic patient care management tool that can display information about patients from each ward. The system is aimed at improving the communication between healthcare professionals for effective patient care (Van Niekerk , 2015:1).

3.10 SUMMARY

In this second phase of the literature review, the information obtained revolved around design, service design methodologies and healthcare service design. Service design has emerged as a creative way of designing services, where designers act as facilitators using design thinking methods to find innovative solutions (Moritz, 2005:4-5). In service design, a wide range of tools and processes can be explored to improve services.

Service design provides endless possibilities to innovate ideas from every corner in an organisation, communities and in the many fields such as healthcare. Healthcare service design has recently become an area where service design methods are being explored to find innovative solutions to complex problems in hospitals (Freire & Sangiorgi, 2010:1-3; Ariani *et al.*, 2017:15-16). Service design tools such as the IDEO, Philips Co-create and the Double Diamond Design Models are examples of how these design processes are being used in different ways to re-design, innovate and develop futuristic products and services in healthcare (Design Council, 2007:10; IDEO, 2012:7; Carney, 2014:14).

Through service design processes, patients experiences in the healthcare environment are being improved (Kitapci *et al.,* 2014:161-163). Therefore, in Afrikan countries, some of the persistent challenges that undermine the quality of care in the hospitals are all avenues where service design can be explored to find innovative solutions.

There is a wide range of opportunities in healthcare service for investment. Some of the opportunities that exist in healthcare include: medication management, ageing with vitality, vital signs monitoring, care navigation, emergency detection and response, physical fitness, diet and nutrition, social engagement and behavioural and emotional health (AARP, 2014:7). All of these areas will require some form of information for patient education in order to improve health and wellness. As such, health services must be designed with humans in mind since they are at the centre of the process. Their involvement can greatly provide valuable information that can offer insight to provide efficient healthcare services (IDEO, 2012: 6-7; Van Niekerk & Bonnici, 2014:3). Also, information obtained through the literature review **Phase II,** provided answers to the following empirical questions as part of this study:

- *What are the available service design methodologies that can be explored to improve healthcare services in underserved contexts?*
- *What design thinking models and tools will be suitable for designing healthcare services in an underserved context?*
- *What design ethos will be relevant in designing services in the Afrikan context?*
- *What are some of the case examples of health innovation services?*

In summary, based on the literature obtained so far, it is clear that the field of healthcare provides several opportunities where design can be used to provide solutions. Designers can explore this field using design thinking strategies to find innovative ideas to improve healthcare services in different environments. Some of the service design methods and tools identified through the literature review have been explored to design health information and education services in an underserved context for this study. The service design research processes explored are described in **Chapter Five** of the study.

CHAPTER FOUR

EXPLORING THEORETICAL PERSPECTIVES

"Design is an essential creative process that initiates imagination, manages the use of appropriate materials and defines required usage rules, thus creating an impact on people through products" – Srini R Srinivasan

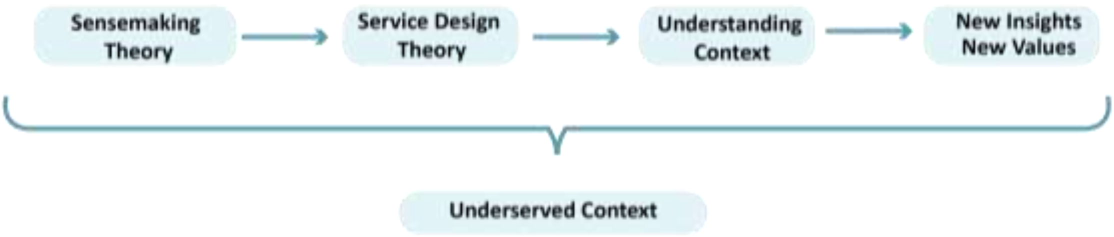


Figure 4.1: Theoretical perspectives in the study

4.1 INTRODUCTION – THEORETICAL FRAMEWORK

In this chapter, theoretical perspectives are explored to provide an underpinning and a direction to the investigation being undertaken (Figure 4.1). Theoretical frameworks as applied in research, provide the underlying principles that facilitate empirical data collection and analysis (Kari, 1998:2; Saunders *et al.*, 2015:2). Theoretical frameworks are usually a combination of different theories that the researcher may put together to help guide the research and analysis. In this study, I drew inspiration from **sensemaking** and **service design theory** as an adjustable framework to understand the research context. This research considers how the health intermediaries communicate with their patients by informing and educating them. Since it is important to provide relevant information and education services, the literacy levels and other contextual factors are important considerations. The target service users of the health information service are mothers who are likely to have low literacy levels and are living in underserved context. Maternal health education and promotion services require effective communication between health intermediaries and patients. Effective communication in healthcare education and promotion can enable mothers to understand and act upon health-related information and to improve upon the quality of their lives (Lawrence, 2010:10). In addition, effective communication can potentially enhance relational care between health intermediaries and their patients. The integration of visual messages to communicate health information has the potential to promote health literacy among women in underserved communities. The nature of the context of this study as described above served as the underlying principle that guided the selection of the relevant theories for the study. I have explored the sensemaking and service design theories as the theoretical framework for the study. I now move on to discuss the theoretical framework and its application within the context of this study.

4.2 SENSEMAKING

Sensemaking is defined as making sense out of ambiguous or complex data. Information sensemaking theory has been evolving since 1972 when the early frameworks began and are still evolving. The development of the sensemaking methodology was started by Dervin and her colleagues 44 years ago at the University of Ohio (Agarwal, 2012:4; Thomas, 2016:12). Sensemaking was developed as a methodological framework to analyse communication. Dervin makes a distinction between the *noun* and the *verb*. Dervin indicates in her model that people should be able to communicate irrespective of their language differences (Dervin, 1998:36; Savolainen, 2006:1116-1117). Sensemaking has been used not only in the field of communication, but also in many different disciplines as a methodology in research activities. Some of these disciplines include nursing, medicine, religion, public education campaigns (Agarwal, 2012:11). Dervin invites researchers to explore the process further and to offer their comments to enhance the sensemaking methodology (Dervin, 1998:44). Sensemaking has suffered many criticisms as a theory, because of its fuzziness in methodology and therefore it still needs to be extensively developed.

Despite these complexities, sensemaking methodologies have been useful to many researchers to derive meaning in their research activities and obtain valuable results (Kari, 1998:1; Godbold, 2006:4-10). An example of the sensemaking metaphor as designed by Dervin is shown in Figure 4.2. Since sensemaking is still evolving, exploring it in different contexts such as this research case could contribute to its development for research activities.

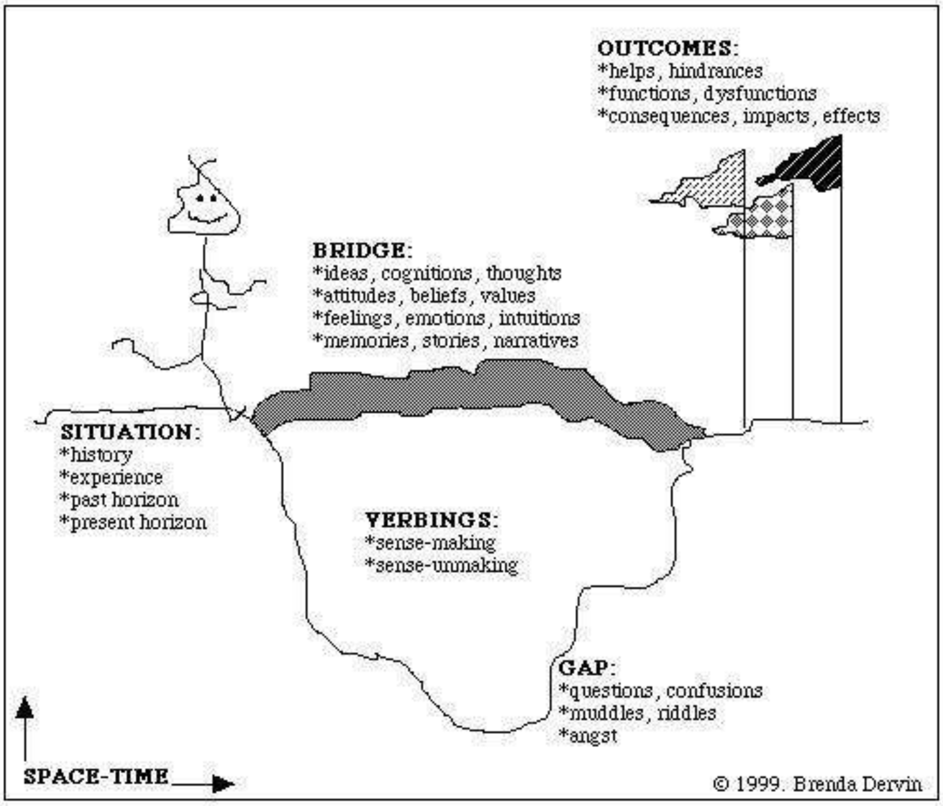


Figure 4.2: Central metaphor of sensemaking
(Source: Dervin 1999, cited in Agarwal, 2012:9)

4.2.1 Sensemaking View – Comparing Approaches

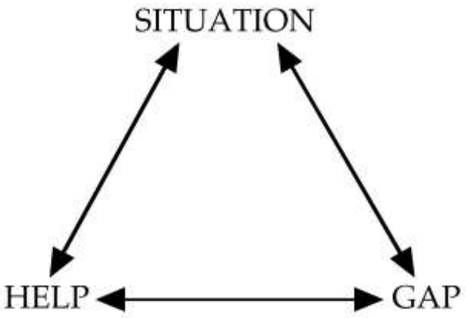
Sensemaking, as indicated earlier, has been evolving since the 1970s until present. Although there are other available sensemaking models, Dervin is the most cited which led me to examine her sensemaking model and other related versions which evolved from her concepts (Figure 4.3). The dynamics of the selected sensemaking triangle in Figure 4.3 read as follows: the **situation** creates the context in which the individual *makes sense* out of something, which is the **gap**. The identified **gap** then drives the person to seek for **help.** Once the individual obtains **help,** it puts him/her in a new **situation** (Dervin, 1998:39; Liu, 2013:1-2)**.** The theory in Figure 4.3 presumes that all the concepts are equal in the process of sensemaking. However, (Kari, 1998:6) suggests otherwise, if sensemaking in a "prototypical" process is conceived as represented in Figure 4.4. In this case (in Figure 4.4), the actor will typically begin the process in a **situation/context** after which the actor will recognise the **gaps** and further build a **bridge** and get **help** (Kari, 1998:6). A brief look at the dynamics of the models within the context of information sciences are explained as follows (Figures 4.3 & 4.4):

a) **Situation**: is the **"context"** of the person seeking information.

b) **Gap**: gap refers to the "**information need"**. It is the conception of what type of information the individual needs to clarify his or her thoughts in a particular situation.

c) **Bridge:** is the **"information seeking"** process—a process in which an individual attempts to find information by searching through available information sources to satisfy **information needs.**

d) **Help:** is **"information use**" which is the outcome of information seeking. It describes the way in which information is obtained to help actors with their **situation** (Kari, 1998:8-9).



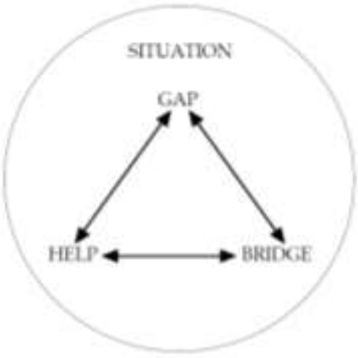


Figure 4.3: The sensemaking triangle, situation–gap–help (Top Left)
(Source: Dervin 1992:69, cited in Kari, 1998:4)
Figure 4.4: The process of sensemaking, gap–bridge–help in situation (Top Right)
(Source: Kari, 1998:6)

However, understanding the **situation/context process** influences all the other concepts in the process of sensemaking. Sensemaking concepts such as the **"Gap", "Bridge",** and **"Help"** are the main processes, which are influenced by the **context** of the individual seeking the information. In this case the sensemaking process implies that the **situation** does not just pop up before sensemaking. Sensemaking occurs within a **situation/context** (Kari, 1998:4-6; Godbold, 2006:6-8). Practically, not all the steps in the classical process are required before sensemaking occurs. The situation and context becomes a critical indicator in the sensemaking process for the information seeker.

In this study, the **context/situation** of the participants will influence any future interventions that are made to facilitate access to health information services. Thus, the **context/ situation** will influence how women (mothers) identify information **(Gaps),** how they **Bridge** it and receive **Help** to make informed choices in order to improve their health behaviour. Context then becomes an integral part of service research and needs to be explored in order to propose better service offerings for potential service users.

4.2.2 Sensemaking and the Research Context

The context of this research is situated in an underserved community in the Western Cape Province of South Africa. In this community, the integration of enabling technologies to facilitate *access* to information from health intermediaries and mothers was explored. In the provision of health information services to patients, their context should inform the design and development considerations to provide equity in their information needs (Figure 4.5).

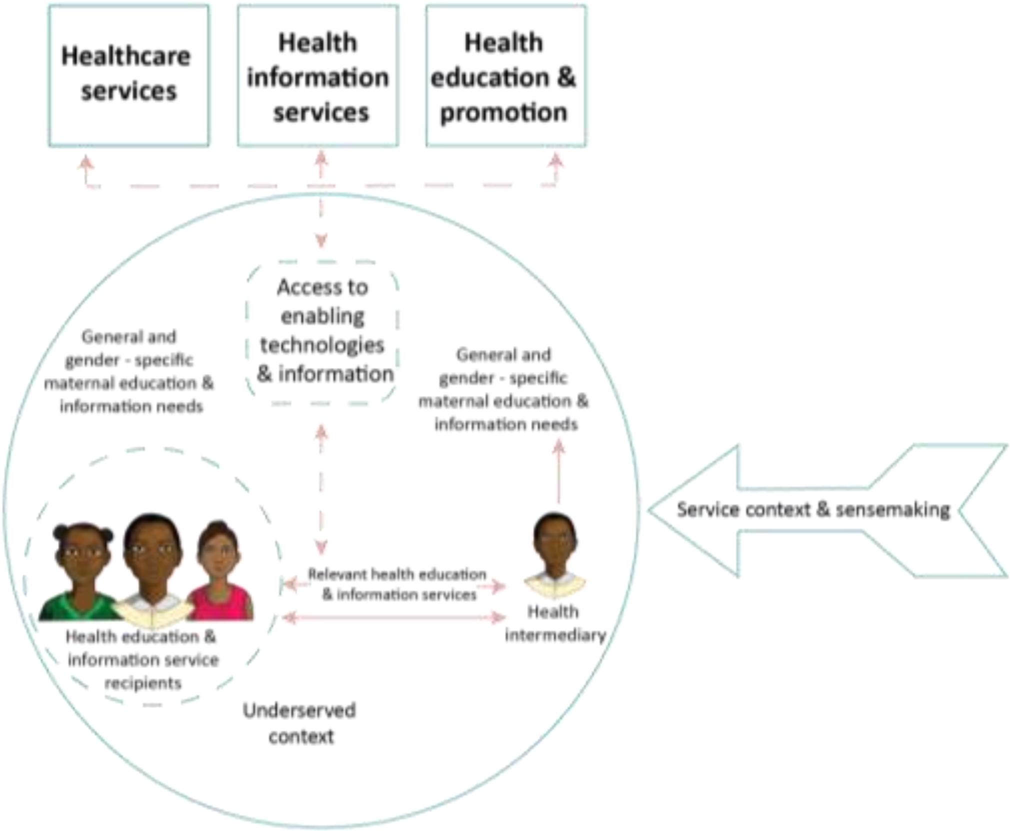


Figure 4.5: Conceptual model showing key elements within the research context (Source: Authors' own construct modelled after ISD4D project in *Forthcoming* - Guidebook) (Source: De la Harpe *et al.*, 2016)

Context largely influences the information quality and determines how health information materials can be accessed for patient education. Although some researchers may perceive **context** as constraints or limitations, it is rather an enabler to information communication and sensemaking (Klein & Myers, 1999:69; Johnson, 2003:738).

Context plays a crucial role, especially when providing information to mothers with low literacy levels. Thus, paying attention to contextual factors and providing easy access can facilitate effective health communication between health intermediaries and women in underserved contexts. Meaning making from the social semiotic perspective relies greatly on **"access" and "context"** (Rani, 2013:99; Sserunjogi *et al.*, 2016:406-408). Designing context specific information in this case, it is important to ensure that information is **accessible** to women from their perspective, without barriers (Figure 4.6). Contextualised information will make it easier for information seekers to **access** and derive meaning. The provision of relevant messages to information seekers can equip them to improve on their health behaviour.

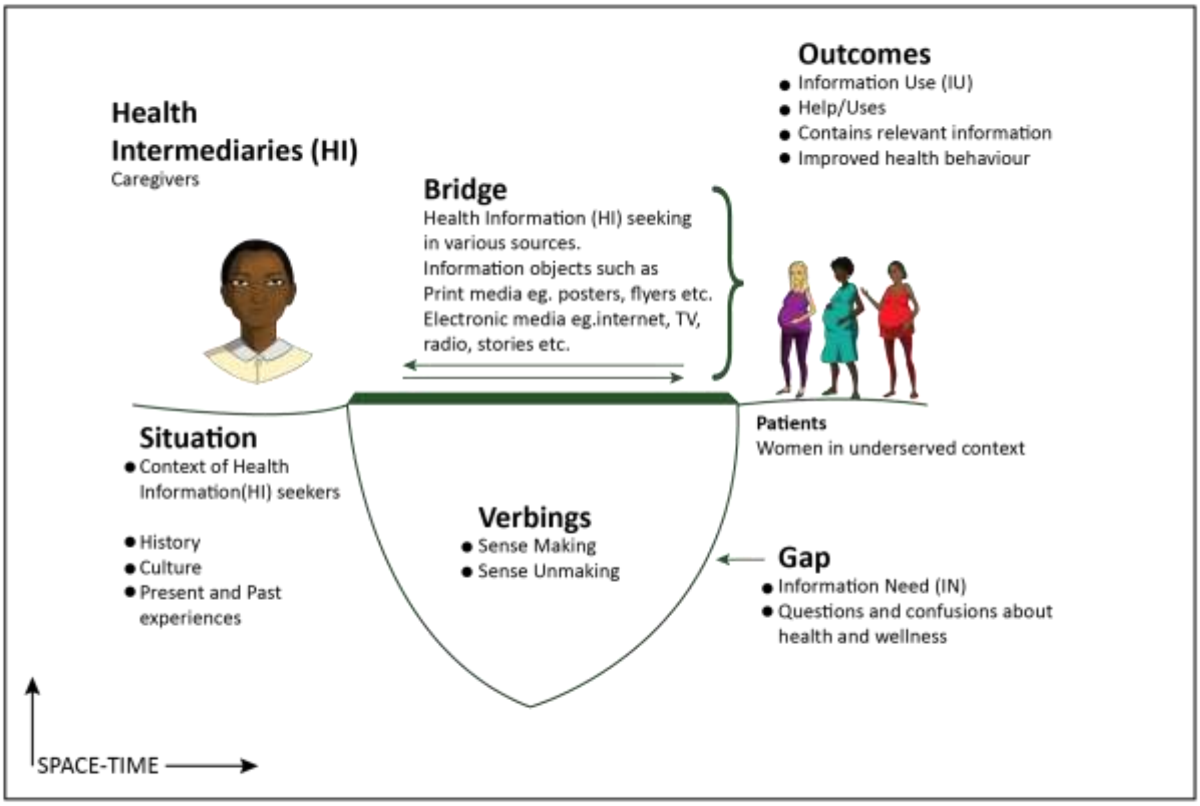


Figure 4.6: Metaphoric view of sensemaking on information needs (Source: Modelled after Dervin, 1999, cited in Agarwal, 2012:9)

4.2.3 Interpreting Sensemaking

In this section, sensemaking concepts have been explored from the designer-researchers' perspective and mapped to key concepts of this study (Table 4.1). The mapping is based on my interpretations of Dervin's (1992:69 cited in Kari,1998:4) sensemaking Triad which was interpreted further by Kari (1998:4). A description of the various concepts in the sensemaking model and its interpretation in relation to the context of this study is presented as Table 5 and a metaphorical view is illustrated as Figure 4.6.

Table 4.1: Mapping the dynamics of sensemaking to the context of this study (Source: Adapted from Dervin, 1992:69 cited in Kari ,1998:4-6)

SITUATION The context of the person seeking information	Context of the social actors or health information seekers (health intermediaries and patients sharing information in a particular situation)
GAP The gap that needs to be filled with information and Knowledge	Health information needs–challenges with communicating health information
BRIDGE Individual finds information from different sources to satisfy an information need (gap) – (information searching)	Health information seeking–searching through health related materials and other relevant sources for information
HELP/USES Outcomes the individual obtained when seeking information at the *bridge* stage to satisfy the knowledge gaps – (information use)	Health information *Use*– equitable access to relevant information that is useful to mothers to make informed decisions for themselves and their children

4.3 SENSEMAKING AND DESIGN

Design is perceived as a problem-solving activity, which coexists with sensemaking. Although they are two autonomous ideas, they have intersecting dimensions. The intersection of these two concepts serves as a reminder that the change that design brings, affects both physical, biological and social areas (Manzini, 2015:35). In design, sensemaking can be perceived as a participatory joint activity where meaning is derived from collective participation of actors (De Jaegher & Di Paolo, 2007:13; Van Dijk & Hummels, 2015:8-9). Design activities are usually participatory in nature and as such, participatory sensemaking occurs through the design process. *Participatory sensemaking: is the coordination of intentional activity in interaction, whereby individual sensemaking processes are affected and new domains of social sensemaking can be generated that were not available to each individual on her own* (De Jaegher & Di Paolo, 2007:13).

In sensemaking, organisms do not passively receive information from their environments; instead they actively generate meaning based on what is of interest to them (De Jaegher & Di Paolo, 2007:13; Torrance & Froese, 2011:39-41). In some instances, sensemaking is an individual activity and at certain instances it is participatory and the whole sensemaking process becomes a shared activity (Figure 4.7).

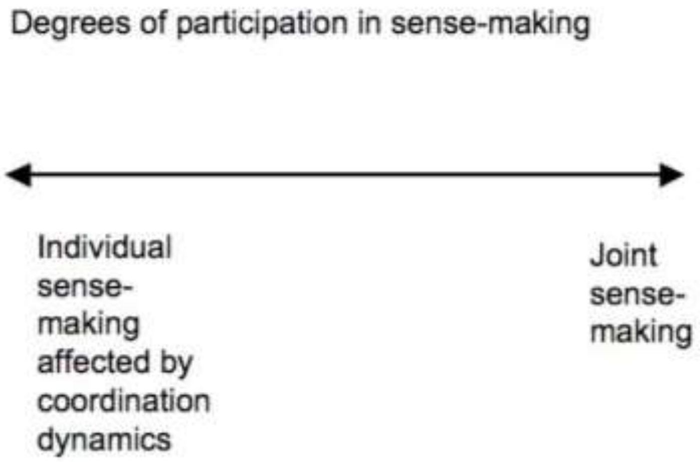


Figure 4.7: Spectrum of degrees of participation in sensemaking
(Source: Adapted from De Jaegher & Di Paolo, 2007:13)

For instance, in a particular design activity, designers may make sense from the *internal* and *external* point of view. All information they require to design a solution for a complex problem will be externalised using visual means such as sticky notes, illustrations and other visual means to bring all data obtained from a research activity into a coherent whole (Kolko, 2010:3-5; Kimbell & Julier, 2012:10-14; Kotina *et al.*, 2017:15-16). In such instances both information stored on computers and even in the memory are laid on the table or in a given space where collective meaning can be derived with other designers. Connections are made from all externalised data, which then leads to propositions that could solve problems identified (Kolko, 2010:1-3). In the process, designers design sense which might be in the form of a system or artefact (Manzini, 2015:35; Corubolo & Meroni, 2015:804-805). Sensemaking of the designed solution can be an individual or a participatory joint activity depending on the solution being designed. The scenario explained, shows that design, as a problem-solving activity cannot be disassociated from sensemaking. Hence, designed solution needs to make sense to actors within the social world in which they are placed (De Jaegher & Di Paolo, 2007:13).

4.3.1 Sensemaking and Service Design Activities

In this service research, sensemaking in the context of service design is about social interactions where shared meaning is derived from a participatory joint design activity. Service design activities involve personal encounters with people and other social interactions which in the process create value for a particular service (Eneberg, 2012:3-5; Cipolla & Reynoso, 2017:4). In the design of services the designer plays a role as a sense maker (Mazzarella *et al.*, 2017:2945). The design processes are conducted as a participatory activity to harness ideas that could bring change or improve a service. Actors involved in the service design process collectively share ideas that were previously internalised. Using design tools and methods these ideas are then externalised and sensemaking becomes a shared experience to gain new insights about context (Kolko, 2010:1-3; Pastor, 2012:2-5; Kimbell & Julier, 2012:10).

Sensemaking as a service design analysis can be perceived as a joint activity on two levels. **Level 1** is about the **local culture** that forms the foundation of the sensemaking process of the particular service solution being assessed (Cipolla & Reynoso, 2017:6). For instance, in the Afrikan context, cultural values and norms such as **Ubuntu** (South Africa), **"Noboa"** or **"Ekomefemo"** (Ghana) and **"Harambee"** (Kenya) which means togetherness (M'Rithaa *et al.*, 2008:62; Van Niekerk & M'Rithaa, 2009:152-153) are to be factored into the design of service solutions. Sensemaking analysis on **level 2** is mainly affected by the cultural **ethos** on **level 1** that serves as the foundation for the service solution. **Level 2** becomes the service solution (Figure 4.8). The new value created by the service solution will largely depend on the degree of the cultural ethos that is included in the designed-solution. Thus, in this research case sensemaking and service design ethos was explored with analytical lenses. The framework was relevant to this study as it served to understand context in order to envision desired service solutions. In a word, *sensemaking* and sense *unmaking* is part of the iterative design process in which solutions are harvested to solve wicked problems in the life-world.

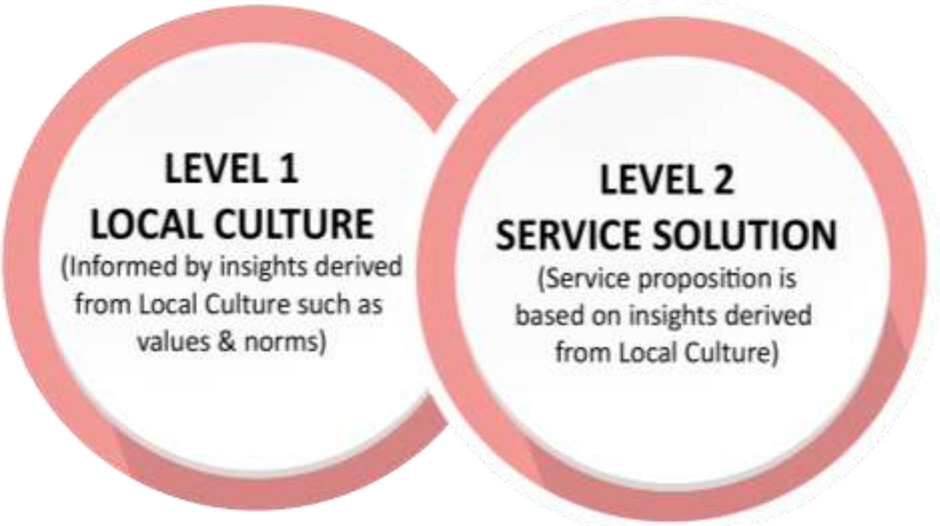


Figure 4.8: Service design as a sensemaking activity
(Source: Authors' own construct modelled after Cipolla & Reynoso's (2017:6) work on service design as a sensemaking activity)

4.4 SUMMARY

In summary, a discussion of sensemaking theories and their application as analytical lenses was discussed in this section. I chose the sensemaking model to guide this study because of the flexibility it offers to combine other available theories, which could help in *making* sense of complex information. Dervin (1998:39) and Kari's (1998:4-6) sensemaking triad served as a baseline to understand sensemaking in the context of service research. Concepts in these classical models have been further interpreted and mapped to key concepts in this service design research.

Service design research involves understanding the context of services and adding value, which largely depends on gaining insights about context. Service design processes often involve a participatory joint activity of making sense of the context of potential users, (De Jaegher & Di Paolo, 2007:13) and these are based on two levels**. Level 1** is **local culture** and **level 2** is the **proposed service solution** (Cipolla & Reynoso, 2017:6). These **two levels** served as the theoretical framework, which set the direction of this research. In addition, the information presented in this chapter provided answers to the following real-world questions as part of the study:

- What are the available theories that could be explored to analyse service design as a participatory joint activity?
- How does sensemaking facilitate knowledge production in design activities?
- How do information seekers make sense of ambiguous information to satisfy an information need?
- What are the sensemaking concepts that could guide the analysis of health information activities in an underserved context?
- How could sensemaking concepts be explored to aid the design of health information services and objects?

Further research is suggested to explore other possibilities of applying sensemaking theories in other aspects of service design research. In other words, it is hoped that other researchers could explore sensemaking theories as a starting point to analyse service design activities while they **make** and **unmake sense** of complex information.

CHAPTER FIVE

RESEARCH METHODOLOGY

"Designers have a dual duty; contractually to their clients and morally to their later users and recipients of their work"— Hans Höger

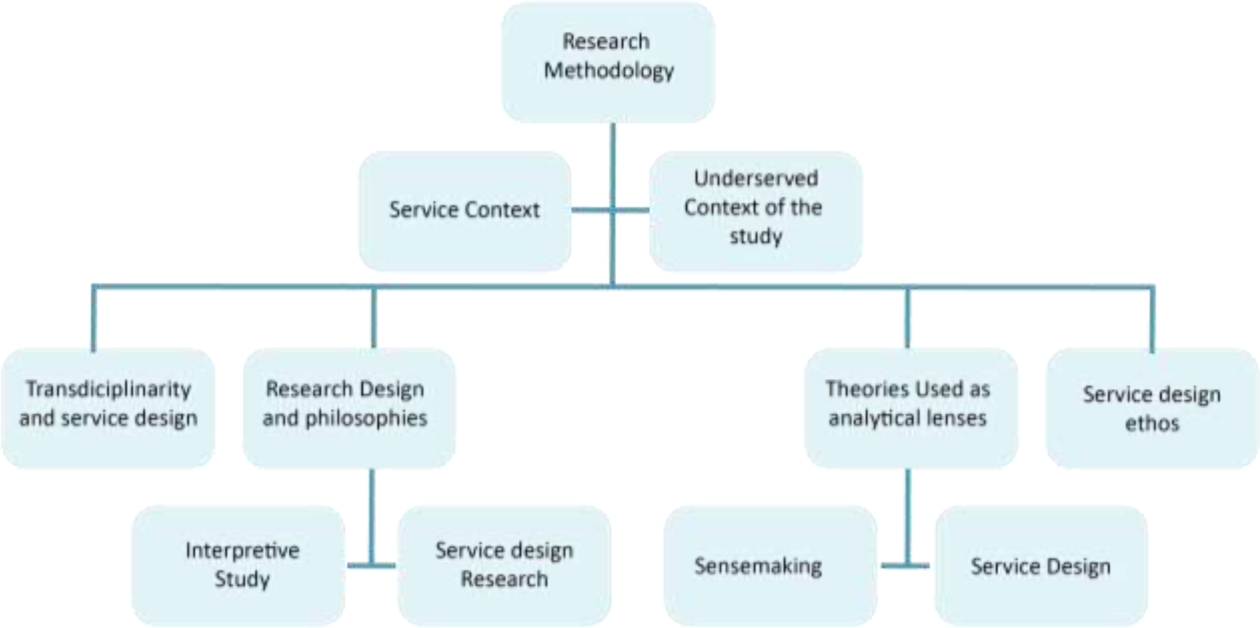


Figure 5.1: Main concepts in Chapter Five

5.1 INTRODUCTION

In this chapter, service design research methodology and its application in the context of this study is described (Figure 5.1). The service design field is concerned with the world as it is. It examines how the world could be perceived and experienced in the future (Sanders & Stappers, 2014:12; Foglieni *et al.*, 2018:16-21). Service designers use visual-based methods such as illustrations, drawings and choreography to formulate solutions to problems that are not currently in existence (Davies & Wilson, 2013:8-9). Through the service design process, designers are able to interpret design specifications, behavioural patterns and transform concepts into services that could be experienced in the future. Service design processes and tools lay emphasis on social skills, visual-based thinking and empathy which is often achieved through the design process (Kimbell & Julier, 2012:14-16). In this sense, designers work as the coordinators in projects between all actors using their visual skills to "*think futures*" of services in a particular context (Miettinen, 2009:60-61). In the previous **chapters (Three and Four),** service design processes, tools, design ethos, sensemaking theories and their application in real world scenarios, to create value to services, has been studied and discussed. The findings that were unearthed through the literature review on service design, guided the application of "designerly ways of knowing" the service context which is the, world of the service (Cross, 1982:221; Cross, 2001:1; Yu & Sangiorgi, 2014:119). In the world of the service, lies the **problem**

space that is being researched in the Afrikan context. The *service context* was investigated to gain insights and *think futures* of healthcare services through service design methods and tools. In this section, procedures involved in the study include the methodological approach, the sensemaking theory, philosophical perspectives, design processes, and tools for data collection.

5.2 SERVICE DESIGN RESEARCH IN THE CONTEXT OF THIS STUDY

Service design as a methodological approach is qualitative in nature and aligns with interpretivist philosophical worldviews, which formed the basis of this study (Klein & Myers, 1999:69). In the context of this study, the qualitative nature of service design methods and tools provided a rich and holistic approach to understand the **what, the how,** and the **why** of the events surrounding health information services in the various service contexts. Also, the qualitative nature of the research allows for the study of attitudes and behaviour of participants within their natural settings (Gray & Malins, 2004:19-21; Johari, 2006:25-27). Design empathy is also achieved through the service design process due to the human-centeredness of the approach (Mattelmäki & Battarbee, 2002: 226-267; Miettinen, 2009:60-65).

In this research case, service design methods and tools were used to obtain data from all relevant sources in the various service contexts. The *service contexts* in this investigation are situated in the Western Cape Province, South Africa *(Service Context A)* and Kumasi Metropolis, Ghana *(Service Context B)* (Debrah *et al.*, 2017:2128-2130). In these *service contexts***,** the *service users,* who were mainly the health intermediaries and patients, are the main research participants in all data collection procedures. Other significant concepts in service design research detailed in this chapter include *the service concept, service providers, service users, service interfaces and underserved service context*. In addition, descriptions of the sample, unit of analysis and observation, philosophical perspectives, service design methods, design tools and its application in a transdisciplinary research domain of designing services in Afrikan settings are detailed in this chapter.

5.2.1 Service Concept – the Mental Picture

A **service concept** is sometimes referred to as **"service in mind"** which is an integral part of services offered to customers. The service in mind then becomes the mental modelling picture of what the customers and the employees perceive the services being delivered (Goldstein *et al.*, 2002:123-124). The implementation of new service concepts in any given organisation demands a process of change in order to meet the needs of service users (Stickdorn & Schneider, 2011:125-126). A service concept is perceived as **how** an organisation would like their services to be perceived and experienced by their customers, employees and stakeholders. The service concept defines the **how** and **what** of service design and serves as a mediator between the clients' needs and the strategic intentions of an organisation. In addition, the service concept provides an integration between the **how** and the **what** of the services to the customers (Goldstein *et al.*, 2002:123-124; Paulišić *et al.*, 2016:234:237).

The hierarchical structure of human activity as shown in Figure 5.2 shows the various levels of human activity that influence a service concept. Human activities are directed towards specific goals and objectives that consist of operations that are influenced by physical and social conditions (Sangiorgi, 2008:20). **Service concepts** represent the value proposition of a company or an organisation that are part of their business strategy to meet customer needs. Therefore, in order to implement a service concept effectively, the interrelations between the **how** and the **what** in human activities within a given service design need to be harnessed to add value to customer services (Yu & Sangiorgi, 2014:119-201).

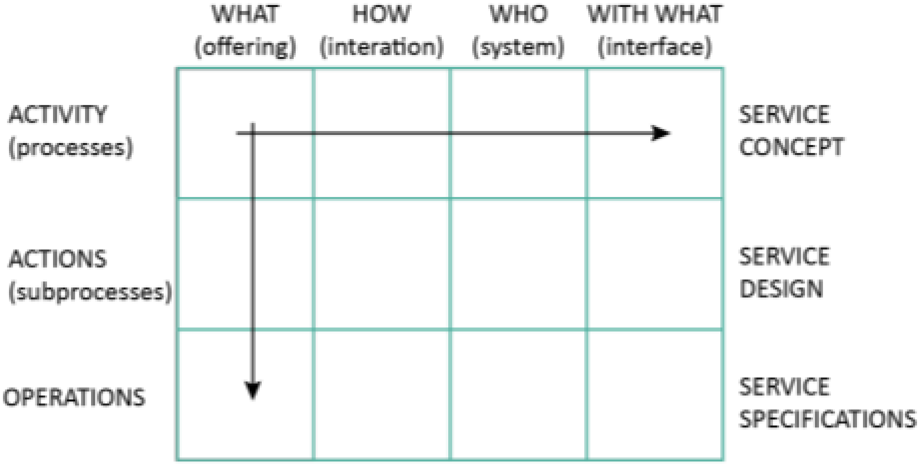


Figure 5.2: Design methodology framework, hierarchical structure of human activity (Source: Sangiorgi, 2008:27)

Further, the service concepts may be perceived on two levels, the *service marketing concepts and service operations concepts*. The **service marketing concepts** refers to the benefits of the service user (Sangiorgi, 2008:27; Paulišić , 2016:236-237; Foglieni *et al.,* 2018:14-16). Whereas, the service **operations concepts** refer to **how** the service will be delivered to potential clients, understanding customer needs and satisfying them (Goldstein *et al.*, 2002:123). The *service concept* can be perceived on four main levels:

- **Service operations:** refers to how the service is operationalised and delivered to customers
- **Service experience**: focuses on the customer's direct experiences with the services being offered
- **Service outcome:** aims at the benefits derived and the results of the service to the service user
- **Value of the service**: is the value proposition of the service to clients assessed against the cost of the service (Clark *et al.,* 2000; Johnson & Clark, 2001, cited in Goldstein *et al.*, 2002:123)

Service users or customers may not perceive these variations within a given service being experienced. They will have a mental modelling of the particular service being offered as a complete experience. The service concepts are key to service design since it plays an integral role in informing the design of the service (Sangiorgi, 2008:27; Yu & Sangiorgi, 2014:382-384). Often it is relinquished in most service design planning, which does not help when the service concepts are not clearly defined. As the service concepts will inform the service recovery in a particular setting, the service recovery then becomes the satisfaction a service user derives from a service (Goldstein *et al*., 2002:112).

Service concepts then become the key benefits and offerings made by an organisation to the end users. These service concepts comprise of a complex set of values and norms. In order to develop an efficient service, there is a need to gain an understanding of the needs and preferences of the potential service users (Sangiorgi & Clark, 2004:149; Fynes & Lally, 2008:330-331; Paulišić *et al*., 2016:237). Using service concept serves as a valuable foundation to drive the design decision. The service concepts or the prototype of the service helps managers to be consistent and competitive in their service design (Yu & Sangiorgi, 2014:384-385).

The **service concept,** outlined in this section, formed the foundation to gain an understanding of the **"how** and **what"** of healthcare services that are delivered within this research context. This study was not designed to evaluate all the service concepts within the healthcare settings of the research case. Instead, the service concepts became the phenomenon being researched in order to understand the **how** and **what** of healthcare information services that are delivered in the selected service context. Also, the service concepts served as a guide to determine the **service encounters** that could be prototyped and improved upon as part of the service providers' offerings within this research context.

5.2.2 Service Providers – The Organisation

Service providers are the main stakeholders who operate the services from the backend of the service. The communication lines in a given service must be open for the service providers as well as members within the company in different departments (Stickdorn & Schneider, 2011:123-126). These service providers are usually the administrative persons who might be involved in running these services in order to provide the needed improvement that might be required by the service user (Goldstein *et al.*, 2002:112; Hämäläinen & Lammi, 2009:182:193). A successful service design draws from the abilities of the service provider to integrate multiple perspectives of participants to design service encounters in line with their companies' goals (Sangiorgi, 2008:26; Foglieni *et al.,* 2018:20-22). Through co-creation the customers are offered the opportunity to add value to the service in partnership with the service provider (Stickdorn & Schneider, 2011:31).

This study is situated in the context of healthcare within the South African context. The healthcare services in this region are provided by both the public and the private healthcare sector (Daviaud *et al.*, 2017:53-56). The healthcare system within the Western Cape Province where the research was largely concentrated is made up of both the public and private services, which are often complimented by home-based healthcare services. Home-based care service is approved by the government and often managed by service providers such as NGOs in South Africa (Debrah, *et al.*, 2014:101-105; De la Harpe, 2014:24).

5.2.3 Service Users – The People

Services are usually designed to meet the needs of users who may be potential clients or beneficiaries of the particular service being offered (Mager, 2006:6-7). Service users' involvement in the service design becomes critical in order to design the services to meet their needs (Stickdorn & Schneider, 2011:29). It is evidenced that involving service users in the research process helps with accountability and quality of designed services in a particular context (Hämäläinen & Lammi, 2009:192-193).

In the field of healthcare, the *service users* are largely patients whose wellbeing might be the ultimate objective of the particular service being offered (Clarke *et al.*, 2017:1-2). Within this research context, the service providers were the health intermediaries and mothers. The main beneficiaries of these services are the patients living within the communities of Grabouw, South Africa (Debrah, De la Harpe & Mugendi, 2015:67-68; Van Zyl & Pennanen, 2013:1-4). However, the *service users* who are the focus of this study are mothers living in underserved-contexts. They then become the beneficial *service users* of the home-based healthcare services provided in South Africa (Debrah, Bhebe *et al.*, 2014:95-98). Involving *service users* in research is key to improving the services (Rise *et al.*, 2013:266-268), especially when dealing with underserved communities.

5.2.4 Service Interfaces

Service interface is the frontline where the service users interact with the service prepositions to achieve the intended outcome of the service from the service providers' point of view (Sangiorgi, 2009:416). The **service interface** then becomes the tangible part of the service which is made up of the products and people (Yu & Sangiorgi, 2014:119-200). Service design in this light, can be perceived as designing experiences that can reach many people through different touch points that occur over a period of time (Sangiorgi, 2009:416; Stickdorn & Schneider, 2011:123). In the *service delivery* processes, the interfaces can be coordinated and managed on **two levels:** the **service delivery component** and the **service package.** The **first level** is pitched at the **service delivery component,** which is the technical service content from which the complete service offering is built. The **second level** then becomes the **service package**, which contains all the components desired by the customer (Figure 5.3 for the service interface). A connection between these *two levels* provides an avenue for the various service providers in the service delivery to exchange information about *service users* (customers) in order to improve the *service delivery* (De Blok *et al.*, 2014:176-178). In this study, the *service interfaces* focuses on *home care and services* for mothers living in underserved contexts (Figure 5.3). Service design was explored to address challenges from the service users' perspective. The design process is to ensure that the *service interfaces* are useful, usable, and desirable from the service user's perspective and thus to advance the value proposition of the service (Mager, 2006:6; Mager & Sung, 2011:1).

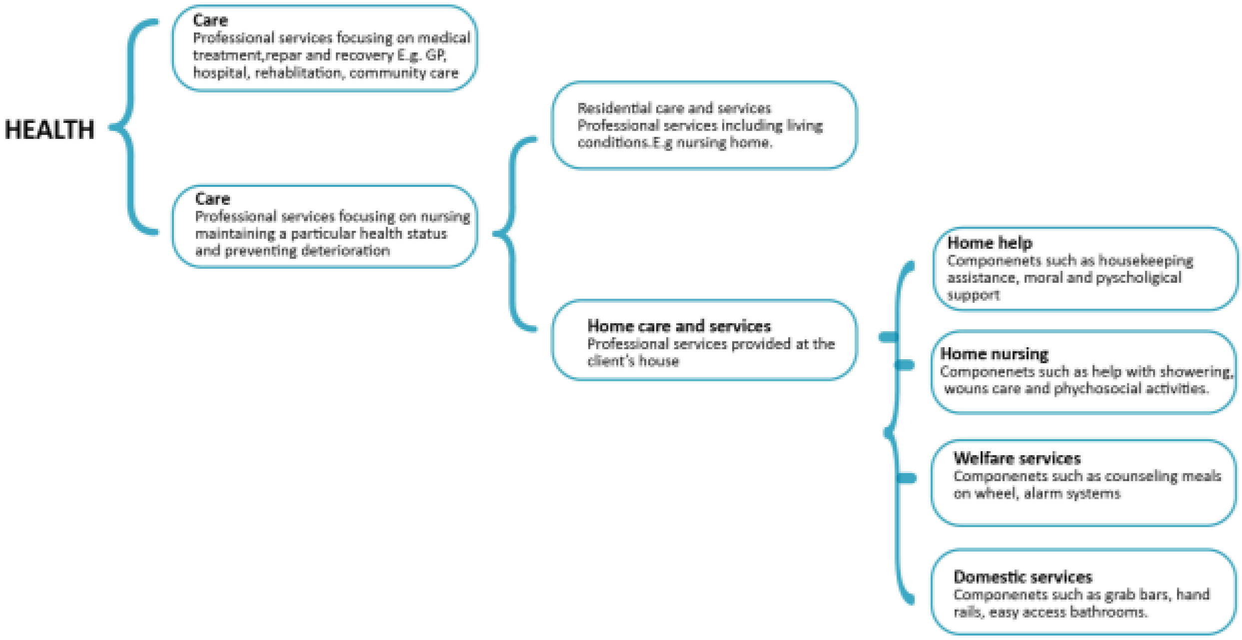


Figure 5.3: Overview service interfaces in a healthcare sector
(Source: De Blok *et al.*, 2014:179)

5.2.5 Service Context – The world of Service

Services offered to customers are operated within a service *context*, which is referred as the *world* of the service. Context in a particular service can be viewed as the specific frame in which the service takes place. The context in a particular service design activity is determined by the research project team and stakeholders involved. The boundaries of the context are then delineated and the extent to which it can be explored. Several opportunities are then determined by the researchers in any given service design activity (Sangiorgi & Clark, 2004:148-149; Dhaliwal *et al.*, 2011:89-90). In determining the boundaries for this study in an Afrikan setting, some questions were put forward in the process of the contextual inquiry: **Where does the context lie in this service? What are the boundaries of this service? How can these boundaries in the service be explored for opportunities?** (Sangiorgi, 2008:15). In response to these questions, the main service context was situated in an *underserved context.* The phenomenon under investigation lies in *healthcare services* and the boundaries were set on *health information needs* and *services*. *Service design* processes were used to explore these boundaries in the service, which lies within an underserved context in Afrika.

5.3 AN UNDERSERVED CONTEXT FOR THE STUDY

- **Service context/ research case:** During the design of services, researchers will often focus on a Service Context And investigate into that particular phenomenon within the research case (De Blok *et al.*, 2014:175). A case study approach is used in many research endeavours to contribute to our knowledge of individual group, organisational, social, political and related phenomena (Yin, 2009:4). The term research "*case*" is used to describe the selected research setting or service context in this enquiry. These two terms are used interchangeably in some situations in this document to describe the particular research context being investigated. Although this research did not follow the rigorous case study processes, the concept of having a particular research case to work with was necessary. Identifying a particular research case, helped in focusing the study and made it possible to explore the *world of the service* hereafter referred to as Service Context A and B. Selecting these particular research cases, informed the service design processes adopted to unearth complexities in underserved contexts for this study.

- **Underserved Communities:** These are usually informal settlements with complex social ecosystems. Underserved communities usually lack fundamental services in their locality, usually highly populated. Moreover, there is a high prevalence of social vices due to unemployment and other related social issues in these communities (Organisation for Economic Co-Operation and Development [OECD], 2003:45). These informal settlements need to improve using available best physical structures, resources and relational services. Local projects that promote social innovation could be initiated and coordinated by a larger framework to improve services in underserved communities (Cipolla *et al.*, 2015:128-129; Avelino *et al.*, 2015:2-4; Huh *et al.*, 2018:146-147). In this light, two major cases were selected and explored to improve healthcare services in underserved communities for this study. These cases were located in **two** informal settlements in Afrikan communities—one in **South Africa** and another **West Africa, Ghana.** In this section, the cases identified in underserved communities and the design process explored are described and analysed hereafter.
- **Selected cases in Afrikan communities:** The *two cases* that were selected are situated in Afrikan communities. The main research case (Service Context A) was located in *Cape Town, South Africa* in the *Grabouw community*. The majority of the research activities were conducted in *Service Context A*—an underserved community. The research was further extended to *Kumasi, Ghana* as the second research case *(Service Context B)*. Design activities conducted in *Service Context B* were mainly for the purposes of validating and testing some of the initial findings obtained from the main research case, *(Service Context A)* (Debrah *et al.,* 2017:2120-2121). Also, the replication of some aspects of the research in Ghana was to ascertain whether the design processes could be replicated in similar contexts, to make it more robust (Yin, 2009:54-55). Furthermore, testing some aspects of the service design processes, helped to improve subsequent design activities and toolkits for future inquiry.

5.3.1 Service Context A – Motivation for selection

CPUT Living Labs and the Grabouw case: The main research case was situated in the Grabouw community (Service Context A). The reason for selecting the Grabouw case is attributed to CPUT, my university, having a Living Lab called **Kujali Innovative Incubation Hub (KI2H)**. There are several existing partnerships between CPUT and other international partners to collaborate on research through the KI2H in the Grabouw community (De la Harpe, 2009:30-37; Alexander & Francke, 2013:8). The relationship and existing activities in KI2H motivated the selection of Service Context A—Grabouw community. The Grabouw community is one of the major project sites within the KI2H projects at CPUT. The K12H Lab initiative aligns with my research interest of improving healthcare services in underserved communities, hence my choice of working in Grabouw.

The KI2H is sometimes simply referred to as **Kujali,** which is a Swahili word meaning "**to care**" (Figure 5.4). Here, I will use the word Kujali to refer to the Living Lab where socially innovative solutions are proposed as part of CPUT's social responsiveness to the South African community (click to view: [**Kujali Lab|CPUT**]). The main goal of Kujali is to create and apply local knowledge for the enablement of individuals, communities, and organisations, through the development of Information Communication Technologies (ICT) solutions that support collaborative design with the active participation of users (Delen, 2010:112).

Figure 5.4: CPUT, Kujali Labs Logo (Left) and ISD4D Team (Right) (Source: ISD4D Archives)

The Kujali Lab houses many projects where students and professionals often come together and work collaboratively on real-life projects. Among these many projects is the *Care Data App* project. This project was aimed at developing mobile solutions to capture, transmit, process and report patient data that is used in home-based healthcare service provision. Also, an additional project within this research is the design and development of Maternal and Child Healthcare application (MCH App) which is part of the larger project of this study, Information Systems Development for Development (ISD4D). The healthcare systems (*InfoShare*) ultimate goal is to facilitate communication between caregivers and patients within the Grabouw community.

Figure 5.5: Activities in Kujali Lab using co-design activities (Source: ISD4D Archives)

Additionally, the methodological approaches used by researchers in the Kujali Lab are co-designing and that forms part of service design processes. Since the solutions often proposed by Kujali are people centred, it becomes important to use bottom-up approaches to co-create solutions tailored towards the specific needs of community members in Grabouw. Therefore, the design strategies used by Kujali aligns with my personal philosophical perspectives of knowing as an interpretivist. Thus, I focus this study on health information services from the caregiver and patient–user perspective in Grabouw. Service design methods such as co-design as applied in the Kujali Lab (Figure 5.5) were explored during data collection in Service Context A.

5.3.2 Service Context B – Motivation for Selection

KNUST Living Labs and the Kumasi case: The second research case was situated in the Bomso and Ayigya communities in Kumasi, Ghana (Service Context B). These two communities have similarities with the Grabouw community in terms of informal settlement, the unit of analysis and unit of observation. This served as a criterion for selection and inclusion in this study. Another motivation for selecting Kumasi as a research case was because there is an existing partnership between KNUST and CPUT to conduct research. Therefore, working in Ghana was an extension of these research activities between the two universities and an opportunity to replicate findings from Service Context A in Service Context B. The data collection was coordinated through the Design for Social Innovation and Sustainability (DESIS) Lab in KNUST, Ghana, and the CPUT Kujali Living Lab, South Africa.

5.4 TRANSDISCIPLINARY RESEARCH

A transdisciplinary approach to research is usually based on collaborative team efforts from different disciplines working beyond their boundaries to solve "*wicked problems*" in society (McGregor, 2004:2; Rittel & Webber, 1973:115; Bernstein, 2015:1-3). Transdisciplinary means transgressing boundaries of various disciplines and workspaces. Transdisciplinarity allows new intellectual spaces to be created. It builds on new theories and methods based on contributions made by investigators in a larger project in the context of real-world problems or themes (Nowotny, 2004:1-2; Gustafsson *et al.*, 2016:12; Sánchez-Escobar, 2017:5-6).

Transdisciplinary research focuses on **breath approach** whereas disciplinary research focuses on **depth approach**. In a transdisciplinary context, these two approaches are complementary in the sense that they are working collaboratively in the **"breath through depth"** approach paradigm to create new knowledge (Pop & Mătieş, 2012:276; Brandt *et al.*, 2013:1-2). So, researchers in transdisciplinary activities contribute their efforts collaboratively to a project in a common ground or space where many prepositions could emerge. In essence, researchers work outside their own discipline to contribute to a larger project in that space, rather than just a part of it, based on shared collaborative teams efforts. They learn from each other while exploring the world as a *complex whole* and *create concepts* that could solve emerging complex or complicated societal problems.

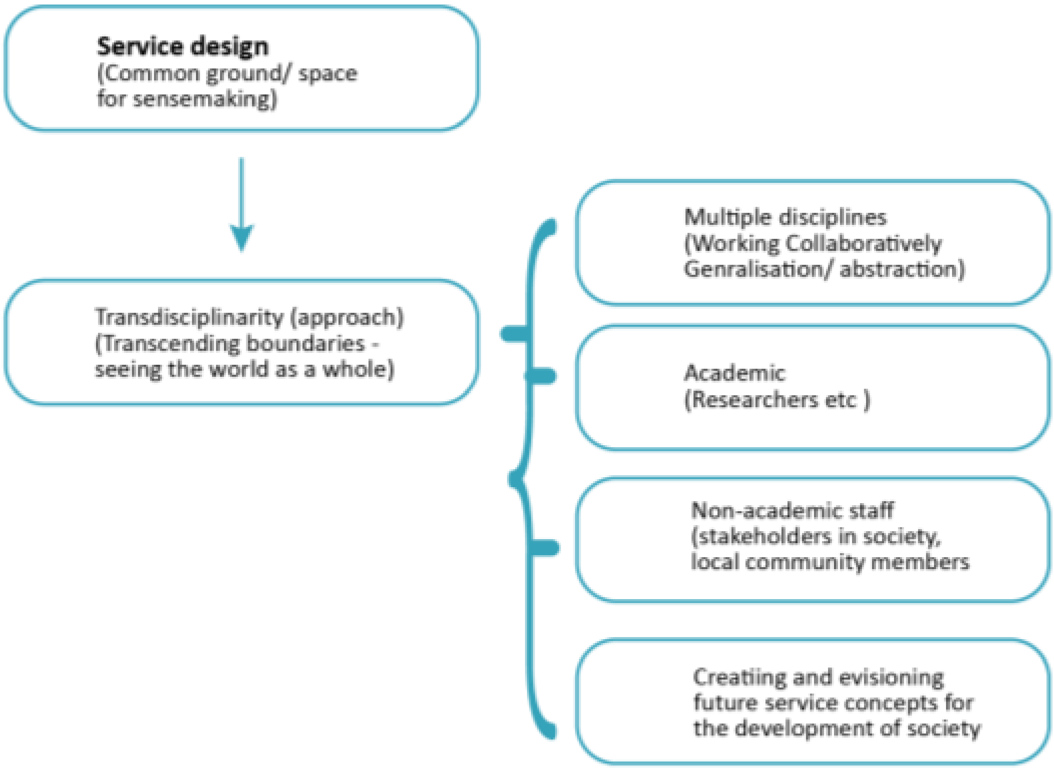


Figure 5.6: Overview of service design in a transdisciplinarity domain

Furthermore, transdisciplinary research moves beyond specific discipline methodologies and combines several approaches from other investigators to address a common societal problem (Brandt *et al.*, 2013:1-2; Ambole, 2016:40). It often involves both academic and non-academic settings that permit an equal collaborative platform for participants and researchers to make inputs to create new knowledge that is sustainable (Lang *et al.*, 2012:25-27; Bernstein, 2014:241-242; Rudhumbu *et al.*, 2017:13-15). Transdisciplinarity concepts provide an opportunity for service design/research in the sense that the two approaches encourage collaborative team participation, solving social problems from an "*outside*–in" process (Gustafsson *et al.*, 2016:11-12). Service design approaches transcend the boundaries of disciplines moving to an abstract space of transdisciplinarity to explore solutions to a problem in a particular context. This motivated the selection of *service design* processes positioned within a *transdisciplinary domain* for this study. Thus, service design provides opportunities for all participants to cooperatively explore new spaces, propose visions, create sustainable concepts and prototypes that could address wicked problems in society (Figure 5.6).

5.4.1 Transdisciplinarity and Service Design

This study lies within the mainstream of transdisciplinary domain and exploring service design processes in underserved contexts. The investigation is part of a larger project, ISD4D, with participating members from different disciplines working collaboratively within a transdisciplinary paradigm (Debrah, Bhebe *et al.*, 2014:96-98). Participating members were both academic and non-academic staff collaboratively sharing knowledge through service design processes as a common ground in the problem space (Figure 5.6).

The team was made up of health intermediaries, developers, programmers, Public Relations Officers (PROs), designers, stakeholders, other local community members, partnering institutions, and NGOs. Participants worked co-operatively, contributing and envisioning the design and development of technology-enabled solutions that could improve healthcare services in the Grabouw community (Debrah, De la Harpe & M'Rithaa, 2015:71-72).

In the research activities, participants did not work as separate teams but as one collective ISD4D team with a common goal of improving healthcare services in underserved communities. The ISD4D teams' efforts of working together required flexible methodological approaches and theoretical perspectives that permit the multi—layered sources of data gathering for the study (De la Harpe, 2012:8-15; De la Harpe, 2014:20-22). As such, service design research processes were mainly explored through an interpretative philosophical perspective in order to obtain the relevant data to meet the set objectives of the study.

I am part of the transdisciplinary research team on the ISD4D project. As a designer-researcher, I contributed to the project from the service design perspective using a multi-method design research approach. I explored designerly ways of contributing to the common goal of ISD4D towards improving healthcare services in underserved contexts. In observing the research activities, team members went beyond their various disciplines and co-created service concepts for healthcare in Grabouw. It was evident in these research activities that participants transcended their disciplinary boundaries. In the process, prototypes of technology–enabled sustainable solutions for healthcare services were designed and developed for future use in the underserved context.

5.5 PHILOSOPHICAL CONTEXT

Research philosophies are an integral part of any given piece of research. In most instances, it serves as a foundation to the theoretical perspectives of the investigation and sets out the direction of the methodology and design. The methodological approach used in this research case, as indicated earlier, is service design, which is qualitative in nature. Leedy & Ormrod (2005:94) noted that qualitative research methods were typically adopted for the purposes of understanding the phenomenon under investigation from the participants' point of view. In this study, using service design processes, which are qualitative in nature provided an iterative process of understanding and gaining insights about the social phenomena under investigation. This study was designed to answer particular research questions that were aligned to my philosophical worldviews as a design-researcher. The philosophical context then informed my methodological approach to the entire investigation. My focus in this research case was concerned with gathering rich insights about the phenomenon being studied and therefore I reflected upon the interpretivism philosophy (Saunders & Tosey, 2013:58; Saunders *et al.*,2019:130). I then used multi-method method qualitative design procedures to gather relevant data for this study (Figure 5.7). The procedures used in this inquiry were constantly revised as needed in order to accomplish the set objectives of the study.

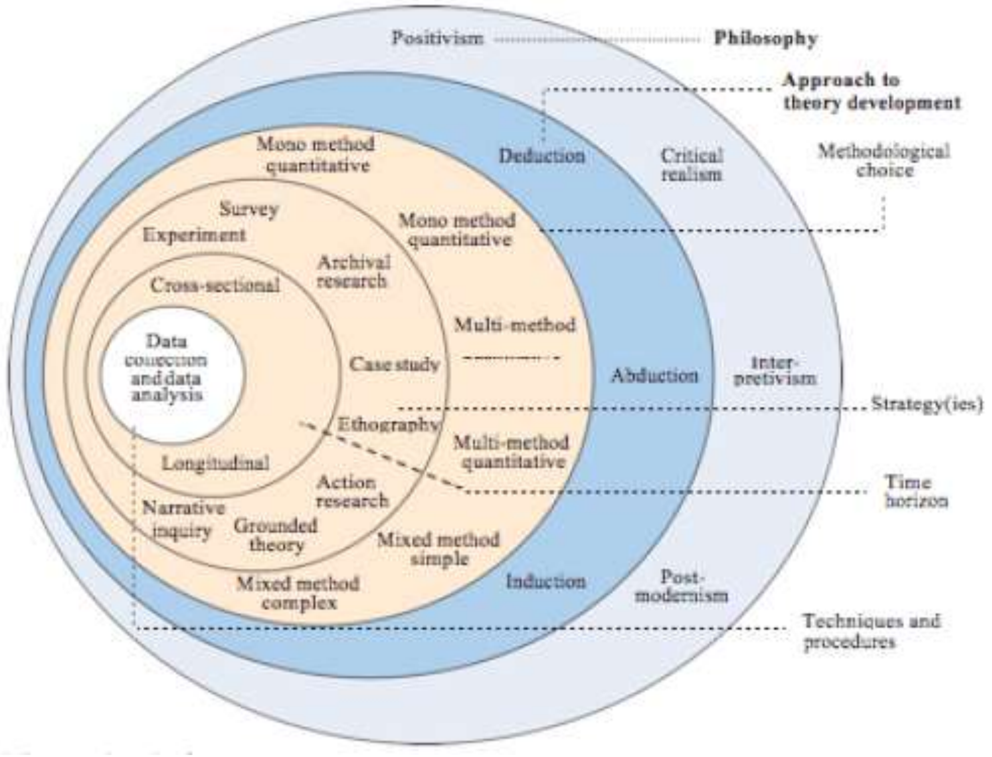


Figure 5.7: The research onion
(Source: Adopted from Saunders *et al.*, 2019:130)

5.5.1 Research Design and Philosophies

Saunders *et al.* (2009:107-108) introduced the research onion as a metaphor that describes research design, philosophies and their inter-relationships within a given investigation. The research onion provides layers of research philosophy, methodological choices and time horizons showing how these interrelationships are important within a given piece of research (Saunders & Tosey, 2013:58-59; Sahay, 2016:1-6). I have reflected upon the elements of the research onion and contextualised it for this research case. In Figures 5.7 & 5.8, I have indicated the interrelationships of the research onion and how it aligns with the methodological and philosophical choices that guided the data collection and analysis in this research case.

- **First layer:** this is the outer layer and represents the research **philosophy** in this study which is interpretivism (Klein & Klein, 1999: 67-69; Walsham, 2006:320-321)
- **Second layer:** this layer shows the various **approaches** used in the investigation – in this case, an **inductive** approach was followed to obtain the relevant data in this study

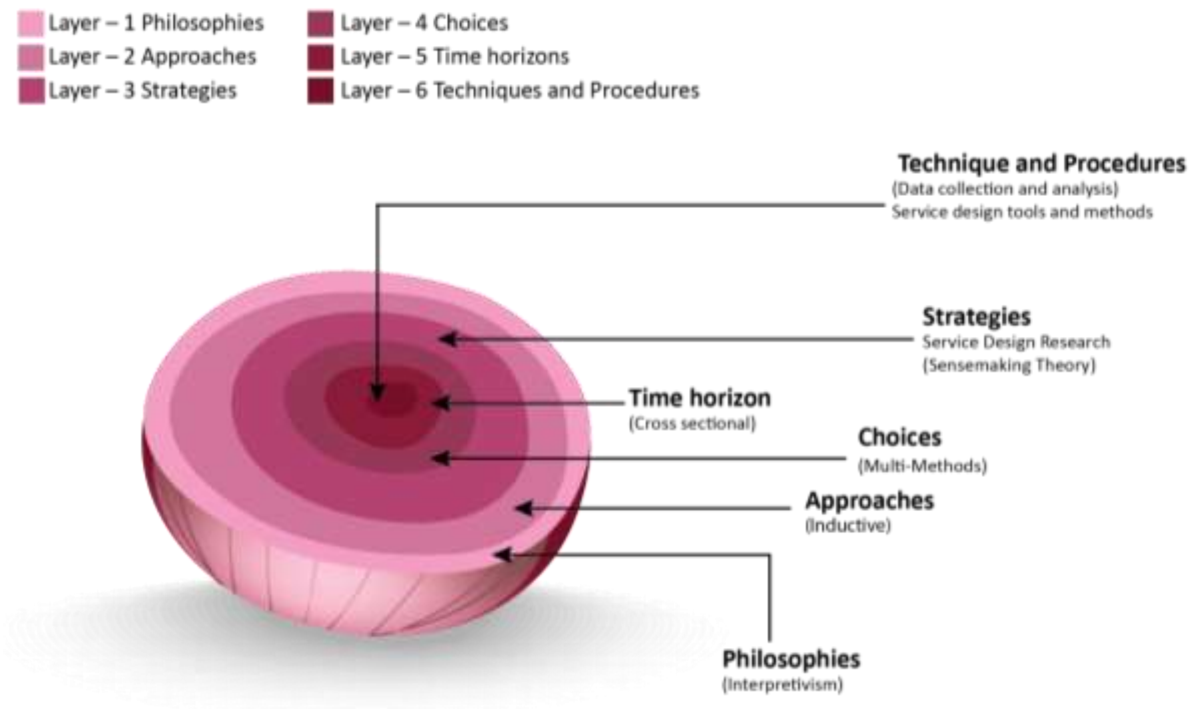


Figure 5.8: The research onion metaphor
(Source: Authors' own construct, adapted from Saunders & Tosey, 2013:59; Saunders *et al.*, 2019:130)

- **Third layer:** this shows the **strategies** I used in this study which is service design as described in the Double Diamond Design process (Davies & Wilson, 2013: 6-7)

- **Fourth layer**: this shows my **methodological choice,** which is drawn from a multi-method qualitative approach (Gray & Malins, 2004:134-137; Olsen, 2004:6-8; Glanville, 2015:2-4). The qualitative procedures made it possible to select several designerly strategies and tools to guide the data collection processes in various research contexts

- **Fifth layer:** this involves the **time horizons** used in this context, which is cross sectional. The investigation was cross-sectional, as I worked within one major study case (Yin, 2009:18-21). Although multiple activities were carried out in the selected context over time, it was not longitudinal. Thus, the time horizon in this case was best suited as cross-sectional

- **Sixth layer:** this indicates the **techniques and procedures** used for the data collection and analysis. These were mainly a combination of methods drawn from qualitative methods and service design processes (visual-based approach). The procedures used include, service design tools and processes such as personas, user shadowing, observations and informal conversations. Furthermore, the service design approach provided an iterative way of conducting the study from the participants' perspective, due to the flexible nature of the adopted research methodology (Davies & Wilson, 2013: 6-7; Jones, 2014:4-5; Debrah *et al.,* 2017:2120). Data were analysed reflecting on service design and sensemaking concepts. In addition, service design research aligns with a qualitative methodological approach and this permitted the study to be conducted and analysed from an interpretive paradigm

5.5.2 Selecting the Paradigms – Interpretive Philosophies

A paradigm is the shared worldview representing the beliefs and value systems in disciplines. The disciplinary system then guides how problems are solved and investigated informed by philosophical assumptions (Kawulich & Chilisa, 2015:1-3; Shah & Al-Bargi, 2016:253). Burrell and Morgan (2005:22-23), proposed four paradigms for analysing social and organisational theory. The matrix is composed of the four research paradigms and these are "**Functionalist", "Interpretive", "Radical humanist",** and **"Radical structuralist"** (Figures 5.9–5.10). In this study, the focus is on **interpretive philosophies.** As such, the discussion is this section will not include the other three paradigms.

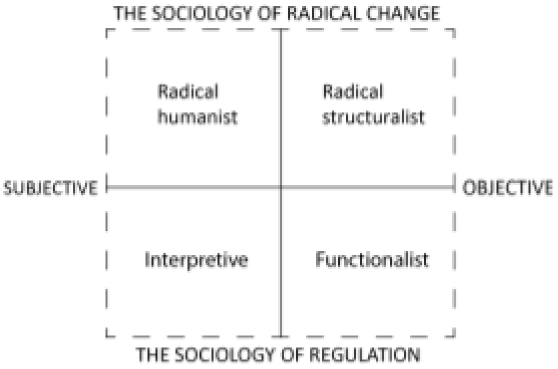


Figure 5.9: Four paradigms for analysis of social theory (Top Left)
(Burrell & Morgan's, 1979:22-23)
Figure 5.10: Research aims and research questions (Top Right)
(Cronje, 2014:3)

Interpretive research is concerned with understanding the subjective social world as "it is" in an on-going process. Research conducted in this paradigm revolves around understanding the importance of the everyday world (Burrell & Morgan, 1979:31; Goles & Hirschheim, 2000:253). Cronje (2014:3) further interpreted these paradigms detailing possible research aims, questions, and the context in which they could be applied for inquiry in the social-scientific world (Figures 5.9 & 5.10).

Hence, to be *located* in a particular paradigm implies that one would view the world in a *particular* way. This study is located in the *interpretive paradigm,* and by this view, knowledge is created through **subjective experiences** of the knower in the social-scientific world. In interpretive research, the nature of reality and making sense of the world is through shared meaning which is a form of *inter-subjectivity* as opposed to *objectivity* (Klein & Myers, 1999:69; Walsham, 2006:320-321; Johari, 2006:27). Thus researching from the subjective philosophies, applicable questions in line with interpretive paradigm where asked.

These questions were **"what"** and **"how"** and in some instances **"why"** in order to understand the essence of everyday-life activities in the problem space (Burrell & Morgan's, 1979:22-31; Cronje, 2014:2). Following the fundamentals of interpretive philosophies, data were collaboratively obtained from the perspective of the participants where they co-constructed knowledge upon a "being" ontology (Chia, 2002, cited in Gray, 2010:18; Kawulich & Chilisa, 2015:1-2). Service design processes were relevant for data gathering in this context, as it is qualitative in nature, which lies within the interpretive paradigm. Through the service design processes, data were obtained from multiple sources that enriched the overall quality of the study. Furthermore, philosophical perspectives such as the **ontology, epistemology,** and **axiology** in relation to **interpretive** studies are described and analysed in the subsequent headings.

5.6 PHILOSOPHIES – ONTOLOGY, EPISTEMOLOGY, AXIOLOGY

The choice of undertaking the study within the interpretative domain was influenced by my *ontological* and *epistemological* stance of the phenomenon under investigation. These philosophical perspectives informed my methodological approach for the study as elucidated earlier as service design research, which is a qualitative study. The context of this study is part of a larger transdisciplinary project titled—Information Systems Development for Development (ISD4D). So the methodological approach used within the context of this study, transcended the boundaries of the various disciplines within the larger project to co-construct knowledge. The nature of reality in this case was based on shared meaning through social interactions with actors within the selected research context (Walsham, 2006:320-321). The data were gathered through lived experiences, analysed and interpreted from the insider's perspectives, which were based on interpretivist philosophical worldviews. Thus, in this research, reality is perceived as a projection of **human imagination,** which makes **facts** obtained highly **subjective**. The study lies within **idealism** *worldviews* since knowledge is **co-constructed** with participants and by these **many truths** may exist within the research context. In addition, the research case is perceived on two levels and these are described as follows:

- **A current state:** intermediaries and women have inadequate information for their health education and information needs in relation to maternal healthcare in underserved contexts

- **A desired state:** intermediaries and women are able to make sense of health information to satisfy their health education and information needs in underserved contexts

As such, outcomes obtained from this study are **dependent** on the view of the **observer.** In this case, the **observer** refers to the designer-researcher making sense of the problem space—**current situation,** within a social subjective world. **Designerly** strategies are explored to improve health education and information services—**desired situation** in underserved contexts (Figures 5.11 & 5.12).

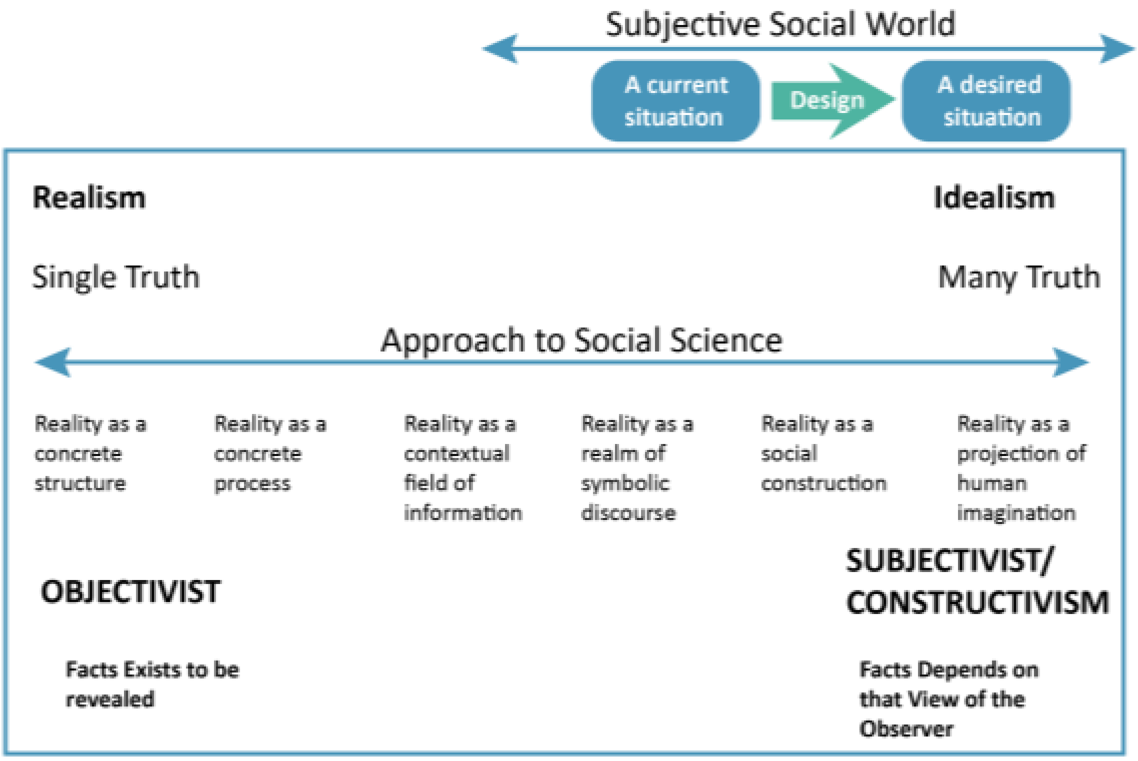


Figure 5.11: Continuum of core ontological assumptions (Source: adapted from Collis & Hussey, 2003:51)

5.6.1 Ontology

The beginning for all research starts with *ontology*. *"Ontology is described as the study of the nature of existence"* (Gray, 2010:16-17; Kawulich & Chilisa, 2015:1-2). For instance, in this context, I perceive ontology from the *subjective* point of view. In subjectivism worldviews, social phenomenon is constructed through the understandings and experiences of the social actors concerned with their existence (Figure 5.11 & 5.12).

The nature of reality was created through my integral involvement as a designer-researcher with the participants involved within the social context of the research case (Collins, 2010:37-55). Furthermore, *ontology* deals with issues of reality and as such it is concerned with the way the world works and what makes it real. *In other words, it is about what we may know* (Grix, 2002:117). Also, *ontology* is described as the study of *"being"* which commonly has two worldviews of reality: *objectivism* and *subjectivism*. However, as stated earlier, this study is concerned with '*subjectivism*' (Figure 5.12) as its ontological worldview (Goles & Hirschheim, 2000:259-260). As such, knowledge is co-constructed through perceptions and social interactions with actors which give meaning to reality in this context (Collins, 2010:91).

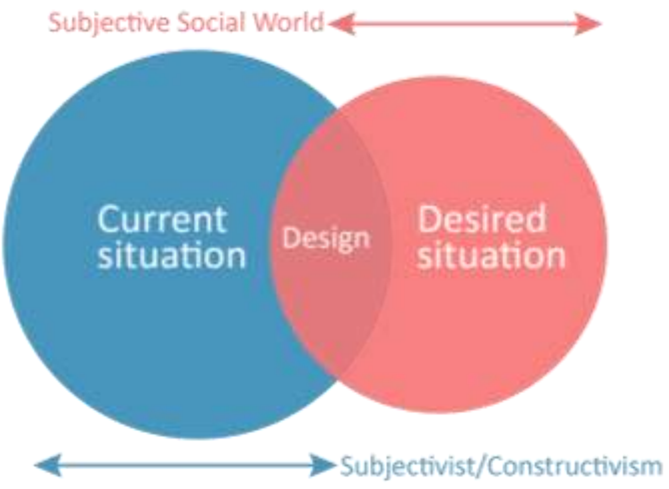


Figure 5.12: Philosophical worldviews – subjectivism/constructivism

5.6.2 Epistemology

Epistemology is about how "*we come to know what we know* (Grix, 2002:117) which sets the direction of the methodological approach. In terms of *epistemology*, Gray (2010:16-17) expressed that *the concept* sets a philosophical direction of the study. Therefore, it can be stated that epistemology facilitates decision making on what kinds of knowledge is appropriate and suitable in a given research. In this sense, transdisciplinary approach was used in this larger project as it aims to develop knowledge and practices for the common good in the life-world (McGregor, 2004:2-3; Bernstein, 2014:241-243; Gustafsson *et al.,* 2016:12). A transdisciplinarity approach is characterised by three forms of knowledge and these are **systems**, **target** and **transformative** knowledge. Some of the questions that characterise these modes of knowledge in transdisciplinary research are:

- **Systems knowledge**: answers questions in relation to genesis, developing problems further and its interpretations in the real world
- **Target knowledge:** answers questions about determining and providing explanations on the need for change, desired goals, and better practices in the real-life world
- **Transformative knowledge:** takes into account questions in relation to technical, social, cultural practices, legal practices and other actionable practices with the aim of transforming existing practices and to initiate desired ones (Pohl & Hadorn, 2007:36-39)

The interactions between these three forms of knowledge were considered in this study. Yet, the focus in this case was geared towards *transformative knowledge*. The transformative ideologies align with the interpretive perspectives stated in this research case. An interpretivist focus takes the view that truth is co-constructed through a shared understanding of the phenomenon being studied by individuals and investigators in a socially constructed world. As an interpretivist from a **subjective** viewpoint, I collected data qualitatively through an inductive approach. This made me part of the data-collection process aimed at understanding individual *sensemaking* and our roles as 'social actors' in the life-world (Collins, 2010:92).

Thus, *ontologically,* this study is about enhancing health information services *(constructed reality)* whereas *epistemologically*, it is situated within the *interpretive* research paradigm. The concept of *axiology,* in line with interpretivist philosophies, guided the *values, aesthetics* and *ethics* used in conducting this research within the various research contexts. The interpretive paradigm informed my philosophical perspectives and methods used in conducting this study within a transdisciplinary domain in an underserved context (Figure 5.13).

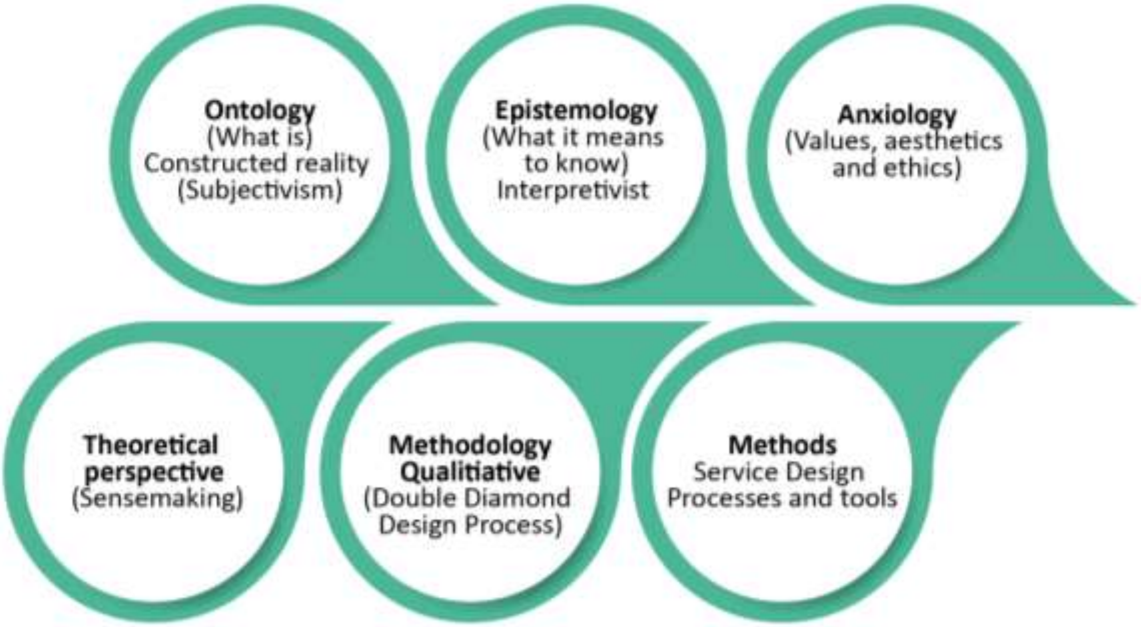


Figure 5.13: Relationship between philosophical perspectives and methodologies (Modelled after Crotty, 1998, as cited by Gray, 2010:17)

5.6.3 Axiology

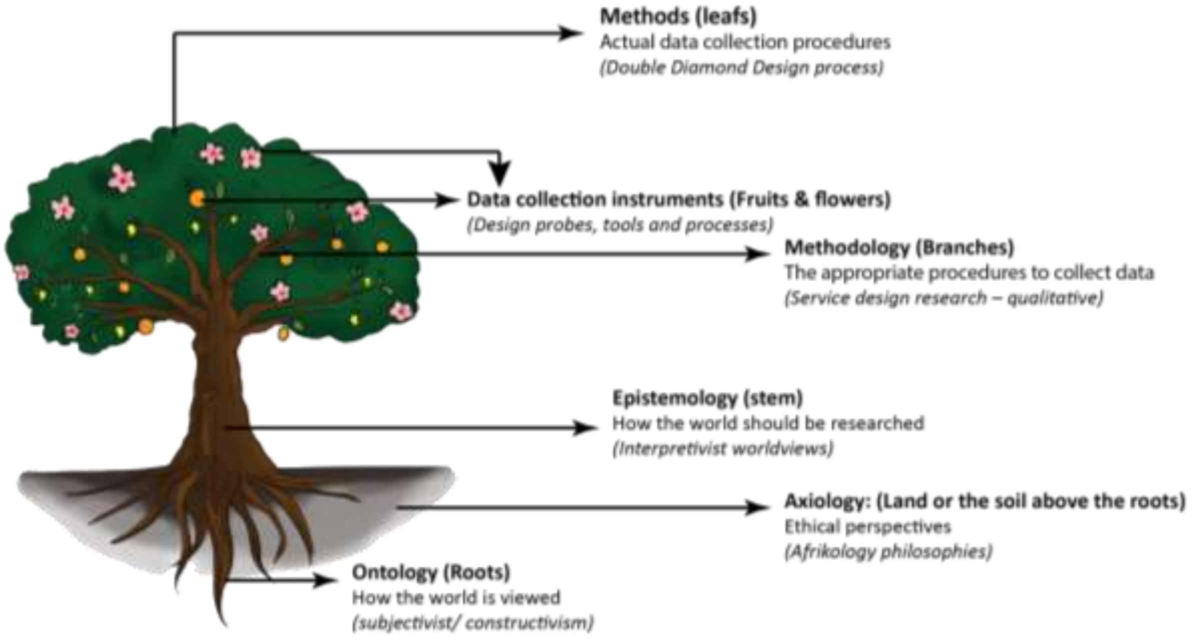
Axiology is concerned with the roles and values in a given research endeavour and indicate the researcher's stance on what is morally right and wrong in the study (Wahyuni, 2012:69-70; Yilmaz, 2013:316). In other words, this refers to the ethical stance of the researcher in a given research, which informs the nature in which reality is created. It also includes aesthetics and the process of the research (Collins, 2010:37; Connolly *et al.*, 2009:12-13). In terms of axiology, I take the *emic* or *insider's* perspective stance due to my philosophical worldview as an interpretivist. This implies that social reality is studied from the perspective of participants and researchers which influences the knowledge created as well as the data analysis (Wahyuni, 2012:70-71). Knowledge is co-constructed with the researcher and participants which makes it value-bound and emic (Wahyuni, 2012:70-71; Yilmaz, 2013:316). Consequently, knowledge created within the context of this study is very *subjective*. I therefore acknowledge that the study is value–bound. This is because the study participants are human beings who are complex entities. Data and knowledge obtained in the study were largely from the participants' perspective. However, some of the data were based on my personal interpretations by reflecting on the phenomenon under investigation. Although, I made efforts to remain neutral, my personal biases will inevitably influence the interpretation and expression of data obtained, due to the *subjective* nature of this study (Collins, 2010:95).

5.7 AN INTERPRETIVE STUDY

Interpretive research can be very useful to Information System (IS) researchers to gain an understanding about human thoughts and actions in social and organisational contexts (Klein & Myers, 1999:67; Johari, 2006:25-26; Dammak, 2015:5-6). Some of the possible philosophical views in interpretive studies include critical realism, phenomenology, hermeneutics, ethnography and Participatory Action Research (PAR) and so on (Burrell & Morgan, 2005:28; Walsham, 2006:320-321).

As stated earlier, this study is part of a larger project, Information Systems Development for Development (ISD4D) and conducted in an underserved context ((see related papers; De la Harpe, 2012:8-15; De la Harpe, 2014:20; Debrah, Bhebe, *et al.*, 2014:96-98). The inquiry is founded on an *interpretive philosophy,* which was within the qualitative research domain. Interpretive perspective is used in this study because the nature of reality was obtained through social constructions (Berntsen *et al.,* 2004:1-2; Walsham, 2006:320-321, M'Rithaa, 2010:119). Knowledge was gained by understanding the world as **"it is"**, through human interactions and shared sensemaking which classifies this study as interpretive research (Klein & Myers,1999:69; Burrell & Morgan, 2005:28-31).

In the interpretive sense, **service design** methodology was adopted for data collection, and in the process, knowledge was co-constructed from the participants' perspective (See Figure 5.14). Some of these social constructs through which knowledge was obtained include: language, consciousness, shared meaning, documents and available artefacts (Klein & Myers,1999:69).



(Metaphor of service design research methodology in an interpretive study)

In addition, design toolkits and processes that I developed were used to facilitate data collection during the **service design** activities (see related paper - Debrah *et al.,* 2017:2120-2121). The data obtained through service design was highly *subjective* in nature and were not designed for direct replication purposes in every design milieu. Subsequent service design processes were modified according to the Service Context Being investigated. I must state that most of the service design activities conducted in Service Context B were mainly for validation purposes of tools and processes of initial outcomes from Service Context A. In the following heading, **service design methodology,** as applied in the context of interpretive study is extensively described.

5.8 SERVICE DESIGN RESEARCH METHODOLOGY

Service design addresses functionality and form from the perspective of its clients (Mager, 2008:355). Service design processes often involve the use of visual based tools and methods of engaging with participants in a shared design space where the user determines the value of the service propositions (Mattelmäki, 2006:32; Gloppen, 2012;50-52; Alhonsuo & Miettinen, 2017:12). However, there are several design models (and methods) available, which assist in exploring solutions to gain insight about specific contexts that could inform the design of services. Some of the available design models include, Human-centred Design (HCD) (IDEO, 2012:1-154), Philips co-create (Debrah, Snaddon *et al.,* 2014:1) and the *Double Diamond* process (Davies & Wilson, 2013:6)**.**

Based on observations and analysing some of these available models, it was evident that each model employs the basic design processes as elucidated in the Double Diamond Design process. The Double Diamond Design processes are *discover, define, develop and* deliver which was proposed by the design council (Davies & Wilson, 2013:6; Du Preez, 2018:32-35)**.** In addition to this, it was observed that most of the identified design process begins with some form of discovery process which is at the early *stages (fuzzy front end)* of the design process (Sanders & Stappers, 2014:10). Research undertaken at this early stage, is mainly to understand context and gain insight about the phenomenon being studied through designerly methods.

However, in this study, the **Double Diamond Design** process was adopted in order to gain insights into the research context (Figure 5.15). This study was conducted with a focus on the *discovery* and *define* process since my aim was to gain insights and understand context (Debrah, De la Harpe & M'Rithaa, 2015:73). The envisioned outcome of the process will be the "*proposed information and educational services for health intermediaries and patients in underserved contexts*". In this logic, it is evident that service design methodological approaches were deemed appropriate for this case, because it is Human-centred and allows the co-creation of ideas from the participant's point of view.

Additionally, service design methods were applicable to this study, as it is important that participants participate as equal partners in the design process since they know their situation and needs best. Thus, the co-design processes, permitted collaborative decision-making with the participants involved (Van Zyl & Pennanen, 2013:1; Mendonca & Van Zyl, 2014:104-105; De la Harpe, 2014:22-25). Participants collaboratively explored possibilities of improving healthcare service delivery within their various communities using co-design methods. This, in turn fostered collective decision-making with health intermediaries and participants. Co-designing to achieve empathy is an important aspect of service design, applicable in this case as the participants are from underserved communities. Therefore, eco-centric design was the ideal approach to understand context in the selected Afrikan communities (Debrah, De la Harpe & M'Rithaa, 2015:72-73).

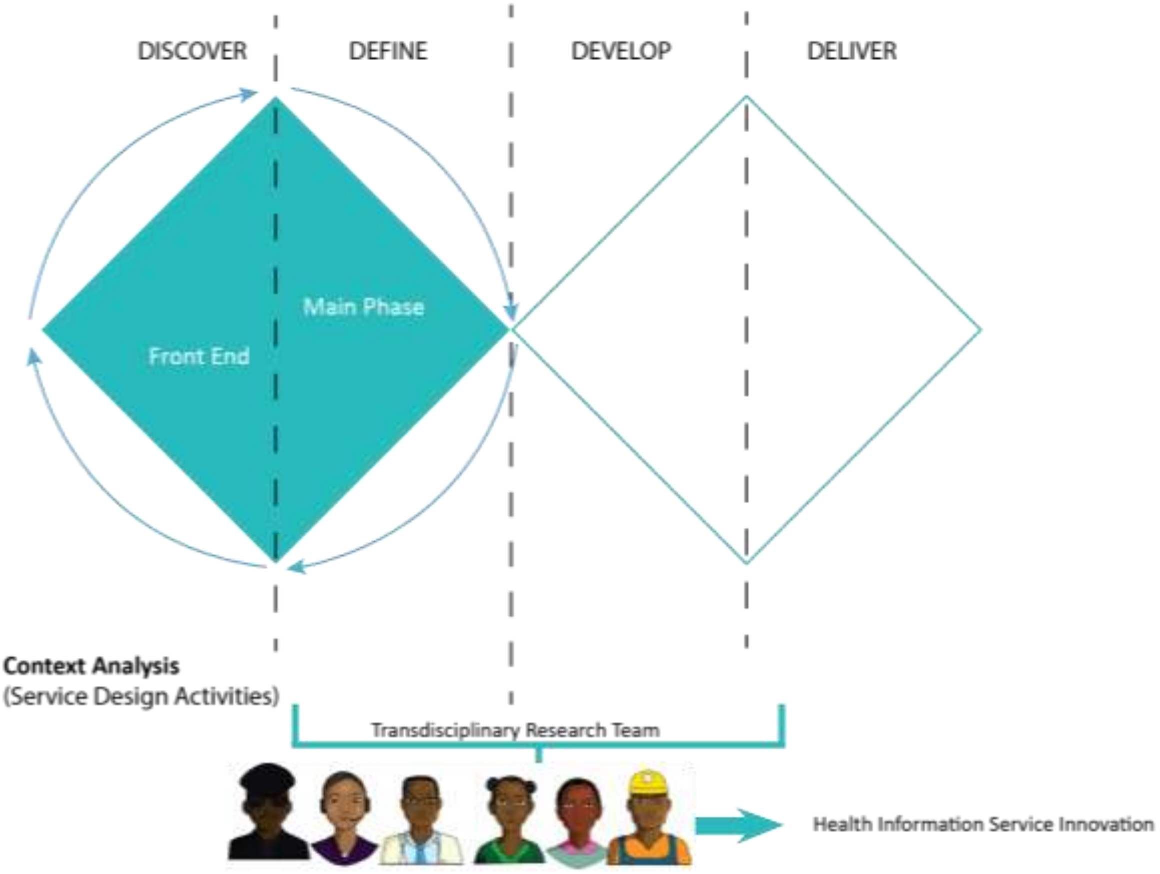


Figure 5.14: Conceptual model of the Double Diamond Design process (The process in the design shows the main phase where the study was undertaken - modelled after Double Diamond Model) (Source: Davies & Wilson, 2013:7; Clatworthy, 2013:6)

5.8.1 Co-designing Services

Co-design is often perceived as *co-creation*. In most cases, both terms are used to refer to people working together towards a common goal. *Co-design* is a specific instance of *co-creation*. Co-design is used as a broad term in this study, as it is applied in most design disciplines. In this study, I refer to co-design in a broader sense, to describe a participatory process whereby the creativity of designers and people who are not trained but are working together in a design and development process (Sanders & Stappers, 2008:2). For instance, in this research case, while I am a trained designer, the health intermediaries and patients who participated in this research, are not trained designers. However, we worked collaboratively in this study to explore possible solutions to emerging challenges in healthcare service delivery, in the context of Grabouw. Participating health intermediaries and patients were not passive participants but rather active participants and contributed their views during the design activities (Donetto *et al.,* 2014:3; Manzini, 2015:1-4). Using service design methods, we were able to empathise with participants in the various service contexts (Sanders & Stappers, 2014:11; Debrah, De la Harpe & M'Rithaa, 2015:71-72; Rygh & Clatworthy, 2018:93-94). Empathy was achieved during the co-design process which helped in understanding the participants' service context much better (Kimbell & Julier, 2012:10).

5.8.2 Empathising with Service Users

Empathic design involves understanding the users' needs as part of the process to inform the design of solutions (Mattelmäki *et al.*, 2014:70-73). Through empathic design, people are better understood from their perspective, their feelings are considered and are integrated into possible design solutions (Mattelmäki & Battarbee, 2002:266; IDEO, 2012:31-33; Vink & Oertzen, 2018:471-472). Empathic design processes such as service design and participatory design, focuses on designing with users and understanding their needs (Holmlid, 2009:5; Kraff, 2018:47-49). Hence, design empathy was achieved through the process of co-designing with participants. The use of the design probes and toolkits in the co-design activities, helped in generating discussion among participants during these designerly activities. These visual elements eventually minimised the presence of co-design workshop facilitators in the various design milieus of the research case (Mattelmäki, 2006:40).

5. 9 SAMPLING

5.9.1 Population – Service Users

Often, in research activities, the investigators may work with people or specific entities to obtain relevant information for the study. The term given to these entities for the study is often termed as the population for the study. The use of population in research activities is theoretically defined as a specified aggregation of study elements (Babbie & Mouton, 2008:173-174; Taherdoost, 2016:18-21). The study was conducted in two major ***service contexts,*** which had different categories of population. Each service context consists of different categories of the population, from which the actual sample was selected for participation in this study.

5.9.2 Sampling Strategies

The purposive sampling technique was adopted for this research. In purposive sampling, the enquirer selects individuals and sites for a study because they can purposively inform an understanding of the research problem and central phenomenon in the study (Creswell, 2007:125). The purposive sampling strategy was then applied in **Service Context A & B**, which helped in selecting the actual sample needed for this study.

5.10 THE SAMPLE

After the identification of the population, the next step was to access the available sample that could provide the relevant information for this investigation, using the purposive sampling strategy (Taherdoost, 2016:19). Since this study was being conducted in two different service contexts, different sample sizes were needed in order to meet the main goals (Figure 5.16). In **Service Context A,** there were four categories of the sample sizes. The sample was categorised in that manner, in order to better inform the data collection processes in the major phases of the research case, whereas, in the case of **Service Context B**, there were two major *categories* of the sample. The sample within **Service Context B** was mainly used for two reasons. Firstly, it was mainly used for piloting the research concepts and identifying possibilities at the forefront of the study. Secondly, the sample category was for the purposes of validation in response to some aspects of the research activities conducted in the main research case, in *Service Context A*.

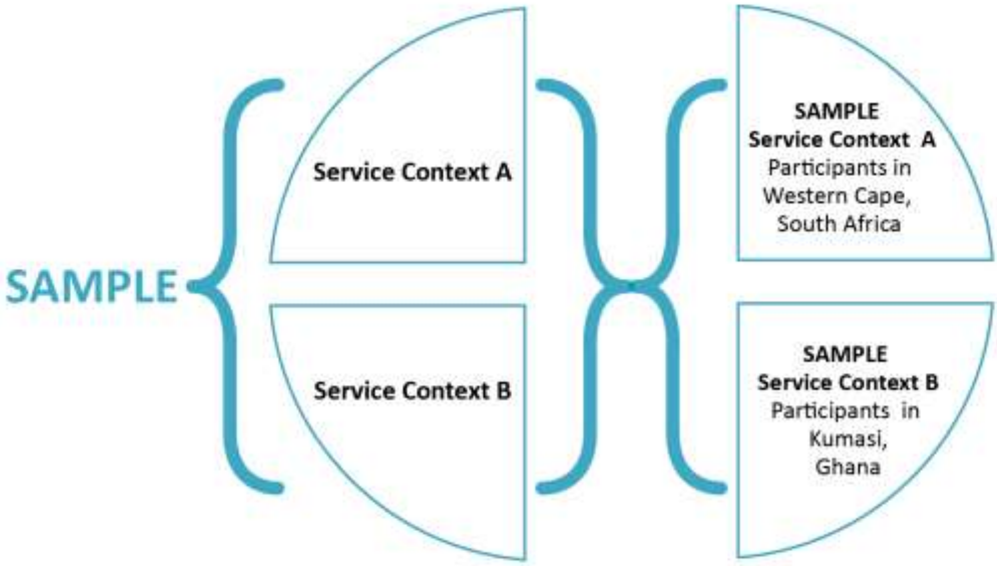


Figure 5.15: The sample categories in the service contexts

5.10.1 Sampling – Service Context A (South Africa)

As indicated earlier in this chapter, ***Service Context A*** is the main research case for this enquiry. The study was designed such that it was conducted in **Two** Major **Phases**, which required specific respondents for each **Phase** of the study. In lieu of this, the sample in **Service Context A,** were segmented into **Four** categories and these are described subsequently (Figure 5.17).

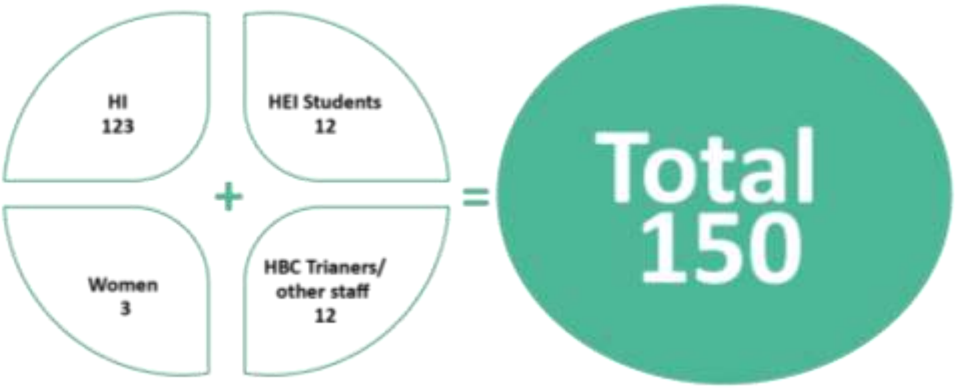


Figure 5.16: Total sample size, Service Context A
(Total sample size for participants in Service Context A)

5.10.2 Sampling Categories

Category One: in this category, the sample was obtained from the population of health intermediaries living in the Western Cape Province of South Africa. Here, within this sample, health intermediaries working in different locations in the Western Cape Province were selected to participate in the research activity. They were mainly nurses, doctors, midwives, doulas, and caregivers. However, a further study was conducted with caregivers in the Grabouw community using service design strategies to understand context. They were purposively selected to participate in the study since they provide Home-and-Community-Based (HBC) services within the research context (Service Context A).

Sample Size: the total sample size in this category was made up of all health intermediaries who participated in this study during workshops and interview sessions and who also responded to the opinionnaires (user surveys). The total sample size of health intermediaries who participated in this study was **one hundred and twenty three (123)** participants, in *Category One*.

Category Two: the second category of sample was made up of women within the Grabouw community. The women were purposively selected to participate as a representation of maternal health information service users within the Grabouw community. Additional reasons are that, the women are prioritised service users and beneficiaries of home-based care services offered in the community. Also, the focus of this study is on maternal and child health information services, which motivated the inclusion of women as participants in the study. Although, many women were invited, few of them were available to participate willingly. Hence, the sample size for participation was limited in this category.

Sample Size: the service users in this sample were made up of **three (3**) mothers living in the Grabouw community. These women were the core participants in this category for the information needs activity for mothers in *Service Context A*.

Category Three: the third sample was made up of students who were purposively selected from the CPUT. Their participation in this study was for validation purposes and as such, complementary to some aspects of the main activities in this research case. The students' involvement was simply an extension to complement the main research activities in the various design milieus. However, the participants were purposively selected as an exploratory group to help validate some aspects of the research findings. Also, their inclusion was aimed at exploring ways of improving research outcomes based on this enquiry in the future.

Sample Size: the sample size obtained in this category was made up of **twelve (12)** students from CPUT.

Category Four: this set of participants was made up of *trainers, administrative staff and coordinators* from Elgin Learning Foundation in the Grabouw community. They were purposively selected for participation since they are the managers of the Elgin Learning Foundation (ELF) and they run the home-based care services in Grabouw. Participants in this category were included in the study to obtain a better view of how caregivers are trained and to identify what types of home-based care services are offered in the Grabouw community. Also, they were able to provide insights about information needs and sources required for training caregivers to equip them for professional practice in the Grabouw community.

Sample Size: there were **four (4)** trainers, **five (5)** coordinators and **three (3)** administrators of home-based carers in this category. The total sample size was **twelve (12)** participants in this category.

5.10.3 Sampling – Service Context B (Ghana)

The sampling in this context comprised of participants from Kumasi, Ghana. The sample was selected for the purposes of piloting and for validating sections of the data obtained in *Service Context A*. The selected samples in this service context comprised of two categories and their participation helped in meeting the aims of this study (Figure 5.18).

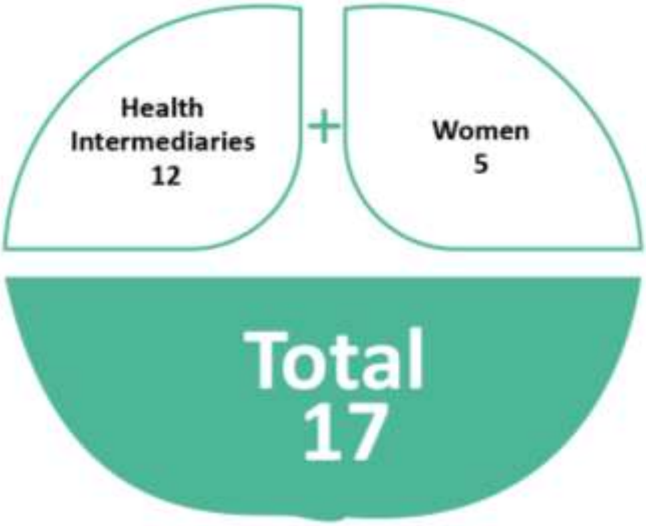


Figure 5.17: Total sample size, Service Context B

5.10.4 Sampling Categories

Category One: this sample set was made up health intermediaries within the Kumasi locality in Ghana. Doctors, nurses, and midwives were purposively selected for participation at the forefront of this study. Their participation at the beginning of this study was useful in exploring health information service delivery for women in the Kumasi municipality. Additionally, their participation provided an insight into the possibilities that could emerge to improve health information services within Service Context B.

Sample Size: the actual sample size for these respondents was approximately **twelve (12)** health intermediaries.

Category Two: in this category, the study sample was mainly women living in the Kumasi environs in Ghana. The participants were from the Bomso and Ayigya community. They were purposively selected for this case because they have similar demographics with women in *Service Context A* (Grabouw, South Africa). The feedback obtained from these participants was mainly for validating sections of the data obtained in *Service Context A*.

Sample Size: the total sample size in this case comprised of **five (5)** women living in the Kumasi metropolis.

5.10.5 Total Sample Size for this Study

The sample size in Service Context A **(150)** and Service Context B **(17)** totalled **167** participants for this study (Figure 5.19). These participants served as the accessible population from which the sample was obtained for this research.

Figure 5.18: Total sample size for the study (Service Context A and B)

5.11 DATA COLLECTION – PHASE I and PHASE II

Data in this research were mainly collected using service design methods, which were qualitative in nature. Collecting data through service design methods offered a wide spectrum of information sources from the participants' viewpoint. This offered a holistic view of the phenomenon being investigated (Olsen, 2004:7-8; Davies & Wilson, 2013). Service design was suitable for the research because the methods are human-centred. The human-centeredness of service design affords participants the opportunity to participate as equal partners in the design process since they know their situation and needs best sources (Stickdorn & Schneider, 2011:51-54; IDEO, 2012:5-8). Service design combines multiple data collection approaches including qualitative data methods such as interviews and observations, as well as other visual methods to obtain data from a wide range of sources (Gray, 2010:184-185). Service design is participatory in nature and allows participants to co-construct knowledge from their viewpoint as they use data collection tools in design activities (Sangiorgi & Pacenti, 2008:2; Blomkvist, 2014:10-11). In summary, service design offers the opportunity to combine multiple qualitative and visual-based methods, which made it suitable to use in this study.

5.12 INSTRUMENTS OF DATA COLLECTION

Instruments of data collection, refers to the procedures the researcher used with the aim of gathering adequate data to answer the research questions in this study (Creswell, 2003:185). Data collection steps in this research, involved the setting of boundaries for the study, collecting information through unstructured (semi-structured) observations, informal conversational interviews, documents and visual materials, as well as establishing the protocol for recording information.

In this research case, service design methods and tools were used to collect data. The methods made it possible to gather relevant data from multiple visual-based sources (Davies & Wilson, 2013:2-3). Through this process, information was obtained from multiple measures of the same phenomenon which potentially improved the overall quality of this study (Yin, 2009:116-117). As such, the multiple data sources made it possible to develop a converging line of inquiry and obtain rich data from the various service contexts.

Service design process offered a multi-method approach and through this process, data collection was organised in two major categories in both Service Context A and B, as **Phase I** and **Phase II**. **Phase I** of the data collection, involved the use of visual instruments to collect data. These visual tools were mainly used during co-design workshops in **Service Context A** and **B** (See related paper, Debrah *et al.*, 2017:2126-2127). Whereas, in **Phase II,** the focus was mainly on the use of opinionnaires to collect data from the participating health intermediaries and women in both *Service Context A and B* (Figure 5.20). The various data collection instruments/ methods as applied in **Phases I** and **Phase II** of the research case are elaborated subsequently.

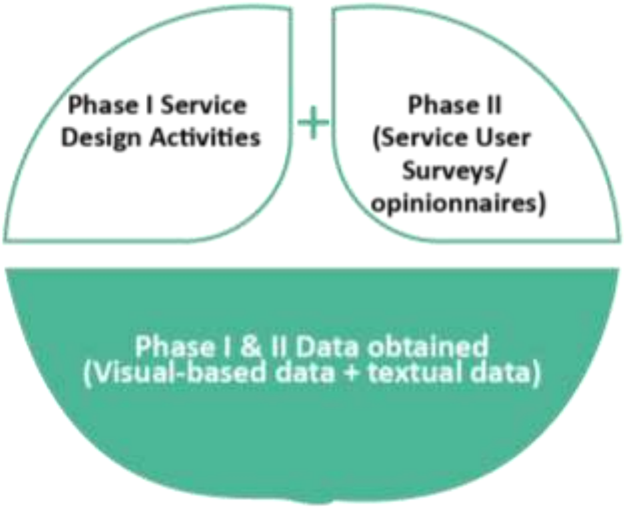


Figure 5.19: Phases of data collection in this research context

5.13 PHASE I – DATA COLLECTION PROCEDURES

5.13.1 Collecting Data – Service Design Processes and Tools

Data collection methods in **Phase I** comprised of service design methods and tools. These comprised of visual modes of inquiry such as user shadowing, storyboarding, short video documentaries, animation films, storytelling, photos, role-playing, drawings/ illustrations, context mapping, user journey mapping, dairies, design probes and toolkits (Mattelmäki, 2006:39-40; Davies & Wilson, 2013:8). Co-design was one of the major processes of obtaining data and exploring possibilities for solutions (Debrah, De la Harpe & M'Rithaa, 2015:72-73). These multiple visual-based methods of gathering data are further explained in subsequent sections. I will start by describing co-design methods and its relevance in obtaining data in a given research activity. Next, is the description of the various design tools and methods and how they were used to obtain relevant data in this research case.

5.13.2 Co-Design Workshops

Co-design workshops were the main means of obtaining data in this study. These were conducted in both service contexts. In these design milieus, participants freely expressed their thoughts without barriers. Co-designing brought to bear real issues that confront participants through conversational dialogues (Sanders & Stappers, 2014:11-13; Debrah, De la Harpe & M'Rithaa, 2015:72-73; Debrah *et al.*, 2016:443-444; Mazzarella, 2018:69-70). Through co-designing, views about work activities and the context of participants were identified. New ideas emerged that reformed preconceived ideas about context and work practices of participants (Steen *et al.*, 2011:55; Debrah, Bhebe *et al.*, 2014:99-105). The co-design activities were organised in suitable design milieus within the various research contexts (Figure 5.21). There were **twenty-two (22)** co-design workshops in total and participants worked collaboratively in groups in Service Context A and B.

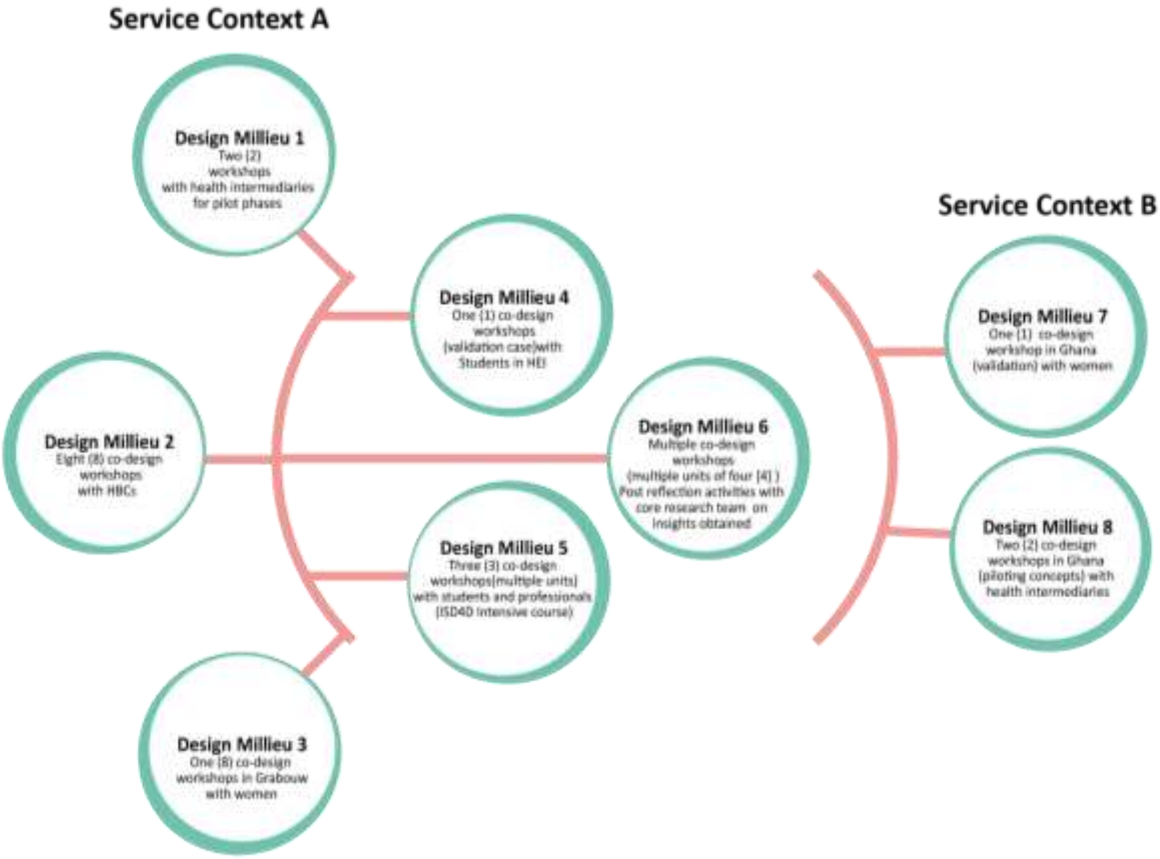


Figure 5.20: Co-design workshops organised in the various design milieus

5.13.3 Co-Designing – Service Context A (South Africa)

There were approximately **nineteen (19)** co-design activities organised in different design milieus in Service Context A. Co-design activities in this service context were mainly organised through the CPUT Kujali Lab and the Grabouw community for validation purposes. In these co-design activities, data were obtained from participants and facilitators from the larger research team. Additional data were then obtained from health intermediaries and other participating students who formed part of the trans-disciplinary research team. After the main co-design activities with the caregivers, Four (4) additional co-design activities were organised for the purposes of validation in *Service Context A*. These co-design activities are described as follows:

5.13.4 Design milieus – major co-design activities

Milieu I

Co-design activities with stakeholders in Grabouw: two (2) main co-design activities were organised at different times at the forefront of the study. This was aimed at soliciting views from available stakeholders involved with home-based care in the Grabouw community. Also, it was aimed at establishing "first connections" to identify areas in which researchers could investigate and collectively propose solutions to problems in the underserved community.

Milieu II

Co-designing with caregivers: in Service Context A, *eight (8)* co-design workshops were organised with caregivers in the Grabouw community. Data were collected through a series of co-design activities with this group of health intermediaries over several weeks.

Milieu III

Co-designing with women (South Africa): in this category, *one (1)* major co-design activity was organised with the participating women in Grabouw. Data were obtained from the perspective of selected women in the Grabouw community using visual-based methods.

5.13.5 Co-Design Activities – Validating Purposes

Milieu IV

Information needs and access activity: in this case, there was *one (1)* major co-design activity, which was conducted with University of Technology (UoT) students for the purposes of validation. This was aimed at testing a few aspects of this study such as design probes and toolkits for the purposes of validation. These were mainly used in co-design activities together with other existing tools to solicit views from students from diverse backgrounds in UoT.

Milieu V

Intensive course: in this setting, *three (3)* additional co-design activities were organised at the Kujali Lab with health intermediaries and the other participating research team in the Grabouw community. This particular co-design activity was for additional validation purposes and it was part of an intensive course organised through the CPUT Kujali Lab. Participating members in this intensive course was made up of health intermediaries and other multidisciplinary research teams from different disciplines and countries. The course was designed with the aim of providing technology-enabled solutions for caregivers in the context of Grabouw.

Milieu VI

Designing with ISD4D (the larger research project) team: in this session, Four (4) co-design activities were organised through the CPUT Kujali Lab. The participating members were the core research team, from the larger research project (ISD4D). The design session was characterised by reflecting and reporting on insights obtained from the service contexts. The data obtained during this session served as the baseline information, which guided the design and development of technology-enabled health information systems for a later stage of this study.

5.13.6 Co-Designing – Service Context B (Ghana)

In this section, I describe all the co-design activities organised in Service Context B in Kumasi, Ghana. In this milieu, there were three (3) workshops organised in Service Context B. The first **two (2)** were aimed at exploring possibilities at the forefront of this study. The subsequent co-design workshop was mainly for validating sections of the research activities conducted in Service Context A (South Africa) and they are described as follows:

Milieu VII

Co-design with women (Ghana)*:* in this case, **one (1)** co-design activity was organised with the participating women in Kumasi, Ghana for validation purposes. The design sessions were used as an avenue to test proposed design probes and toolkits.

Milieu VIII

*Piloting the research concept***:** at this phase of the study, *two (2)* co-design activities were organised with the health intermediaries within the Ghanaian community. The design engagements were held at Clinic A in the Bomso community, Kumasi, Ghana. The purpose was to explore possibilities of improving health information services at Clinic A. The co-design activities organised in this case, served as the starting point of the research and offered an opportunity to pilot emerging research concepts for the main study. Overall, co-design activities as a method of data collection provided substantial data from the perspective of all participants. Conducting the study through this method helped in co-constructing knowledge with participants in both Service Context A (South Africa) and Service Context B (Ghana).

5.14 DESIGN PROBES, TOOLKITS AND PROCESSES

"Design probes are an approach of user-centred design for understanding human phenomena and exploring design opportunities" (Mattelmäki, 2006:39). Design probes enable users to express their personal experiences, thoughts and views. Through this process, actors involved in design activities generate possibilities rather than solve problems (Mattelmäki & Battarbee, 2002:267-268; Hulkko *et al.*, 2004:43-44). Hence, design probes and toolkits served as additional methods of collecting data at the forefront of this study (Sanders & Stappers, 2014:11-12).

The design probes were based on preliminary results obtained from the baseline studies conducted in the main research context (Service Context A). The design probes and toolkits facilitated more visual methods of gathering data. These design probes made it possible to empathise with participants during design engagements in subsequent research activities (Mattelmäki & Battarbee, 2002:266-267). Some of these tools were adopted from existing design toolkits while others were designed as part of the research outcomes for the inquiry (Debrah *et al.,* 2017:2124-2126). A description of the service design methods, probes, and toolkits, and how they were used for gathering data in the various service contexts are described under the following headings.

5.14.1 User Shadowing

User shadowing is a method used in service design to observe participants in their natural settings. Usually, in research activities, observations normally take place in natural settings where the phenomenon is being studied (Yin, 2009:109-113; Nova, 2015:19-21). Two main types of observation strategies were used to obtain data in the main research case—*Service Context A* (Grabouw, South Africa). These were the *participant (overt)* and *non-participant (covert)* observation strategies which were helpful in obtaining data in all design milieus (Gray, 2010:397). User shadowing in this context could be referred to as the non-participant observation process, which was used to observe the caregivers in Grabouw. Whereas, the participant observation process was mainly used for data collection during the co-design activities in the various design milieus in Service Context A and B (Figure 5.21-5.22).

5.14.2 User Shadowing – In Service Context A (South Africa)

User shadowing/observations in the Service Context A made use of both participant and non-participant observation. User shadowing was used in different milieu in Service Context A where it was deemed as an appropriate technique to obtain relevant data for this study. The various design milieus are categorised according to what type of user shadowing (participant/non-participant) was used per design milieu (Figure 5.22).

5.14.3 User Shadowing – Non-Participant Observation

Milieu I: in this milieu, user shadowing was largely used to observe caregivers in the context of Grabouw. Here, caregivers were directly observed in the Grabouw community as they went about their professional practice in the community. At certain instances where patients were comfortable to receive visitors, basic home-based care services were observed. Caregivers expressed that it could sometimes be very therapeutic for patients to see new faces. Patients actually do enjoy meeting new people and therefore our visit was valuable in contributing to the healing process (Figure 5.22).

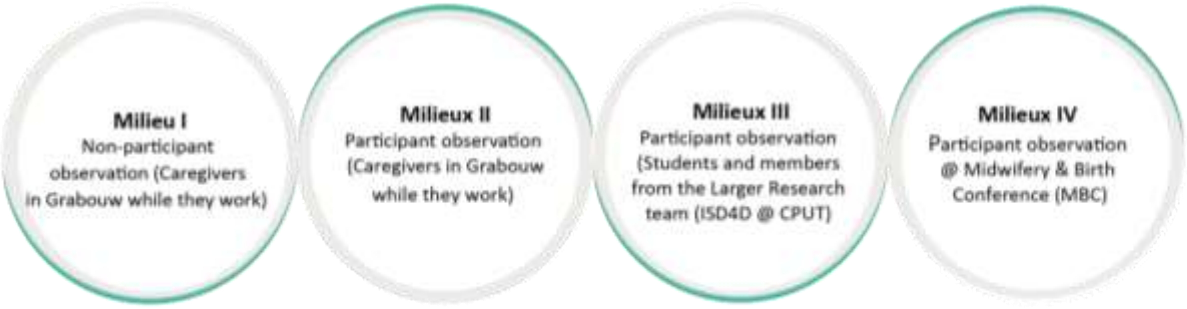


Figure 5.21: Participant observations in the design milieus
(Diagram showing participants and observations made within Service Context A)

5.14.4 User Shadowing – Participant Observation

Milieu II: in these milieus, the *participant observation* approach was employed during co-design workshops with research participants in Grabouw. In these scenarios, research participants actively engaged in co-design workshops while I observed their activities in the natural settings within the design milieus (Figure 5.22).

Milieu III: in this milieu, participant observation was conducted at the UoT through co-design activities. This process served as a tool for data collection during co-design activities as part of the intensive course, which was titled "*The information needs and access workshop*", with student participants at the UoT. Additionally, participant observations were made during co-design activities at each reflection stage of the entire larger project with the ISD4D team (Figure 5.22).

Milieu IV: in these milieus, participant observations were carried out during the Midwifery and Birth Conference (MBC) in Cape Town (click to view: [**MBC-Conference**]). Here, I participated in maternal health activities (Appendix 8: [click to view sample: [8] **CPD certificate - MBC**]). The activities observed in this milieu were mainly characterised by birth stories and education on different modes of birth processes that are available. Other significant issues discussed were how women can access available health information to assist them to make informed decisions for themselves and their unborn babies. Observations made in this milieu provided valuable data that helped in gaining a better understating of the health information needs of women in the Western Cape Province, South Africa. Additionally, there were other birth-related workshops and activities for women enabling them to know what to do in emergency situations and also to have a healthier life. I observed and participated in some of these activities. In my view, my observation and participation provided an insight into the healthcare services available to women within the South African healthcare sector (Figure 5.22). Also, in this milieu, it was evident that the birth experiences and information shared in this conference will provide equity in maternal health information services in South Africa, when made available to women in hard-to- reach areas.

5.14.5 User Shadowing – Service Context B (Ghana)

Data collected in Service Context B was mainly done using participant observation in two different milieus in Kumasi, Ghana. The observations were limited to the co-design and participatory design activities only in these milieus (Figure 5.23).

Figure 5.22: Participant observations in design milieus
(Diagram showing participants and observations made within Service Context B)

Milieu I: in these milieus, the *participant observation* approach was employed as a way of collecting data during co-design activities with women in Kumasi, Ghana. Participants were observed as they engaged with the design tools during co-design activities. Through this process, data were obtained for the purposes of validating initial information obtained from the early stages of this study.

Milieu II: the observations made in this setting were at the early stages of the research. This involved observing the environs of Clinic A where the possible technology-enabled intervention could be implemented in future. In this setting, only participant observation as a data collection technique was employed. In these milieus, some aspects of maternal healthcare services provided by health intermediaries were observed at Clinic A. In summary, participant observation was a useful technique to obtain data in these design milieus.

5.14.6 User Journey Mapping

User journey maps are a graphical interpretation of the overall service being offered in a particular organisation in a story form. A user journey map usually shows the correlation of service or product being offered from the perspective of the service user. Also, user journey maps lay emphasis on service recovery, which is the satisfaction, the service users expect from an organisation. The user journey maps are made up of the *personas*, the *timeline*, the *emotions*, *touch points* and *channels* (Delen, 2010:44; Davies & Wilson, 2013:8; Jäppinen, 2015:49-50).

The personas were used to illustrate the characters (participants) and their goals during the design sessions. The *timelines* in the maps showed how the caregivers usually work within their communities, whereas the *emotion* shows the great and not-so-great moments during the caregiving activities. The *channels* were mainly the context of caregiving where the users are interacting with that particular service. In this case, the user journey maps were only used in *Service Context A (Grabouw, South Africa) since it was the main research context.* These user journey maps helped in obtaining data on the type of healthcare services offered by health intermediaries in the Grabouw community. This design tool helped in visualising the overall service of caregiving in the Grabouw community.

5.14.7 Context Mapping – Service Context A

In the context mapping process, different concepts are put together to understand how different key elements relate to each other (Gray, 2010:321). As part of the designerly methods, context mapping was used to gain insights about participants. Context mapping became one of the major processes of obtaining data from the perspective of caregivers in Grabouw (Van Zyl & Pennanen, 2013:3-4; Sanders & Stappers, 2014:5-6). Using context mapping, the important people, places and other related concepts within the Grabouw community were identified (Mendonca & Van Zyl, 2014:105-106). The context mapping process started with the workshop facilitator indicating one key element and then participants added additional labels to it. Sticky notes were mainly used in this process to label the important features within this context. Using these visual elements, the various stakeholders, the important people, places and other key actors in the Grabouw community were made known in this milieu (Van Zyl & Pennanen, 2013:4; Debrah, Bhebe *et al.*, 2014:101-103; Debrah, De la Harpe & M' Rithaa, 2015:72-73).

5.14.8 User Personas

A user persona provides a description of a specific type of customer who is likely to use a particular service. The persona is made up of the psychographics of the potential service user and these characteristics can be a representative sample of other potential customers in a particular service (Delen, 2010:45; Davies & Wilson, 2013:16; Jäppinen, 2015:46-48). A character was created to represent health intermediaries, which served as the user persona during data collection. User personas become the central point of focus and a tool for reflection and discussion during co-design activities. These visual representations were silhouette images and photos, which were used as a starting point for brainstorming activities in this context (Debrah *et al.,* 2017:2126-2127).

The user personas captured some details such as the persona's name, demographics, characteristic statement, goals, ambitions, influences, and activities. Furthermore, other characteristics of health intermediaries and possible expectations from their patients were captured using this visual tool for data collection. Since the study is user-centred, the personas were useful in identifying the various roles played by the other health intermediaries and stakeholders within the home-and community-based healthcare services in Grabouw (IDEO, 2012:107-108; Debrah Bhebe *et al.,* 2014:100-105). Again, the user personas served as a valuable source of information to identify all the potential health information service users in Grabouw during the post reflection activities with the larger project team (ISD4D) members. Through these user personas, the relevant specifications that could inform the design and development of the health information system were identified.

5.14.9 Role-Play

Role-play is an activity in which individuals in the design space assume characters in real-time without having any special props to support the actual action. Role-play occurs in motion and it is usually a fun activity. Most often role-play is informed by the design concepts or ideas that have been generated as a means of setting in motion service user experiences, solutions or ideas in visual formats (Brown, 2009:4; Johansson *et al.*, 2010:58-60; IDEO, 2012:108; Davies & Wilson, 2013:20; Debrah *et al.*, 2016:444). Role-play is indeed one of the most useful creative tools in the design thinking process. The *role-play* process was mainly undertaken with caregivers in Grabouw only and not with all the other participating health intermediaries in *Service Context A*. This was because the other health intermediaries were not part of the co-design activities in the selected design milieus.

As a data gathering tool, role-play was used to explore particular *service moments* or *touch points* during healthcare service delivery by caregivers within the context of Grabouw (Kaario *et al.,* 2009:127-128; Blomkvist & Segelström, 2013:7-8; Blomkvist & Segelström, 2016:338-340). Role-play processes in the Grabouw design milieu involved the use of music, dance, performances, and presentations by the caregivers. Caregivers acted out how they were going to interact with patients during their health education activities in the community (Delen, 2010:92-94; Debrah, De la Harpe & M'Rithaa, 2015:71-72). The role-playing activity was undertaken as part of their training sessions at the Elgin Learning Foundation. Caregivers demonstrated how they share information and administer care to their patients in the Grabouw community. Role-play activities were recorded which provided valuable data for this study.

5.14.10 Storytelling

Storytelling is used in design activities to elicit communications between designers and participants (Mazzarella, 2018:69). However, in the context of service design, storytelling is termed as *micro narratives* within service sciences to distinguish them from related activities such as planned storytelling (Blomkvist & Holmlid, 2009:27). Micro narratives are mainly used as a means of complementing a service idea. Once the story is illustrated in simple ideas, it is then visualised by the designer in the form of a story. Storytelling becomes the technique to communicate with the other members of a particular group or team working on a particular project to find solutions to a problem (Debrah *et al.,* 2016:444; Brun, 2017:3). The story obtained from the teller can serve as the basics that inform the first roughs of the storyboards. In storytelling, some spaces are sometimes left blank on the storyboard to be completed by other stakeholders and service users (Johansson *et al.*, 2010:19-22; Roberta, 2009:1-3).

The storytelling technique was used as a tool to set the stage by the designer-researcher to communicate with participants during co-design activities in the Grabouw milieu. Storytelling as a data collection tool was complemented by visuals such as user personas and storyboards during the co-design activities. All of these visual design tools served as forms of elicitations which provided additional primary data for the inquiry (Delen, 2010:103; Drew *et al.,* 2016:1678). These micro narratives/ stories were co-constructed by the participants during the co-design activities to elicit past and anticipated future experiences (Buskermolen & Terken, 2000:33).

Caregivers told stories about their personal life and professional practice in the community using the micro narrative/storytelling technique. Caregivers expressed their thoughts verbally and by writing short notes about their future dreams and aspirations. Storytelling in these milieus was characterised by *facial art,* another form of body arts. Participants used body arts to visually express their emotions and working strategies in the Grabouw community (Debrah, M'Rithaa & Chisin, 2015:para 1-2).

Storytelling as a data collection tool in these milieus provided a much deeper insight into the personal lives of caregivers in Grabouw inquiry (Delen, 2010:103; Debrah, De la Harpe & M'Rithaa, 2015:71-73). These stories obtained from participants, informed the design of an additional storyboard, which emerged from the initial design activities. Data obtained with this design tool, gave an indication of how future innovative solutions could be explored to facilitate maternal health information services in Grabouw. Also, information captured in the storyboard could serve as a guide for designers who aspire to develop storyboards for communications in future design activities in Grabouw.

5.14.11 Storyboards

A storyboard is a series of drawings that describe a particular story or scenario (Boiron *et al.,* 2015:1). The picture panels are usually accompanied by text to explain the various actions that are assembled to tell a story or a sequence of activities. Storyboards tell the story of a particular group of people over time and each picture may represent a particular event (Greenberg *et al.,* 2012:64). Storyboards are similar to comic strips. In service design activities, storyboards can be likened to journey maps but focuses on communications and activities (Blomkvist & Segelström, 2013:7-8; Blomkvist, 2014:72-73).

In this case, storyboards served as another form of object/visual elicitation. Storyboards were used during co-design activities as part of the data collection process. The storyboards were used as icebreakers during the design activities. Storyboards stimulated conversations among participants and served as a means of presenting visual-based data. The storyboards made it easier to visualise and understand the research context better. Furthermore, it served as a medium of communicating baseline information to the rest of the (ISD4D) team, which informed healthcare service innovations. Storyboards created from this research can be useful as a starting point for researchers who aspire to conduct research in Grabouw.

5.14.12 Illustrations

Illustrations are very useful in visual based-research. Illustrations serve as elicitations and are very valuable sources of primary data in interpretive research. In this case, two main sources of visual data were generated. These were participant-generated and researcher-generated visual data (illustrations) (Collins, 2010:138-139; Blomkvist & Segelström, 2013:12-13). The participants' generated illustrations were obtained during co-design activities as part of the ideation process. Additional illustrations were researcher-generated and these were taken from existing sources such as clip art and magazines. These illustrations were used as part of the brainstorming sessions.

The illustrations were used during co-design activities in both *service contexts A and B* to generate discussions. In *Service Context A,* illustrations helped caregivers share their thoughts about caregiving. In the case of the participating women, the illustrations served as a visual language tool that catered for the varied literacy levels during co-design activities. Similarly, in *Service Context B (Kumasi, Ghana)* the illustrations were used to facilitate communication between the participating women to clarify key concepts during co-design activities. On the whole, the illustrations were used as prompts to generate ideas collaboratively amongst participants during the design workshops (Debrah *et al.,* 2017:2129-2130).

5.14.13 Diaries

Dairies are useful tools in collecting data in a given research. The dairies held a two-fold function: firstly they were mainly used as a means of collecting data from participants (Hulkko *et al.*, 2004:43). They were used for recording research- related information from the design researchers' perspective. Dairies were primarily given to participants to provide information for the study at their own pace. However, it was observed that participants rarely used the diaries, which were provided. Disposable cameras were made available to participants to support the documentation of events in the diaries. Yet, still they preferred discussing their thoughts in co-design activities rather than documenting their daily activities in diaries or using disposable cameras. It was observed that factors such as the literacy levels of participants and the affordances of these data collection tools could have inhibited the effective use of these tools in the various milieus. As a result, alternative strategies will be needed to promote the effective use of dairies within the various service contexts in further research.

Secondly, the dairies were used as a reflection tool for this study. In this sense, dairies were used for note taking during the planning stages, data gathering processes and completion of this study. The dairies were useful in recording important dates for meetings and plans for the next research activity (Gray, 2010:325). I must state that dairies were not primarily used for note taking in this research case, but rather as a data collection tool for obtaining data from participants. In both cases, the diaries facilitated the recording of data from participants and provided factual description of events within the phenomenon under investigation (Collins, 2010:127).

5.14.14 Photography, Audio and Video Recordings

Photographs, videos and audios were mainly used to stimulate discussion or recall events in the research activities (Gray, 2010:326). These multimedia tools were used as a means of recording data in Service Context A (South Africa) and Service Context B (Ghana). In some cases, visual media, which were obtained from other sources, were used as elicitations during co-design activities in the various service contexts. These videos were mainly motivational messages that were in the form of short video documentaries and animated films. Some were health-related videos and photos, while others were simply highlights from previous design activities. They were screened at the beginning of each co-design activity which served as ice-breakers to facilitate discussion with participants (Collins, 2010:138). This helped in breaking boundaries and power structures between participants and facilitated communication during co-design activities.

Additionally, the photos and videos served as a visual means of recording research activities and data in the design milieus. Furthermore, the audio and video recordings were used as digital diaries that served as a point of reflection for the larger research project. The audio visual tools made it easier to document visual data and share research outcomes with participants in subsequent co-design activities in the various design milieus (Gray & Malins, 2004:89).

5.15 INFORMAL CONVERSATIONAL INTERVIEWS

In the data collection process, informal conversational interviews were equally valuable tools of data collection. These conversational interviews were in the form of guided conversations rather than structured questions (Yin, 2009:106). The interviews were mainly conducted on a *one-on-one* basis and sometimes in groups of **two (2)** to **three (3)** participants. The interviewees in this case were mainly health intermediaries in Service Context A and B. Using semi-structured interview guides in some instances I prompted the interviewees and they provided responses to the questions in a very unstructured manner. In addition, the conversations were documented using recording devices such as video cameras and other sound recording devices (Gray, 2010:374-375). These informal conversational interviews were conducted in the various design milieus in both service contexts A and B.

5.15.1 Conversational Interviews: Service Context A

Informal conversational interviews in Service Context A were aimed at gaining insight into the context of healthcare services within the Western Cape Province and more especially in the Grabouw community. The conversational interviews were extended at a later stage to include other health intermediaries practicing in both public and private sectors in Cape Town, South Africa.

Milieu XI: the conversational interviews were organised in focus groups with the participating members. The groups were made up of three (3) to five (5) people per session at the Elgin Learning Foundation during the preliminary stages of this research. Conversational interviews were conducted with three to five (3-5) caregivers per session. Three (3) trainers, three (3) coordinators and two (2) administrators of home-based carers participated in these sessions in the context of Grabouw. One of these administrators was a nursing sister and the other was a home-based carer. Their core mandate was to manage caregivers and administrative procedures regarding daily caregiving in the Grabouw community.

Milieu XII: in this setting, the conversations started with **two (2)** health intermediaries who have been working as midwives with over 20 years of experience in Cape Town. Additionally, **two (2)** health information designers participated in the conversational interviews. They were selected for conversations because they have been working collaboratively with the UoT to design health information materials in Cape Town, South Africa.

These informal conversations were further extended to include other selected health intermediaries in Cape Town. In this case, there were **two (2)** nurses and **two (2)** doctors from the UoT who were involved in these conversations. Additionally, there was **one (1)** doula and **two (2)** midwives from both the public and the private sector who participated in this category. All the health intermediaries and participants provided valuable data regarding the phenomenon under investigation. Data obtained from these conversations provided qualitative information, which served as the baseline for further inquiry in Service Context A.

5.15.2 Conversational Interviews: Service Context B

In Service Context B, interviews were conducted at the early stages of this study as a way of surveying the landscape of health information services in Kumasi, Ghana. Informal conversations conducted in this context aimed at exploring the boundaries of health information services offered in the vicinity (Kumasi) and identify opportunities for this study.

Milieu I: in Clinic A, there were informal conversations with selected health intermediaries. There were **four (4)** midwives**, four (4)** community nurses, **one (1)** gynaecologist, and **two (2)** other doctors who doubled as administrative staff at Clinic A. Most of the interviews conducted at Clinic A were organised at the convenience of health intermediaries so that it did not interfere with their daily work practices.

Milieu II: in this setting, the interviewees were mainly women in the Bomso and Ayigya community in Kumasi, Ghana. After contacting the women, they indicated their availability and they were visited on the scheduled dates to conduct the conversational interviews. **Four (4)** women were engaged in such interactions in this context. Their feedback gave an impression of what to expect during upcoming co-design activities. In view of this, modifications were made to sections of the design methods and toolkits in order to facilitate a successful co-design session.

5.16 PHASE II – DATA COLLECTION

Collecting Data – Service User Surveys (Opinionnaires)

The use of surveys depends on the world view of the investigator and what the study seeks to achieve (Gray, 2010:338-339). This study is situated within interpretive research domains and as such, qualitative tools for conducting **surveys** were used. However, in this research, the term service **user surveys/**user surveys are used interchangeably with opinionnaires, which is simply a qualitative type of survey. Opinionnaires were used in soliciting views from participants within the various service contexts. Conversely, questionnaires and opinionnaires might be similar in their appearance, but they serve different purposes. The difference between these two survey tools is that questionnaires are best used for summative evaluation (quantitative) whereas opinionnaires are suitable for formative evaluation (qualitative).

Opinionnaires (user surveys) were used in this study for problem diagnosis and to explore possible solutions from the perspective of participants (Alden, 2007:48). Adopting opinionnaires as qualitative data collection tools, provided insights into potential challenges experienced with health information service delivery within the various service contexts. The opinionnaires were very useful ways of eliciting conversations to obtain personal views from participants about health information services. The user surveys helped in identifying possible ways of improving health information services based on the participant's opinions. Additionally, user surveys helped in soliciting views from a substantial amount of health intermediaries within a reasonable timeframe without interfering with their professional duties.

5.16.1 Designing the Service User Surveys (Opinionnaires)

A well-designed user survey (opinionnaires) can be easily completed by respondents to provide data, which can be very rewarding to the investigation (Gray, 2010:338-339). The user surveys were in two (2) different sets, designed to solicit views from health intermediaries (Set A) and participating women (Set B) in the various service contexts. These user surveys were designed during the preliminary stages of the study. As part of the design process, informal conversational interviews were conducted with selected health intermediaries in Cape Town, South Africa. Feedback obtained from these informal conversational interviews and available literature, served as a starting point to design the opinionnaires for the survey.

The opinionnaires were designed such that it consisted of multiple choice questions and close and open ended sections in order to obtain different views from participants (Sahin, 2011:429).

The layout of the questions and the overall aesthetic appeal was factored into the design process so that it could be easily completed by the respondents (Appendices 6 & 7: [click to view samples – [6] **Survey - HCWs** [7]**; Surveys - patients**]).

After drafting the opinionnaires, it was administered to selected health intermediaries and other typical potential respondents in healthcare to pre-test this tool. The pretesting was conducted to check for errors, clarity of expression, the use of right terminologies in healthcare and the required time needed by respondents to fill in the opinionnaires (Madriaga, 2014:210). Pretesting these user surveys made it possible to reduce non responses by respondents as well as reducing ambiguity (Gray, 2010:359). The process helped in improving the overall quality and aesthetic appeal of the opinionnaires making it easy to be completed by respondents. In summary the user surveys provided qualitative data which served as additional information for this study (Alden, 2007:48; Khan & Iqbal, 2014:121).

5.16.2 Administering the Service User Surveys

The *two (2)* different sets of opinionnaires were administered to respondents on an individual and group basis in the various service contexts. Administering the opinionnaires to the other respondents (women and health intermediaries) through direct contact was quite advantageous. Collecting data through direct contact, increased the trust between administers (design-researcher) and respondents. Through such means a greater proportion of respondents were encouraged to complete the opinionnaires (Gray, 2010:230).

5.16.3 Administering User Surveys to Health Intermediaries

The user surveys (in Set A) were administered to health intermediaries in Service Context A (South Africa) on an individual and group basis. I personally gave out some user surveys to respondents during the data collection process. In addition to this, the opinionnaires were distributed with the assistance of other health intermediaries at major hospitals in Cape Town. Additional user surveys were administered during the annual Midwifery and Birth Conference ([MBC], 2014) in Cape Town, to solicit views from participating health intermediaries (click to view: **[MBC - Conference**]**)**. The completed opinionnaires were returned by the close of the conference to the researcher. Meanwhile, sets of these opinionnaires were also administered to caregivers in the Grabouw community.

5.16.4 Administering User Surveys to Women/Mothers

The surveys (in Set B) were administered to participating women, in both service contexts A and B. In these contexts, they were administered to participants on a one-to-one basis during co-design engagements. Participating women in Grabouw (Service Context A) were given these tools and they were provided with the needed assistance to fill in the opinionnaires. Similarly, the surveys were administered to the women in Kumasi, Ghana (Service Context B). They were given the opinionnaires during the co-design activities and they were assisted accordingly to fill it in. Administering the surveys to the women personally was useful, as some of them needed assistance to fill it in due to the disparities in their literacy levels. In such instances, the questions were read out to them, and their responses were used to complete the corresponding questions.

5.17 DATA ADMINISTRATION – PHASE I and PHASE II

Data administration involves processes such as sorting, storage of data, safekeeping, and transcription of the data. Data obtained from **Phase I** and **II** of the research were stored in safe formats. In storing the data, issues of privacy and confidentiality of information were considered in order to secure the information for data analysis. The feedback obtained from **Phase I** and **II** that required transcribing was done accordingly in order to ease the data analysis process. All data obtained in paper-based formats were kept in a secure storage environment for reporting, analysis, and future referencing. Digital versions of data obtained were simply stored on external hard drives and in the cloud to store different versions of data obtained as backups.

5.17.1 Phase I – Service Design Processes

In Phase I of the study, data were obtained through co-design activities and other service design methods. Information obtained through this design phase was in both visual and textual formats. These were paper-based worksheets and digitally recorded data. The paper-based data were photographed and converted into JPEG file formats, which were stored on external hard drives. All data obtained were further stored electronically using cloud based tools such as Google Drive and Dropbox, which served as a backup of all the data obtained. Meanwhile, all the paper-based information was kept in a safe and secure environment for later referencing and analysis.

5.17.2 Phase II – Service User Surveys (Opinionnaires)

At this phase of the research, data were obtained through user surveys. Feedback obtained from respondents were digitised and captured unto Excel sheets. The digital versions of the data obtained from the user surveys were stored onto external drives for backup and safekeeping. Digital versions were later stored in the cloud for analysis. The hard copies of the data were kept in a secured safe for later referencing and analysis.

5.18 CATEGORISING DATA – PHASE I and PHASE II

In qualitative data analyses, categorising the raw data are useful as it is easier to *dismantle, segment* and *reassemble* data to form meaningful findings in order to draw inferences. These were guided by the research questions and aims to amend the collected text into meaningful pieces and recombine them logically to make sense (Wahyuni, 2012:75). The data obtained from **Phase I** and **Phase II** of the study were categorised accordingly and aligned to the main research objective. The information was grouped into *categorical* and *quantifiable* data. The *categorical* data were not quantifiable and therefore they were grouped into themes and analysed accordingly. The *categorical* data were largely from data obtained from service design engagements in Phase I *of the study* and partly from data obtained from user surveys (opinionnaires) in Phase II of the investigation. On the other hand, qualitative data obtained in Phase II of the study through user surveys were *quantifiable*. These were measured numerically which means they were more precise as per the feedback obtained from respondents (Gray, 2010:450).

5.18.1 Phase I – Service Design Processes

Qualitative data obtained during Phase I of the research were both textual and visual-based data. Data obtained during this phase of the research were grouped thematically since most of them were unquantifiable. Data obtained in design engagements were categorised as *textual, image, audio and video data* (Van den Eynden *et al.*, 2011:12-15). *Textual data* comprised of the responses obtained from co-design activities, which were all converted into Microsoft word formats. *Image data* were mainly information obtained through photographs and videos during co-design activities. *Audio data* consisted of recordings from conversational interviews, which were transcribed into text formats using the Dragon Audio transcription software for analysis. The data transcribed were labelled according to the transcribed feedback obtained from respondents. They were coded with notes indicating the details of interviewees, duration of conversations and locations where interviews were conducted. The systematic labelling made it easy to identify all data categories. This was helpful during the process of data analysis.

5.18.2 Phase II - Service User Surveys

Qualitative data obtained through the user surveys were mainly categorised into two streams. The categorisation was based on responses obtained from health intermediaries and women who participated in this study. All the responses obtained from health intermediaries through user surveys within Service Context A, were categorised as Data Set A for the analysis. Feedback obtained from women in Service Context A and B were both classified as Data Set B. The distinctions made from the various data sets simplified the data analysis process from the user surveys administered to both sets. Further, qualitative data obtained through the user surveys were largely quantifiable (close-sections) and partly non-quantifiable (open sections). However, the quantifiable sections were recorded accordingly using Excel spreadsheets. The open-ended sections were equally recorded using word processors and grouped thematically for further analysis.

5.19 DATA CLEANSING – PHASE I and PHASE II

The cleansing process involves the removal of errors and any other inconsistencies to improve the data quality for analysis. In cleaning the data, the process involved cross checking the data to remove any information which was accidentally omitted or entered incorrectly (Van den Broeck *et al.*, 2005:0966-0967; Rahm & Do, 2000:1-2). All incorrect entries and any omitted information that was omitted were corrected to improve the overall data quality. Also, issues concerning anonymity and confidentiality were addressed through the data cleansing process. All identifiable information that could be traced to individual participants was avoided. The identities of participants were replaced with pseudonyms in relevant sections of the study in both *categorical* and *quantifiable* data obtained (Van den Eynden *et al.*, 2011:26-27). However, in some instances, names of organisations were indicated in the analyses. This was unavoidable due to the context of the research case.

5.19.1 Phase I – Service Design Processes

The data cleansing process involved at this stage of the study, involved the cross checking of data recorded with the help of two research assistants. All data recorded from the fieldwork was scrutinised by comparing the recorded information with what was obtained in the field. Those that were inadvertently omitted were corrected respectively. Data reported in this thesis from these data sets represent the actual information obtained from fieldwork. In some sections, slight modifications have been made for the purposes of clarifying respondents thoughts where required.

5.19.2 Phase II – Service User Surveys

User surveys were used mainly to collect largely quantifiable data and partly non-quantifiable data from respondents. In the data cleaning process, efforts were made to ensure that *quantifiable and non-quantifiable* data obtained were cleaned as much as possible for the analyses to make it reliable. The non-quantifiable data were recorded and the key recurring data were cross-checked to ensure that it tallied with the information recorded in the system. In the case of quantifiable data, the cleaning process was conducted with the assistance of two different statisticians. This strategy was a way of ensuring that data entered into the computer was "clean". In the data cleaning process, the statisticians provided assistance by cross checking entries to ensure that no incorrect figures were made. In addition to this, a frequency analysis was then conducted to highlight any spurious figures that had been entered (Gray, 2010:454). All missing sections were corrected accordingly and in most instances, only the valid responses obtained from respondents were considered for the statistical analysis.

5.20 DATA ANALYSES – PHASE I and PHASE II

Data analyses usually involves a multi-method approach also known as methodological triangulation, based on the raw data obtained (Patton, 2002, cited in Wahyuni, 2012:75). At this stage of the research, the primary data obtained has been prepared for the analysis. The preparation towards the analyses included transcribing raw audio data, visual data and textual data, which were then cleaned for the evaluation (Van den Eynden *et al.*, 2011:26; Wahyuni, 2012:75). The analysis was conducted according to the data obtained from **Phase I** and **Phase II** of the study. This was then interpreted using selected theories as lenses (Figure 5.24). The data analysis process at this stage of the research, involved making sense out of the information obtained during the fieldwork by drawing inferences from the raw data obtained.

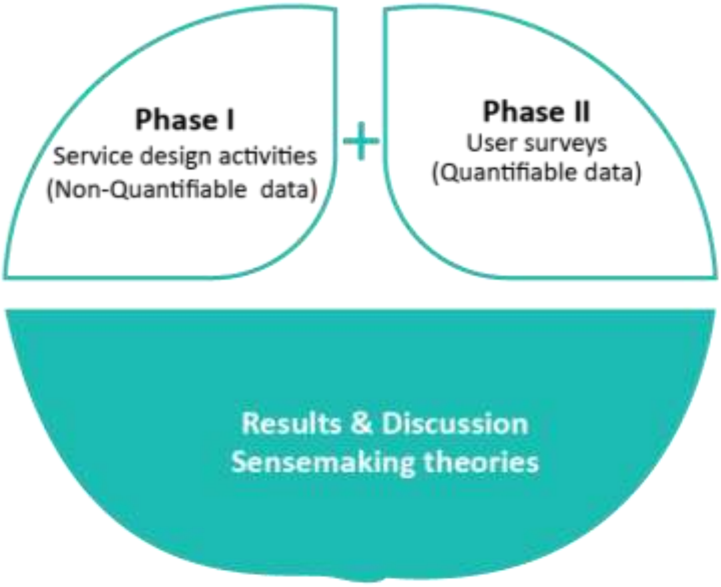


Figure 5.23: Categories for analysing data – Phase I & Phase II

5.20.1 Phase I – Service Design Processes

In **Phase I,** the data were analysed based on information obtained from the service design activities from the various service contexts (A and B). Affinity diagrams technique was explored to analyse data obtained from these designerly activities and to make sense of the information obtained. Affinity diagram is a tool used to sort out large amount of information and cluster them into themes based on their natural relationships (Judge, 2008:1-2). Affinity diagrams are sometimes referred to as KJ diagrams which was named after Kawakita Jiro who developed it in the 1960s (Ulrich, 2003:1-2; Lucero, 2015:231-232). The affinity diagrams were used in this research to engage team members to foster collaboration and encourage participants to make contributions within the transdisciplinary research domain in this study. Data obtained through the design processes were often divergent views, which were converged using affinity-diagramming strategies through an iterative design process (see Figure 5.25).

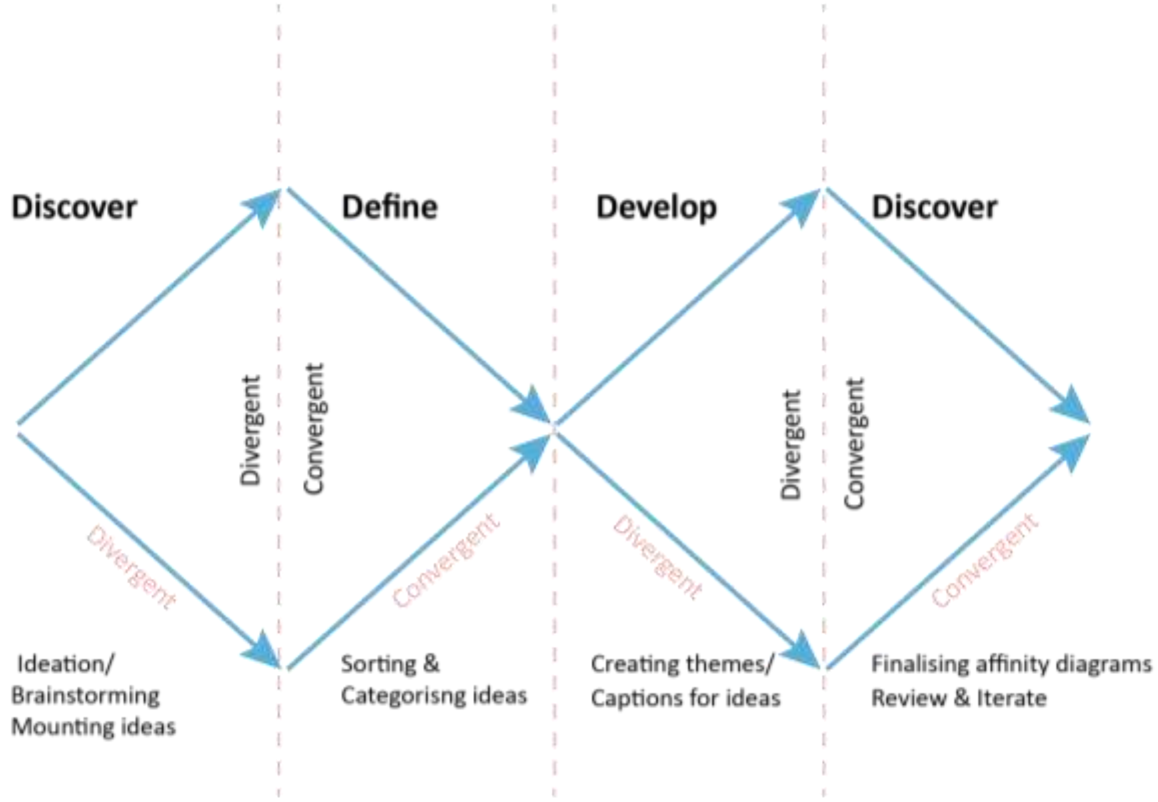


Figure 5.24: Data analysis – affinity diagram strategies

The various steps in creating affinity diagrams were guided by the design process as shown in Figure 5.25. The visual and textual data obtained from the service design activities, were clustered into themes through the affinity diagram processes in order to make it easy for the data analysis and information sensemaking. Also, transcripts obtained from audios, videos and field notes were analysed through the identification of the most recurring themes. The data sets obtained were further analysed using the affinity diagramming strategies to identify the links in the thematic clusters for understanding. Additional feedback obtained from the service design activities were analysed and grouped into tables using the Microsoft Word and Excel Software. Data sets obtained are now easily shareable with the research team for further sensemaking and interpretation.

5.20.2 Phase II – Service User Surveys

Data analyses in **Phase II** of this study, consisted of information obtained from user surveys administered to health intermediaries (data Set A) and women (data Set B) within the various service contexts. The responses provided by health intermediaries and women were analysed using computer-assisted tools such as IBM SPSS Statistics, 23 software and Microsoft Excel (version, 2011). The data obtained through user surveys with close-ended sections were coded and analysed statistically with the assistance of these software. The information obtained through the open-ended sections of the user surveys were analysed through the identification of key themes in the data. Results obtained from various sections of the user surveys were then summarised and reported as the outcome of the data analysis process.

5.21 UNIT OF ANALYSIS – INDIVIDUAL PARTICIPATION

Unit of analysis is the major entity being studied or analysed in a given research case. The primary research questions in a given study serves as indicators for identifying the unit of analysis such as a group or an individual entity (Yin, 2009:29-30). In this study, there were four (4) major categories of the unit of analysis. These units of analysis mainly referred to the individuals in the research context. In these units, the health information accessibility, understanding, usability, communication, and the use of health information services were studied. These units of analysis as identified for the study is presented as follows:

- **Unit I – Health Intermediaries**

  The unit of analysis in this case comprised of health intermediaries from different backgrounds in the Western Cape Province of South Africa and partly from Ghana. These health intermediaries consisted of midwives, childbirth educators, obstetricians, nurses, doctors, doulas, and home-based carers.

- **Unit II – Women/Mothers**

  The second category of the unit of analysis was made up of women (mothers with children/ pregnant) living in the Grabouw community in the Western Cape Province of South Africa. Secondly, women living in the Bomso and Ayigya community in Ghana were also part of this unit of analysis.

- **Unit III – Learners (HEIs)**

  The third category consists of students from higher education. This was mainly done to complement some aspects of the research activities being conducted in the various design milieus. Observing these units of analysis unearthed possibilities of improving health information and health education services in the various service contexts.

- **Unit IV – Service Concept**

  The service concept was considered as a unit of analysis for this study because the service was being conducted through an organisation – Elgin Learning Foundation. The organisation is also a training institution for the home-based carers. Therefore, the "**how"** and the "**what"** of the home-based healthcare services in relation to health information service design becomes a vital unit of analysis for the study. Hence, the service concept, which is the mental picture of health information services as perceived by women (patients) in the various service contexts, was established as a unit of analysis.

5.22 UNIT OF OBSERVATION – INDIVIDUAL'S SENSEMAKING

The unit of observation in this case is mainly the actual item that was collected, observed or measured in the process of observing the unit of analysis (Sedgwick, 2014:1-2). The units of observation in this study are in two categories:

- **Observation Unit – Category One**

  The first level was mainly observing the health information services and practices offered by health intermediaries in the various service contexts in South Africa and Ghana. The unit of observation consists of all information objects used to facilitate interaction during health education and promotion activities within the various service contexts.

- **Observation Unit – Category Two**

  The second category was mainly observing the health information and educational services received by mothers/women in the various service contexts. The observational units included information objects such as documents, artefacts, images and other ICT tools they use to address their information and educational needs in the various research contexts. All of these items were observed and collected during the process of learning about the research participants (unit of analysis) in the various service contexts.

5.23 THEORIES USED AS ANALYTICAL LENSES

In analysing data obtained, several theories were examined from literature and sensemaking was adopted because it aligns with interpretive perspectives of this study. Sensemaking and service design theory formed the foundation of the study. Sensemaking is making sense out of intricate data (Dervin, 1996:12). The **sensemaking process** involves searching for information, breaking it down and re-organising it into a comprehensible whole (Dervin, 1998:36; Agarwal, 2012:4; Andrews & North, 2012:123-124; USAID, 2019:31). For example, as a design-researcher, I have searched for information, analysed it and re-organised it into a comprehensible whole in the form of this thesis document. **"Designers** are producers of **sense** or **sensemakers"** (Manzini, 2015:35). Designers, design artefacts, and systems that must make sense to users. In all of these instances, it is only when these artefacts or systems make sense to users that it is perceived as a solution to an on-going problem. In sensemaking processes, people should be able to communicate sufficiently, irrespective of their language differences (Dervin, 1998:36). Designers are able to transcend barriers to communication through the visual language. They might design this process in the form of designed artefacts or systems for specific functions. Again, sensemaking is relevant to design in the sense that it provides tacit knowledge (Price *et al*., 2017:3). Sensemaking in the service design sense, involves the social construction of meaning through interpretive process in the life-world (Maines, 2000:577; Cipolla & Reynoso, 2017:5). Collective sensemaking (Figure 5.26) is attained through social interactions that inform decision-making in the service design process for **change making** (Pastor, 2012:2-5). Sensemaking in the service design research allows designers to empathise, understand user needs and specifications which inform the design of the service concepts (Kolko, 2010;3-5; Mazzarella, 2018:69).

Figure 5.25: Sensemaking for Changemaking in the context of design (Source: Adopted from Pastor, 2012:2-5)

5.24 SENSEMAKING ANALYSIS IN SERVICE DESIGN ACTIVITY

Sensemaking analysis, in this case, is informed by Cipolla & Reynoso (2017:7) research on service design as a sensemaking activity. In their view, sensemaking analysis as a participatory or joint activity and can be categorised on two levels. The **first level** involves the cultural background/context of the services. The **second level** reflects the service solutions which are designed based on interpretations made from the cultural background/context in **level one** (Cipolla & Reynoso, 2017:7). In my interpretations for this study, sensemaking analysis in level one can be classified as **context** and **level two** is interpreted as the contextualised/ **proposed solution** in an underserved community. These sensemaking categorisations served as a framework to analyse the information obtained in **Phase I** and **Phase II** of the study through an interpretive perspective. An overview of the methods for the sensemaking analysis on **level one** and **two** is described in this section (Figure 5.27). However, a detailed discussion on the sensemaking analysis is presented in **Chapters Six to Eight** of this document.

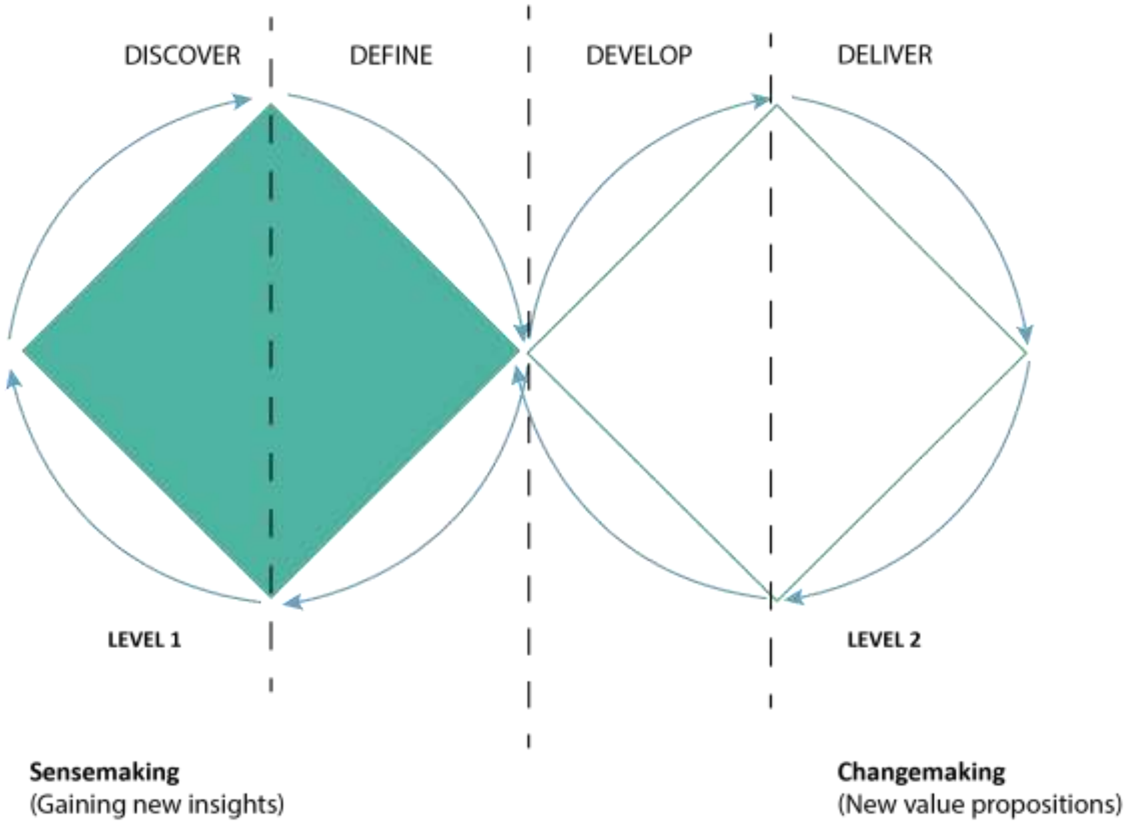


Figure 5.26: Service design activity and sensemaking analysis

- ### Level One – Understanding Context

This study was designed with a focus on level one sensemaking to gain insights of the context/local culture within the research case. Sensemaking analysis in level one involved understanding local culture/context through interpretive worldviews (Figure 5.27). Through a service design approach (in Diamond 1 – discover and deliver), data were obtained and classified for the analysis. Firstly, the shared sensemaking process comprised of knowledge about the service context (new insights) that might influence the service design (new value) propositions.

Secondly, concepts in the classical sensemaking process were adopted as a lens to gain insights about the information needs and wants of health intermediaries and their patients. The sensemaking process is described as follows: The individual will begin the process from a situation/context (information seeking); the gap will be the information need; the bridge will be the information seeking process; and then help is the information use or the outcome of the information seeking process (Kari, 1998:8-9; Dervin, 1998:36). These sensemaking concepts served as guiding principles to analyse the communication processes of the service users. In the process, design principles were identified that could inform future design and development of technology–enabled solutions for health information services in an underserved context.

- **Level Two – Proposed Service Solution**

  At this level, information obtained for the sensemaking analysis were mainly categorised based on outcomes from level one to inform the design process on level two at a later stage of this study. The activities on level two will mainly focus on the development and deliver phases of the design process to prototype a contextualised solution (new value propositions). Since the study was not extended further to these phases, design principles were suggested based on level one sensemaking analysis. These design principles emerged from the classical sensemaking process to guide the future design and development of the proposed technology-enabled health information system.

5.25 RESEARCH QUALITY

Research quality is achieved by the quantitative tradition when the research measures are reliable and valid to ensure that the results obtained can be replicable and generalisable. However, this does not often apply in the context of qualitative research. Due to the nature of qualitative research, reliability and validity for the purposes of generalisability of measures is not the focus. Rather in qualitative research, emphasis is placed on the uniqueness and context of the credible knowledge produced (Wahyuni, 2012:77; Trischler & Zehrer, 2012:60-62; Yilmaz, 2013:314). Although these are not the usual measures in traditional qualitative mainstream to achieve research quality, some of the measures regarding validity and reliability were explored as a hybrid measure in this design research. In this case, measures were put in place to address challenges that could undermine the quality of data gathered. As such, social science and design research procedures such as validity, reliability, triangulation and ethics with the focus on context were considered to enhance research quality in the study (Collins, 2010:83-85). The steps that were taken towards achieving research quality in the various service contexts are described under the subsequent headings.

5.26 VALIDITY

Validity refers to the credibility of findings and conclusions from a study. In interpretative research, validation is the judgment of the trustworthiness or the goodness of a piece of research (Angen, 2000:387, cited in Creswell, 2007:205). In this study, validity refers to the quality control measures that were used in gathering and analysing data. Also, it refers to the extent to which the data obtained reflects the social phenomenon being observed (Wahyuni, 2012:77). In this enquiry, service design methods were used that involve small groups of people, personal observations, and individual cases within specified context. Therefore, the validity process as applied in other social science interpretive research becomes less important in this context (Krauss,2005:760; Yilmaz, 2013:317-319). However, validity measures were considered and contextualised in this research case at the forefront of the study for the following purposes:

- To pre-test certain aspects and outcomes of the research, such as design probes, toolkits, processes in different design milieus and research context

- To develop new ideas for future design engagements
- To sharpen knowledge gained to inform design processes
- These considerations helped to ensure that the information obtained were credible and therefore making it a valid research case

5.27 RELIABILITY

As part of the process of enhancing research quality, it was essential to ensure that the information obtained from participants in this study remained reliable. Reliability, in qualitative research, refers to the stability of responses to multiple coders of data sets obtained in a given research (Creswell, 2007:210). Also, it refers to the consistency of methodological approach as well as the methods applied in the research (Wahyuni, 2012:77). Obtaining stable responses from health intermediaries and largely low-level literate participants (women) may present some challenges of inconsistency. However, it was ensured that the processes used in Phases I and II of the study, were as rigorous as much as possible. The methodological approaches used in the various service contexts were similar to ensure that the information obtained remained reliable. This study was designed in this manner so that other researchers can follow these procedures and make modifications to suit similar research contexts (Yin, 2009:45; Yilmaz, 2013:317-319).

In practice, data collection instruments such as the user surveys (opinionnaires) administered to respondents were very simple in terms of layout, length, and general appearance. The user surveys were designed such that it could be read easily, understood, and answered by participants. This increased the chances for responses to be obtained from participants (Collins, 2010:128). Further, additional steps were taken to ensure that there were no language barriers in terms of communication. As a result, data obtained was valid, thereby making information obtained reliable and unique within this study context. Qualitative *objective* and *subjective* analysis was combined in this case using the concept of triangulation. The concept of triangulation made it possible to analyse data using multiple sources of data sets leading to more reliable results (Hussein, 2009:3-4). All data obtained through user surveys were analysed objectively (statistical analysis) in order to make the data sets more reliable. Whereas data obtained from service design engagements were analysed *subjectively,* as they were based on co-constructed knowledge from the perspective of participants (Alden, 2007:42). The outcome of this research as observed in its natural settings has been presented in the *next three chapters* of this thesis.

5.28 TRIANGULATION

Triangulation refers to the process of collecting data from multiple sources of data sets, with the hope that it will converge to support a particular hypothesis or theory. It is worth noting that triangulation is not solely designed for validation purposes but serves as a means of obtaining a deeper understanding of a phenomenon (Olsen, 2004:1). There are different categories of triangulation such as theoretical, analytical, investigator and methodological (Hussein, 2009:3-4; Ziyani *et al.,* 2004:12-13). In this context, the methodological triangulation was used to obtain a deeper and wider view of the research case. The data collection process and analyses involving a multi-method approach is termed methodological triangulation (Patton, 2002, cited in Wahyuni, 2012:75). Multiple design methods and tools were used in collecting data as a means of triangulating the data sets to reveal unique findings (Hussein, 2009:4; Collins, 2010:52-53). All recurring themes, which represented converging views from the data sets, were identified and summarised as the evidence obtained from the study. In instances where inconsistencies were observed in the data sets, the evidence obtained served as opportunities for further research. Other researchers can follow or modify these methodologies to arrive at convergent or divergent views in future research endeavours.

5.29 ETHICS

In research activities, it is necessary for the researchers to uphold ethical principles and behaviour. Philosophically, ethics is a term derived from the Greek word *ethos*, which means character or custom (Young, 2013:90-91). Ethical behaviour and approaches require researchers to adhere to moral norms (principles) in line with their research community. The researcher is expected to do the right thing that is morally right and acceptable within a particular context. There are different approaches to ethics: the consequentialist, non-consequentialist, and principlist approach. A combination of both consequentialist and principlist (principlism) approaches were considered in this study since it aligns with visual-based research (Collins, 2010:82-83; Carlsson, 2011:2).

In the consequentialist approach, ethical decisions are made based on the consequences of a specific action (Carlsson,2012:72-73). In this perspective, the ethical decisions that were made can be arbitrated based on the situational analysis of context to be considered as good or bad. Therefore, the consequentialist approach made it possible to make decisions that were morally right during the research process to uphold ethical values in the study. Additionally, the principlist approach which is based on principles such as *confidentiality, anonymity* and *respect* for autonomy were maintained in this study to protect participants and information obtained (Collins, 2010:82-83; Carlsson, 2011:7-10).

Additionally, based on the epistemological lens of Afrikology these ethical philosophical worldviews were situated within an Afrikan ethos of **Ubuntu** (togetherness) (Buntu, 2014:1-2; Wanda, 2013:9-10; Wanda, 2015:156; Rukooko & Komakech, 2017:23-24; M'Rithaa & Jamie, 2017:1-2; Osha, 2018:1-2). These encouraged participation throughout the research in the spirit of Ubuntu to explore sustainable solutions to healthcare within an underserved context (Lutz, 2009:1-2; Chilisa *et al.*, 2016:317-318). These approaches were applied on two main levels of the research: service design processes **(Mode I)** and general ethical considerations from university for this research **(Mode II).**

5.29.1 Service Design Ethos – Mode I

Design ethos is required in service design activities because the process is people centred. Service design deals with soft issues, which provides endless possibilities in a given research (Fritsche, 2011:9-10; Stickdorn and Schneider, 2011:23-24).There are often divergent views arising from a given piece of service design research and therefore ethical issues are bound to arise. In all of these instances, the designer plays a role of making sound judgements throughout the design process that makes the designer the voice *of* and *for* the people (Carlsson, 2012:72). In line with service design processes, all data collection procedures were more *eco-centric* rather than *egocentric*. In this case, these were the first steps of acting morally throughout the service design processes in the various research contexts. Also, following fundamentals of design ethos, the study was conducted in a more egalitarian way, making designers and participants work collaboratively to identify probable solutions in their contexts (Young, 2013:90-91; Debrah, De la Harpe & M'Rithaa, 2015:71-72). In all the service design activities efforts were made to avoid *Akrasia* – meaning acting on opinions rather than reason. Instead, the study was conducted focusing on "*what*" we wanted to achieve reflecting deeply on *enkratic* (acting reasonably) norms as expected to be demonstrated in service design activities (Inácio & Gerardo, 2006:1-2; Coates, 2011:321-322; Reisner, 2013:436-438).

5.29.2 Ethical Considerations – Mode II

Ethical considerations in line with social science and design research were followed throughout the data collection process. The ethical principles of Faculty of Informatics and Design (FID), Cape Peninsula University of Technology (CPUT) were maintained throughout **Phase I** and **II** of the study. I endeavoured to uphold conventional and expected code of ethics and principles. I also incorporated amongst others, the guidelines of beneficence, respect for human dignity and justice (Appendices 1-5: [click to view samples – [1]**ethical clearance;** [2]**permission letter;** [3] **ethical concern ;** [4]**ethics - students;** [5]**ethics - researcher**]).

Secondly, there was a *promise of* **confidentiality** from my part as the design researcher to actors involved that no sensitive information would be revealed to third parties unless prior permission was obtained. Thirdly, participants had the **right to withdraw** from the study at any point. In the course of the research activities, participants were constantly updated about the goals of the project and its progress so far.

Also, I constantly checked with participants to clarify any misconceptions to make sure that nothing was taken for granted in the process of the research. The constant **communication** and feedback loops helped in **maintaining good faith** between researchers and participants throughout the study to alleviate any misunderstanding (Gray, 2010:330).

Additionally, permission letters were obtained from all relevant organisations involved, at the forefront of the study. All participants completed consent forms prior to any research engagement and they were not forced to participate in this study (Appendices 3 & 4 [click to view samples – [3]**ethical concern ;** [4] **ethics-students**]).

The intended purpose of this study was made known to all participants and their contributions to it were explained. Any participant who decided to pull out from the study and cancel any information they delivered were allowed to do so (Gray & Malins, 2004:69-71; Appiah, 2014:123-124).

All names of participants were omitted from the results so that their reputation and organisations image would not be ruined (Gray, 2010:454). However, due to the nature of the research methods, the names of geographical locations and the NGOs involved could not be avoided in reporting the research outcomes. In situations where the names of participants could not be mentioned, the roles of participants in their various organisations were indicated for explanatory purposes.

Additionally, care was taken not to expose participants to risk during research activities. It was relevant to make the participants comfortable during design activities and all data collection processes. Measures were put in place so that participants were very comfortable during research activities in the various design milieus (Debrah *et al.*, 2017:2128). In the field of healthcare, the work practices of health intermediaries are very sensitive because it involves saving human lives. As such, it was unethical to take too much of their time from their official duties to participate in research activities. In reasoning ethically, this situation motivated the use of user surveys as a way of collecting data without interrupting in the daily working activities of the health intermediaries.

Participants were not patronised into the research by giving them incentives. Instead, the importance of the study was emphasised to them, which encouraged voluntary participation. Through this process, participants engaged in the study with more enthusiasm, which contributed to the success of this study (Debrah, De la Harpe & M'Rithaa, 2015:69-71). Efforts were made to communicate the results obtained from the study correctly, without any bias. The data obtained from this study were not used in any adverse manner as communicated to participants, prior to their involvement in the study. So far, some of the research outputs have been shared at conferences, seminars and as journal publications. All participating members and institutions involved in the study have been acknowledged accordingly. Other visual-based materials such as photos, films and digital catalogue, which was part of the research output, were presented to participants at a later stage. These outcomes were shared to alleviate any misconceptions that might have occurred during data collection processes. This activity was organised to establish trust between research participants, Elgin Learning Foundation (ELF), myself (design researcher), colleague researchers (ISD4D) team, and CPUT.

Additionally, a health information system has been proposed as an outcome of the larger ISD4D project which is envisioned to be implemented in the future to facilitate communication among caregivers in Grabouw (De la Harpe *et al.*, 2014:139). The proposed system was a way of making the participants appreciate their own work, contributions and participation part of the research outcomes. The development of the healthcare system was an attempt to give back to the community as they have contributed to the study. This was a measure not to leave participants to "*clear up the mess*" after research but rather provide avenues to sustain the research activities in their context (Gray, 2010:328-329; Futerman, 2015:18-19). In a word, the design ethos described in this section was the guiding principles during the investigation making it value–laden.

5.30 SUMMARY

This study was conducted with the goal of improving health information services in an underserved context. In designing services, it is important to understand context using an **"outside in"** approach so that design solutions will respond to the needs of the service users (Gustafsson *et al.*, 2016:10). This study was conducted within a transdisciplinary research domain using interpretive philosophies as guiding principles to gain insights about the world of the service (Klein & Myers, 1999:67-68; McGregor, 2004:2-3). Knowledge in this case was collectively generated with participating actors involved. Participants consisted of service users, providers, and service researchers from diverse backgrounds. Participating members worked collaboratively with stakeholders in an underserved context as the common ground (Debrah, Bhebe *et al.*, 2014:98-100). As a result, multiple technology-based prepositions emerged that could be used to solve societal problems in healthcare in the research context (De la Harpe, Kabaso & Debrah, 2014:145; De la Harpe, 2016:25-28).

The investigation was conducted through a service design ethos mainly in Cape Town, South Africa *(Service Context A)* and partly in Ghana *(Service Context B)*. The main research case was in **Service Context A** where lots of research activities were undertaken through a designerly way of knowing. Additional research activities were further conducted in **Service Context B,** Kumasi, Ghana and that was mainly for validation purposes (Debrah *et al.,* 2017, 2128-2130).

The **Double Diamond Design** process was used as a framework to collect data in the various service contexts. The study was conducted largely in the **first Phase** of the Double Diamond Design process **(discover and define phases)** to gain insights into the various service contexts. Data were collected using a multi-method approach (Debrah, De la Harpe & M'Rithaa, 2015:73). Gathering data via this approach aligns with methodological triangulation to gain a deeper and wider perspective of the research case. In the **first phase,** service design tools such as user shadowing, storyboards, context mapping, personas, and co-design activities were used to collect data. In the **second phase**, service user surveys (opinionnaires) were used as a means of collecting data from health intermediaries and women. The data obtained through these multiple data sources was meant to establish the context of health information services within the main research context in Cape Town (Service Context A). The data obtained was grouped as **categorical** and **quantifiable** data for the purposes of the analyses.

Sensemaking theory was used as an analytical lens to gain a wider view of the phenomenon being researched. In addition, using the sensemaking approach for the data analysis provided deeper insights about the study context for **change making** in future within the world of the service (Pastor, 2012:1-5; Humantific, 2015:1-2). In the analysis, efforts were made to improve the overall quality of the research, in order to make the outcomes obtained valid and reliable from an interpretive perspective. Conducting this research through designerly ways of knowing made it possible to achieve design empathy with the participants to inform the service design better. It is evident that using service design as a methodological approach was appropriate and provided both **convergent** and **divergent** views on the research context. The findings from these design activities informed the design and development of a prototype health information system at a later stage of this study.

Furthermore, in this service design research, there were emerging questions at the early stages of this study. In this section, answers to some of the emerging empirical questions in this study were obtained. These are presented as follows:

- *How should service design research be conducted as a sensemaking activity with research participants in an underserved context?*
- *How do suitable philosophical perspectives shape this study as a service design research activity?*
- *What service design tools and processes would be suitable for data collection in the research context?*
- *How should service design and Afrikan ethos be explored to guide data collection in an underserved context?*
- *How should service design and sensemaking theories be explored as analytical lenses in the research context?*
- *How do research participants make sense out of design tools and processes in a given service design activity?*
- *What principles of sensemaking theories and service design can be explored to analyse the use of design tools and processes in service design activities?*

In summary, it is envisioned that the service design methodological approach outlined in this chapter could serve as a foundation for other service researchers when investigating in underserved contexts. Preferably, service researchers are encouraged to allow the **"spaces"** in which they research to **"speak"** to them, while they collaboratively make **sense** with service users of the process to add new value to the desired service concepts. Future service researchers are encouraged to be open to endless possibilities in their service design activities when working in similar Afrikan contexts.

Data obtained in

Phase I

Service Design Activities

CHAPTER SIX

PRESENTATION OF RESULTS, DISCUSSION AND FINDINGS

PHASE I – SERVICE DESIGN PROCESSES AND TOOLS

"Once the problem was stated, its solution came to me in a flash" – Anton Fokker

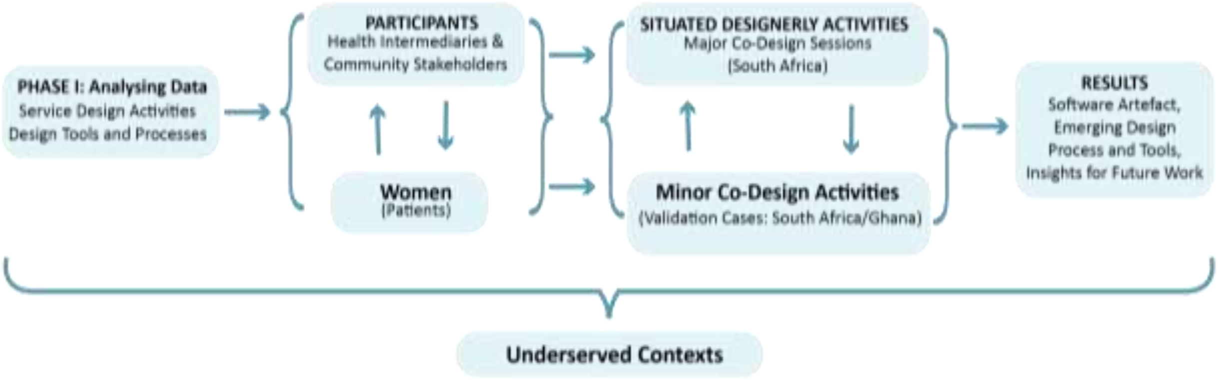


Figure 6.1: Major concepts discussed in Chapter Six
(Conceptualising service design procedures for analysis in Phase I)

6.1 INTRODUCTION

In this chapter, the data obtained through service design activities is presented (Figure 6.1). Information described in this section is largely obtained from service design activities conducted in the Western Cape Province of South Africa—Service Context A. However, further service design activities were conducted in Ghana—Service Context B, as part of the validation cases. These service design activities were conducted to gain insights into the various research contexts and to explore the design of information services that may be relevant for potential service users. Assessing context to gain understanding has become critical for researchers and more especially, when designing solutions as an intervention for underserved communities, as described in this study.

Today, there is a growing interest by researchers to understand the context of participants involved in a particular research case. Designers and developers benefit a great deal when they are immersed in the local contexts of their actors. These actors are anticipated to be the future beneficiaries of the designed solutions. In the process of immersing themselves into local communities, researchers gained multiple perspectives and understanding of the persons in their cultural settings (De la Harpe, 2014:30). As such, gaining insights about the context was critical in order to identify service solutions that could facilitate health education and information services in the selected contexts. Some of the key questions addressed in this chapter through the service design activities are the following:

1. **What are the characteristics of technology–enabled health education and information services that could facilitate the ability of health intermediaries and pregnant women to make sense of health information relevant to their needs in underserved contexts?**
   - ***a)*** *What are the alternative ways of assisting health intermediaries in disseminating information to support pregnant women in making informed decisions during prenatal, antenatal, neonatal and postnatal periods?*
   - ***b)*** *How does the circumstance of health intermediaries and patients in underserved contexts affect the dissemination of relevant health information services?*
2. **How could technology-enabled health (education) information services be designed using visual media to facilitate interaction between intermediaries and pregnant women in underserved contexts?**
   - ***a)*** *How can health information communication services be designed to meet the education and information needs of patients (women) with low literacy levels?*
   - ***b)*** *What are the available service design research processes and tools that could be explored to design health information services in underserved contexts?*

In these service design activities, the Double Diamond design process was explored with a focus on the first two phases in the design process. The data presented in this section was obtained at the **discover** and **deliver** phases of this design process. Insights obtained through the service design tools and processes are presented as a collective activity in the various design milieus. These design milieus were categorised according to the major co-design activities that were undertaken in a particular setting in various research contexts.

The service design activities were predominantly conducted in the Grabouw community, whereas subsequent activities were organised in Cape Town at the Kujali Living Lab, CPUT. Insights derived from the first two phases of the Double Diamond design process (**discover and define**) informed the **develop** and **deliver** stages. The activities conducted in the second Double Diamond process, resulted in a technology-enabled health information solution. The proposed healthcare system is envisioned to be implemented in the future to improve health information service delivery in the Grabouw community. In addition to this outcome, a proposed design process model titled **"ISD4D life cycle"** has emerged which is based on the design activities conducted in this study as part of the larger research project (De la Harpe, 2016:26). It is anticipated that the proposed design process model could be explored by future researchers when planning and designing similar projects in underserved communities in Afrika. The chapter concludes with a summary of insights derived, lessons learned, participants' reflections and suggestions for further research in underserved communities in sub-Saharan Afrika.

6.2 ANALYSING DATA: SERVICE DESIGN ACTIVITIES

Affinity diagramming strategies: an affinity diagram is a tool/ technique, which is used to organise large amount of information for further interpretation. The affinity diagram was developed in the 1960s by Kawakita Jiro and it often referred to as the KJ diagrams (Ulrich, 2003:1-2; Judge, 2008:1-2; Lucero, 2015:231-232; Taylor, *et al.*, 2017:3). Affinity diagrams may range from several data collection tools, process and data sets such as brainstorming sessions, transcripts from interviews, notes from observations/ ethnographic activities and recorded texts from focus groups discussions obtained during fieldwork (NHS Improvement, 2011:2; Conzemius & O'Neill, 2014:113-116). The data obtained using affinity diagrams from these multiple data sets are often divergent views which is then grouped according to its natural connections to identify the most recurring themes (Burge, 2011:2; Lucero, 2015:231-232).

The data sets obtained through service design activities in this research case was analysed thematically using affinity-diagramming strategies. The affinity diagraming processes was conducted during design engagements with participants and after every major design session. A detailed reflection was made from the service design activities, which then informed the next design engagement. The affinity diagrams was used to further organise data obtained in the ***discover*** and ***deliver*** phases of the Double Diamond Design process (Davies & Wilson, 2013:6). Several divergent information obtained from the service design activities was categorised into convergent thematic clusters for further interpretation (Spiridonidou *et al.*, 2010:3). Some of the ideas obtained were clarified and combined with other related themes. The most recurring themes were then prioritised for discussion. Sensemaking served as an adjustable lens to make sense of the large amount of information obtained through the service design activities. Information obtained from the affinity diagramming process was then recorded for *easy sharing, discussion* and *sensemaking* to inform future design and development processes (see Appendix 19 for designerly method cards and some highlights from service design activities).

Phases in affinity diagramming: the affinity diagramming processes adapted for this case was based on the Kawakita Jiro (KJ) as explained by Ulrich (2003:2-10) and related work from other researchers such as Burge (2011:1-12) and Lucero (2015:231-248). The classical affinity diagram processes were adapted to the context of this study to sort out data obtained through designerly strategies. In design activities or systems, designers have their own ways of making sense out of information. These processes both occur simultaneously, as an internal and external ways of reflective sensemaking to inform desired solutions. Designerly ways of knowing were explored to make sense of the data obtained in this enquiry. Also, one of the ways designers make sense of complex information include: using design vernacular which is *visualisation* as a means of representing and making meaning of complex information (Cross, 1982:222-223; Nickpour, 2012:15-20; Nickpour *et al.*, 2014:1-2; Snyder, 2017:2097-2098). In this case, visualisation is explored as a strategy to externalise information or ideas, which were internalised from the perspective of both researchers and participants (Kolko, 2010:1-5). These designerly strategies were incorporated as part of the affinity diagraming process to externalise and formalise information obtained in the study. The various procedures that were used to sort out and categorise ideas obtained in this study is described in the subsequent lines that follow (see Figure 6.2).

Figure 6.2: Phases in affinity diagraming processes

- **Phase I – Ideation/brainstorming sessions:** this stage involves the gathering of ideas for analysis to respond to the main probing questions (Figure 6.3). Co-design sessions were organised in the various design milieus. Ideas were generated using post-it stickers and other visual-based materials. Additional data obtained from the service design activities such as observations and interviews were documented for further interpretation. At this stage, most of the information obtained was divergent views from the design activities and they were captured for further analysis

Figure 6.3: Phase I, ideation/ brainstorming sessions

- **Phase II – Mounting of ideas:** information/ ideas obtained in the co-design sessions were mounted on a wall in the various design milieus in a randomised manner for further sorting and interpretation (Figure 6.4) At certain instances these information were mounted on a desk so that researchers could engage with the ideas being generated for further re-grouping and clustering of themes for information sensemaking

Figure 6.4: Phase II, mounting of ideas

- **Phase III – Sorting and categorising ideas:** concepts on display were then sorted again at this stage through an iterative process. During this phase, the thematic clustering processes started to attain more convergent views of ideas obtained (see Figure 6.5). These processes begun with members grouping and re-categorising ideas into related groups. Some of the ideas that did not belong to any particular cluster were separated to from additional categories for interpretation. In instances where a participant/ researcher opposes a particular selection, they moved ideas around with little or no discussion until the process was completed. These processes gave everyone an equal chance to contribute to the thematic clustering of ideas obtained to gain a better understanding of information obtained

Figure 6.5: Phase III, sorting and categorising ideas

- **Phase IV – Creating themes/ captions for the diagram:** captions were created to guide the re-grouping of ideas. These were mainly done through a collective agreement from both participants and researchers (Figure 6.6). The major recurring themes were identified and used as the captions. In some instances, new ones were written to guide the data categorisation processes. These main captions and sub-captions were then used to organise the rest of the data obtained and the relationships from them were identified for further sensemaking and interpretation

Figure 6.6: Phase IV, creating themes/captions for the evolving diagram

- **Phase V – Finalising the affinity diagram:** at this phase of the process, data obtained was then crystallised into a more structured format. During these processes, the data sets have been further converged and information obtained was more concrete for interpretation. The organised data with the various captions were further clustered, reflecting on the research problems and objectives being addressed through the study. A more structured affinity diagram was created with the main captions and sub-captions serving as a guide to identify the various themes (Figure 6.7)
    - **Recording and sharing data:** all data obtained at this stage was recorded using digital tools such as Microsoft Office and Excel to make it easier to store and share information with co-researchers in the Larger ISD4D Team. The recorded digital information was color-coded for easy identification of the various thematic clusters. Similarly other additional information was recorded in plain text for clarification and to distinguish it from the rest of the data obtained. The core thematic clusters were highlighted and their relationships were identified for interpretation and sensemaking. The outcomes then served as the foundation to inform the next stages of the ***Develop*** *and* ***Deliver*** stages of the Double Diamond process (Figures 6.8 – 6.9)

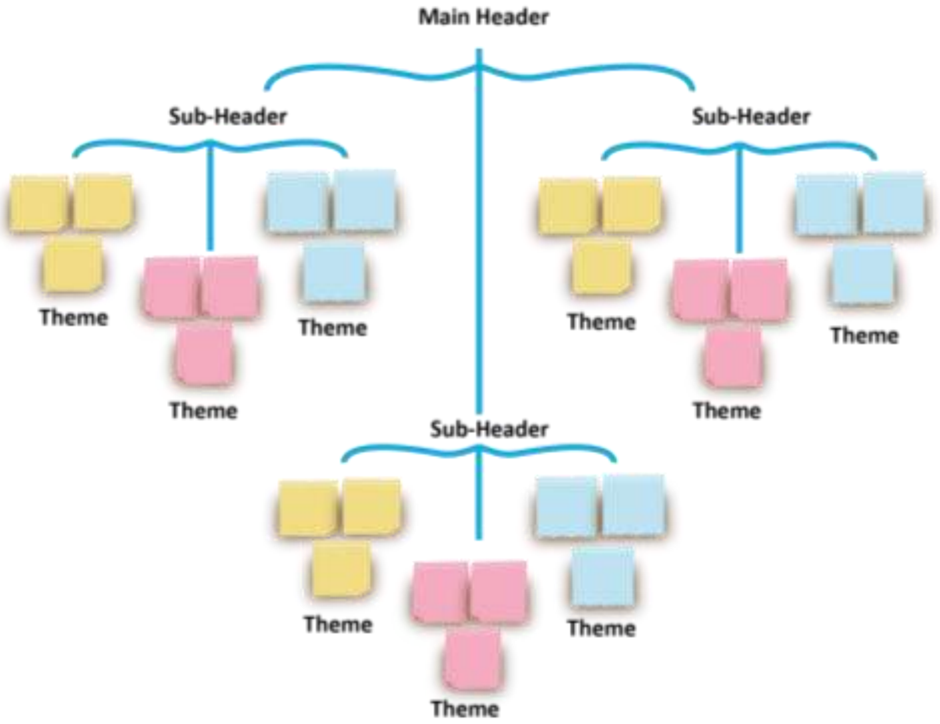


Figure 6.7: Phase V, finalising the affinity diagram

Figure 6.8: Phase V, Recording and sharing data

- **Review process and iterate:** the affinity diagramming processes were repeated iteratively with the larger project team after obtaining field data and at instances where re-grouping/ categorization was required. The information was reviewed to remove duplicated data and re-categorise according to the probing questions, which was being addressed. The iteration was done when necessary to review information obtained and modify solutions and inform design and development processes (Figure 6.9)

Figure 6.9: Phase V, Record, review process and iterate

Furthermore, in this section of the thesis, the processes and insights derived from the probing have been described as per the designerly activities in the various service contexts. A detailed reflection on the service design activities and summaries of outcomes obtained from the affinity diagrams have been indicated as the expanded data sets (see Appendix 15). Some of the findings obtained from these service design activities have been published in design-related conferences and journals (see Appendix 18). As such, a detailed description of the service design activities in the various research contexts has been described in this section. I now move on to describe the various service design activities, insights derived and it's application to the design and development processes.

6.2.1 The Grabouw Case: An Underserved Context

The main context of the study where most of the service design activities were undertaken is located in the Grabouw community. Grabouw is an underserved community, situated in the Overberg region in the Western Cape province of South Africa. The Grabouw community is about 70km from Cape Town, when driving along the Garden route. Grabouw is located in the Elgin Valley and managed by the Theewaterskloof municipality. It is the largest fruit-producing sector in the agri-business, hosting about 76 farms. Farming has become the major occupation of the people living in this area (Van Zyl & Pennanen, 2013:1-4; Debrah, Bhebe *et al.*, 2014:96; Ambole, 2016:67).

Grabouw is a mountainous area and the community consists of largely informal settlements (Figures 6.10–6.12). People living in this community often perceive the mountain as a barrier to the social amenities and healthcare services in the major city centres in the Western Cape Province (Van Zyl & Pennanen, 2013:6). The geographical situation in Grabouw limits indigenes psychologically in their ability to access healthcare, education and other basic amenities in Cape Town. Cape Town is the main city centre that could potentially improve their socio-economic status and well-being in the community.

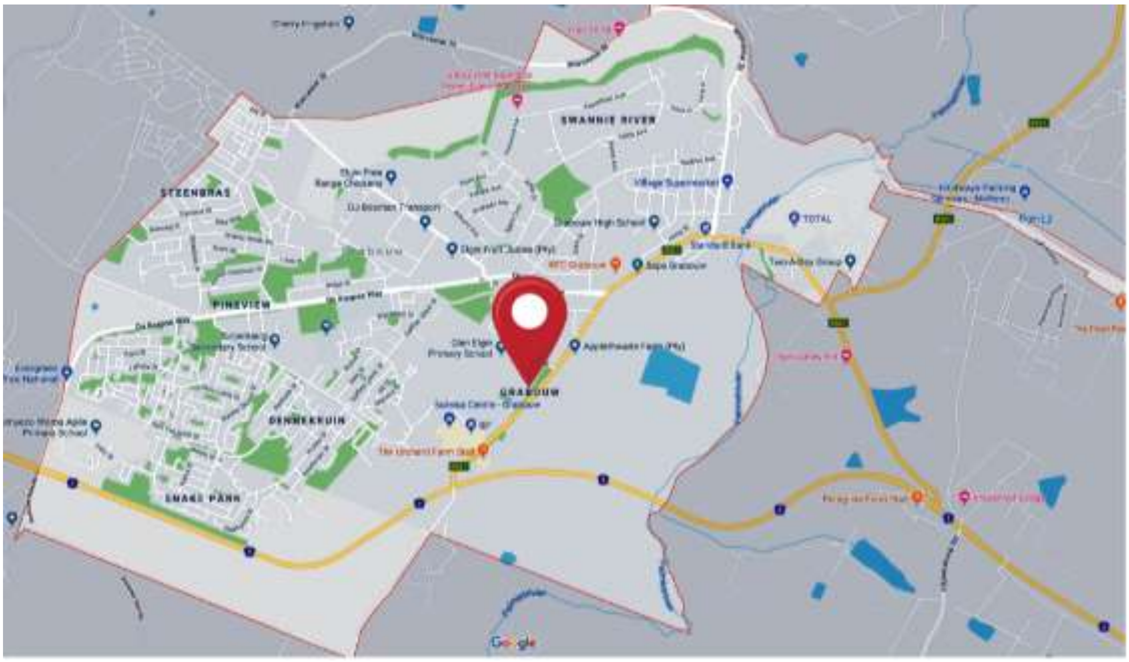


Figure 6.10: Google Map of Grabouw, Western Cape
(Source: Google Maps, 2019)

Figure 6.11: Grabouw Townships in Western Cape, South Africa
(Source: Author)

Further, the Grabouw community is faced with a myriad of social challenges due to political reasons and socio-economic factors that are prevalent in most underserved communities in South Africa. Some of the pressing social challenges in the community include crime, drug abuse, abortion, high rates of youth unemployment and health-related issues such as HIV/Aids (Mendonca & Van Zyl, 2014:103).

Members in the Grabouw community are mostly middle and low-income earners, whereas a larger population are unemployed.

Figure 6.12: Grabouw townships in Western Cape, South Africa (Source: Author)

In addition to this, there is often a slow response of government intervention in the community, leading to instability and sometimes, social unrest (Van Zyl & Pennanen, 2013:6). For instance, during the data collection process for the study, some of this social unrest was actually experienced which slowed down the research process as it was simply impossible to access the community. These social instabilities sometimes negatively impact upon interventions that could be implemented in the Grabouw community for social and community development.

Notwithstanding, there are several initiatives being explored to improve the standard of living of persons in the Grabouw community and one such initiative is in the area of healthcare. The introduction of home-based care (caregiving) services can improve the health and well-being of people living in South African communities (Debrah, Bhebe *et al.*, 2014:96). Caregiving services are one of the initiatives in healthcare, which is supported and recognised by the South African government. Caregivers are key stakeholders in the delivery of healthcare services and they provide extra care services to complement what is offered at the general hospitals and clinics in South Africa. Caregivers provide care services to chronic patients at home and promote health education to people living in hard-to-reach areas in the Grabouw community and other municipalities in South Africa.

6.2.2 Social Innovation and Sustainability: Care Services in Grabouw

Social innovation can be described as goods or services which are *good* for society and can potentially *enhance* the capacity for society to act collectively towards achieving positive societal results (Kiem, 2011:210; Manzini & Staszowski, 2013:i-ii; The Young Foundation, 2014;10; Manzini, 2015:11-12; Mazzarella *et al.,* 2017:2935-29-36). For example, the provision of caregiving services within the South African contexts can be perceived as a social innovation initiative, which promotes sustainable healthcare services for the wellbeing of patients in underserved communities. In the provision of healthcare services, technology remains one of the major drivers of social innovation globally (Boelman *et al.,* 2015:2-3). As such, the introduction of new mobile technologies into healthcare has the potential to improve care services through bottom-up approaches in underserved communities (Manzini, 2007:27; Avelino *et al.*, 2015:2-3). In this research case, some of these mobile technologies are being explored through designerly ways of knowing for the good of society. From an expert designer-researcher perspective, it is envisioned that new service propositions which will emerge from this study, would lead to social change and promote sustainable healthcare services in Grabouw (Manzini, 2015:62).

Healthcare services in Grabouw are mainly accessed through one major Government clinic known as the *Day Hospital* (Van Zyl & Pennanen, 2013:6). Healthcare services provided at the Day Hospital are further supported by the extra services provided by the caregivers to patients in hard-to-reach areas. Also, caregivers attend to patients on a daily basis; providing care and offering information to them within the Grabouw community. In the work practices of caregivers there are challenges that confront them daily. One of the areas that is under-researched is the area of communication (**information sharing and exchange**) between caregivers (health intermediaries) and their patients (Debrah, Bhebe *et al.*, 2014:105). In addition to this, information accessibility is even more difficult, due to the low literacy levels of patients (mothers) living in hard-to-reach areas in the Grabouw community. The state of low literate populations compounds the challenges associated with persons accessing relevant health information that could promote a happy and healthier society (De la Harpe *et al.,* 2014:139).

Therefore, in this study, it was critical to explore alternative ways of providing health information services to facilitate interaction between caregivers and their patients in the Grabouw community. Some of the challenges identified in the Grabouw community led to exploring socially innovative ways of improving care services in underserved contexts. These healthcare services that require innovative solutions include: *health education* and health information services (Figure 6.13). Also, the study was designed with the goal of exploring sustainable healthcare service solutions that could be implemented in the selected underserved community in South Africa. Service design research methods were explored with participating health intermediaries, women and other stakeholders in Grabouw, to gain insights about the research context that could inform future service propositions (Debrah, De la Harpe & M'Rithaa, 2015:72-74). The data obtained through all the design activities have been detailed in the subsequent headings that follow.

Figure 6.13: Social innovation model
(Source: Authors' own construct)

6.2.3 Demographics of Participants – Caregivers

In this service context, health intermediaries who participated in the service design activities in Grabouw were mainly caregivers. The participating caregivers were predominantly females with only one male (Figure 6.14). The common languages spoken in the community are Afrikaans and isiXhosa. The caregivers are predominantly coloured people who are indigenes of the Grabouw community. Some of them are married with children and others were not married but are parents. Their ages range between 20 years to over 50 years. Their educational levels range between Grade 7 to Matric level. Most of them have been practising as caregivers for a number of years, ranging from 11 months to over 11 years of experience as caregivers. Participating caregivers are trained at the Elgin Learning Foundation (ELF) – the main community college responsible for training caregivers in the Grabouw area.

Figure 6.14: Caregivers in Grabouw community

6.3 TRAINING CAREGIVERS IN GRABOUW

Home-based care services, as offered in Grabouw, are a part of government initiatives in the Western Cape of South Africa. The government provides training for caregivers through Non-Profit Organisations (NGOs) and training institutions resident within local communities. However, the Elgin Learning Foundation was identified as the main organisation in the Elgin Valley where this research was conducted. The Elgin Learning Foundation is the principal community college that is located in Grabouw. The Elgin Community College offers accredited training programmes and short courses for community development. Their programmes are designed for sustainability and to add value to members within the Grabouw community. Home-based care is one of the flagship programmes of the Elgin Learning Foundation. Caregivers are trained to provide home-based care services in the Grabouw community (Elgin Learning Foundation [ELF], 2013:para-1-6).

The caregivers are trained to care for the sick and elderly at their homes. This system provides these caregivers with employable skills for community empowerment and emancipation (Van Zyl & Pennanen 2013:5-6; Debrah, Bhebe *et al.*, 2014:96-97). The training services offered by the Elgin Learning Foundation are a sustainable, value-driven educational strategy for development. The training programmes at the Elgin Learning Foundation are an integrated approach for rural development and aimed to solve complex societal problems that are pertinent in Grabouw.

Caregivers who attend training sessions at the Elgin Learning Foundation come from different areas within the Grabouw municipality. Some of the common areas where the caregivers live and work include Elim, Santa, Swellendam, Caledon and which are located in South Africa. Occasionally, caregivers attend training sessions at the Elgin Learning Foundation as part of their continuous professional development to upgrade their skills and to extend their services to members in the community. Practically, the caregivers are at the forefront in promoting healthcare services at grass root level in the Grabouw community.

6.4 GRABOUW COMMUNITY ENGAGEMENTS

6.4.1 Creating “First Connections” with Participants

The preparatory phases of this research involved making “**first connections”** with stakeholders in the Grabouw community. The preliminary arrangements in the community involved making contacts with the right persons that could facilitate research activities in this community. Contacts were then made with the Elgin Learning Foundation. There was frequent communication through emails and phone calls to key stakeholders in Elgin (Figure 6.15) to establish a research agenda and to discuss plans for upcoming service design activities. At this stage of the investigation, all prior information required to facilitate further data collection in the Grabouw community were obtained at Elgin. Next, was to meet with Elgin staff in person and to brief them on the research activities, as a follow-up to all previous communications. At this stage, all arrangements and necessary permissions were obtained from the main Elgin stakeholders that would be involved in the research activities. Afterwards, follow-ups continued through emails, phone calls, and personal contacts to modify any other arrangements that required modification. After this, all arrangements for data collection were finalised and the Elgin staff served as liaisons between researchers and participants in the Grabouw community.

Figure 6.15: Elgin Learning Foundation (ELF) in Grabouw

6.4.2 Preparations for Service Design Activities

Preparations for the service design activities included budgeting, planning for logistics and other relevant materials required for the design engagement in Grabouw. Careful planning was necessary to achieve the desired results within a reasonable timeframe of the research plan. Staff members from Elgin provided all the onsite logistics for the service design activities in the Grabouw community. After this, the researchers' intentions and plans were communicated to participating caregivers and Elgin staff as a way of establishing trust and to prepare them psychologically for the service design activities ahead (Figures 6.16–6.17). All participants signed an informed consent prior to any research activity to ensure that they participated at their own free will (Appendices 3–5: [click to view samples – [3] **ethical concern**; [4] **ethics - students;** [5] **ethics - researcher**]).

Figure 6.16: Interacting with caregivers in Grabouw community (Top)
Figure 6.17: First connections with Caregivers at the Imizamo church in Grabouw (Bottom)

6.5 MAJOR SERVICE DESIGN ACTIVITIES: SERVICE CONTEXT A

Service design strategy was used for data collection in this research context. Data described in this section is obtained from service design processes and tools such as user shadowing (observations), informal conversational interviews, and co-design activities. The Double Diamond design process served as a guide for the design process, with a focus on Diamond 1 – **discover** and **define** phases. The study was highly exploratory that served as a designerly way of engaging with participants and to obtain information from their perspective. The data are summarised and described as a collective activity based on the tools and activities conducted in the various design milieus. These design activities are described in the subsequent headings that follow.

6.6 DESIGN MILIEU I: BASELINE STUDIES IN GRABOUW

Preliminary studies were conducted in Grabouw as part of the larger research project (ISD4D). The service design activities conducted in the community provided insight into possible challenges that confront health intermediaries in their daily professional activities. Information obtained from the baseline studies provided an insight into the healthcare service landscape in the Grabouw community (Figures 6.18 - 6.19). In addition, some of the participating health intermediaries who provide services to mothers in the Grabouw community, such as caregivers, nurses and midwives, were identified. Caregivers were purposively selected as the main participants since they attend to patients in remote areas within the Grabouw community. Caregivers were invited to participate in the study through the Elgin Learning Foundation. There was a need to study the caregivers further and to observe their work practices in the Grabouw community. As a follow-up activity, several design activities were conducted to gain a much deeper insight about caregivers and the home-based care services.

Figure 6.18: Informal settlements in the Grabouw Community (The informal settlements [at the "Locations"] are non-government approved housing solutions. These are privately owned sharks by community members in Grabouw, Cape Town)

Figure 6.19: Formal settlements in the Grabouw community (The formal settlements [at the "Locations"] are government-approved houses as an alternative to affordable housing for community members in Grabouw, Cape Town)

6.7 DESIGN MILIEU II – SITUATED DESIGNERLY ACTIVITIES

6.7.1 User Shadowing in Grabouw

User shadowing is a service design method that is employed to understand how people interact with the world around them. These approaches have similarities with ethnography methods of collecting data, where the researcher immerses himself/herself into the community and documents the phenomena being observed either by note taking or by using cultural probes. User shadowing became a useful technique to obtain first-hand information from participants in their natural settings and to gain deeper insights about their contexts. In these design milieus, the user shadowing process was conducted by observing caregiver activities in two different settings. The first setting was in the Grabouw community where some of the caregivers live and work. The second location was at the Elgin Learning Foundation. At Elgin, the observation of the caregivers was done during their training sessions (Figure, 6.20). The user shadowing process in both settings, involved observations, informal conversations, interviews and note taking; using digital devices such as video cameras and audio recordings. The user shadowing process was carried out in a discrete manner without interfering with the work or activity being undertaken by the caregivers at any time.

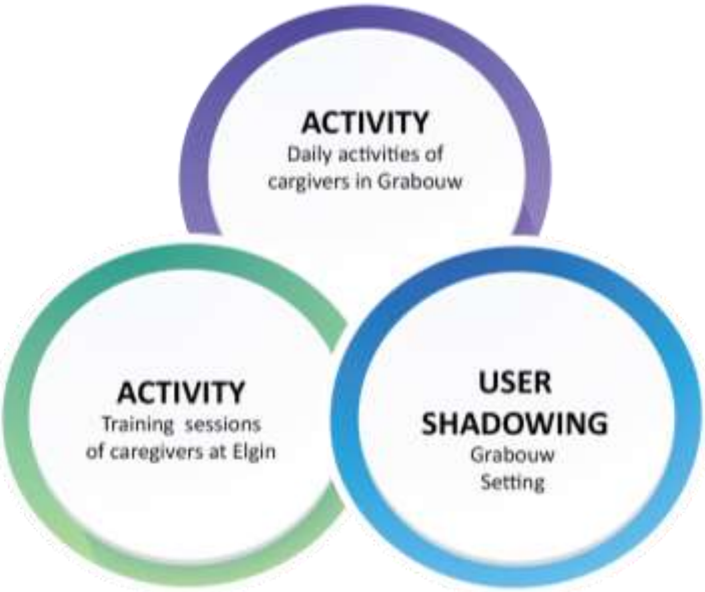


Figure 6.20: User shadowing activities in Grabouw community

6.7.2 Activity I: Caregiver’s Day

The caregiver’s daily activities usually begin by converging at a centre in the Grabouw community. This centre is a prominent church in the community known as the Imizamo church. The Imizamo community church serves as the temporal administrative office for caregivers in the community. Caregivers usually start their day by converging at Imizamo church in the morning before they begin their daily activities. They usually submit their daily or weekly reports on caregiving in the community to their administrator and co-ordinator for feedback. The caregivers then discuss their plans for the day’s activities, that is then moderated by their co-ordinator, who is a professional nurse.

6.7.3 Activity II: The Caregiving Process

In the course of this study, the researcher observed one of the oldest-serving caregivers living in the Grabouw community. She was nominated by the coordinators of the home-based carers to participate in this study because she is a very experienced caregiver. As a research participant, she was very receptive of the experience of observing her as she went about her daily work activities in the community.

The user shadowing process was characterised by informal conversations as the designer-researcher journeyed with the caregiver to visit patients in the community. Using recording devices, such as cameras, our conversations were recorded. The day's activities of the carers were thus captured in an unobtrusive manner.

The daily caregiving activities observed are usually characterised by greetings and friendly conversations between caregivers, patients, and community members. The caregiver usually checks the general condition of the patients to find out if their condition has improved from previous visits. Asking follow-up questions to patients, based on previous care visits, provides caregivers with vital information on the necessary steps to take in the future to improve patient care. Patient data and other health related information are recorded manually on paper by the caregivers. The recorded data are then later given to the home-based care administrator after the day's work. This data are captured electronically onto a computer. This information is then sent to relevant persons at the Elgin Learning Foundation for forwarding to the RSA Department of Health (DoH). The compiled patient data are used to monitor patients' progress and to access caregivers' activities in the Grabouw area.

Figure 6.21: Caregivers in Grabouw
(Source: Author)

Furthermore, during the user shadowing activities, the carer shared that there were days when she only did washing and cleaning of patients. Whereas, on other days, she provided dressings for wound care and gave patients their medications.

Sometimes she bought food supplies for them to make sure that all the basic materials required by the patient were available to them at home. Additionally, it was observed that caregivers usually use basic materials for the caregiving processes in their communities. They usually carry backpacks, which contain the needed basic tools and materials as well as patient medication for use during the caregiving processes (Figure 6.21). In one of the scenarios observed, the caregiver indicated that she sometimes brings in friends (other people) from the community to visit patients at home whenever it is convenient so that patients do not feel lonely. The joy of patients receiving visitors other than caregivers was confirmed during one of our visits to a patient who was very glad to have people from outside the Grabouw community visiting. It was a delight to experience the patients' interaction and joy of the caregivers when offering care services to patients in remote areas in the Grabouw area.

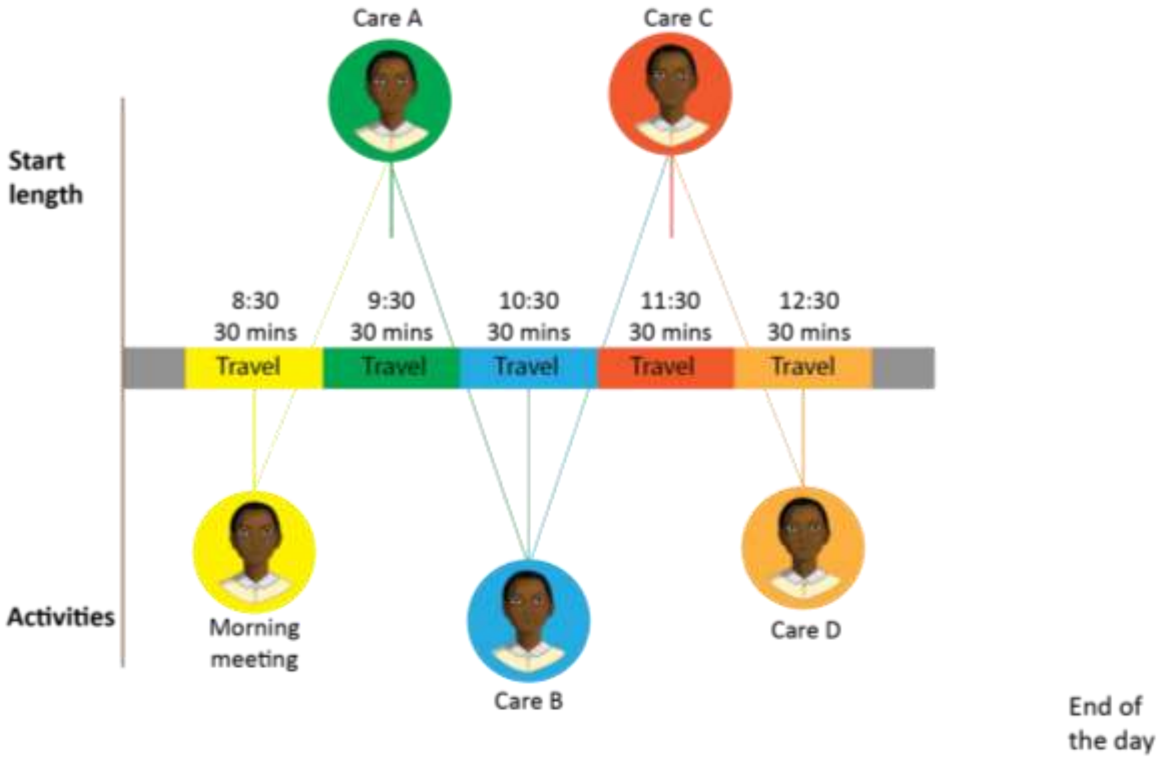


Figure 6.22: Average working timeline of a caregiver in Grabouw
(Source: Authors' own construct)

In summary, it was observed that the caregivers are very passionate about their work and dedicated to the care services they offer to patients in the remote communities. An average working timeline, as observed during the caregiving activities, is presented in Figure 6.22. The diagram (Figure 6.22) illustrates the average traveling times observed in the Grabouw community. However, the caregiving activities usually vary per day and as such, activities observed on a particular day may not be the same as on other days. Therefore, observations made on this particular day may not be generalised across all the activities that caregivers may undertake on different days and at different locations in the Grabouw community.

6.7.4 Activity III: Health Campaigns in Grabouw

The user shadowing activities at this stage were carried out with a focus on health education activities in the Grabouw community. The health campaigns are held on Tuesdays and Thursdays as part of the weekly activities of caregivers in the Grabouw area. As the caregivers journeyed into the community, their activities were observed without interfering with the work activities for the day. The user- shadowing process was characterised by friendly conversations which were recorded while caregivers journeyed on foot to the various areas to interact with patients (Appendix 11: [click to view sample **– [11] storyboard|user shadowing**]).

On the day of the health education activities, caregivers started their journey from the Imizamo church, where they usually meet each morning to start their days' work. The caregivers gradually walk through the community into another meeting point in the main Grabouw township. This is a second office in the community for the caregivers. The caregivers re-group at this office and discuss their day's work. Caregivers meet with other directors in this area for further discussion and instructions for the health education activities for the day. The caregivers discuss the various locations in the community where each team member is expected to interact with identified patients during health education activities. Caregivers then select their partners and plan their strategies for the health campaign. After organising themselves, they are then deployed by coordinators to various locations in the community to start the health education activities (Figure 6.23).

Figure 6.23: Caregivers conducting health education and promotion (Observing carers providing health education services in the Grabouw community (Source: Author)

Figure 6.24: Health education and promotion materials (Health information objects obtained from caregivers in the Grabouw community) (Source: Author)

Amidst prayers and singing, they prepare themselves psychologically for the day's activities. After this preparatory process, they carry all their regular supplies for health education and promotion. These materials include items such as boxes of medications, bottles and empty containers, health information materials (information objects) and condoms, which they carry in transparent plastic bags for health promotional purposes (Figure 6.23–6.24). They gradually disperse on foot into the community, with each team focusing on particular houses to visit. Their activities are monitored by the co-ordinator who also joins them in the health education campaign, for later evaluation reports. In an excited mood, they move from house to house to educate community members on their health. In addition, they go as far as journeying through mountainous areas within the Grabouw community to reach patients in remote areas. The health education activities are often exhausting but due to their passion for the work, caregivers carry on throughout the day until their targets are reached.

6.7.5 Activity IV: Caregivers at Elgin

The user shadowing process was extended to the Elgin Learning Foundation in Grabouw. At this location, it was easier to interact with trainers and caregivers for data collection, since prior arrangements had already been made with the Elgin staff. Participating caregivers were selected based on recommendations from their trainers and administrators at the Elgin Learning Foundation. In the user shadowing process, it was observed that caregivers are trained on three different levels. **Level One** is usually the first year of the training process. **Level Two** explores more of the advanced stages in the caregiving training process. **Level Three** is the final year for training caregivers, after which they are deployed to practice in their various communities in Grabouw.

Caregivers who were selected to participate were mainly from **Level Two** and **Level Three** since they were most experienced and, as such, were better placed to provide relevant feedback for this study. As the designer-researcher, I lived at the training centre for four to five days at a time, over a period of twelve months, during the data collection process. The goal was to deepen relationships with the caregivers and to familiarise myself with the Grabouw environment to make data collection easier. Living with the caregivers facilitated interaction between the designer-researcher and the participants. After normal working and training hours each day, there was an opportunity to interact with the participants. These informal interactions and conversational interviews deepened relationships and heightened the interest of caregivers to participate in this study. These informal interactions, at the forefront of this study, increased the trust between participants and researchers. This facilitated subsequent co-design activities at Elgin and Grabouw.

6.7.6 Activity V: Training Sessions of Caregivers at Elgin

In the user shadowing process at the Elgin Learning Foundation, the researcher observed the training sessions and other activities of caregivers. The purpose for this was to gain insights about their training sessions, lessons and specifically to observe how they prepare for health education campaigns. Essentially, the user shadowing process was useful to ascertain the information needs and sources of caregivers for health education activities in the Grabouw community. Additionally, my immersion into the process assisted in exploring how visual media could be integrated as part of the training of caregivers to facilitate health education activities in Grabouw.

The designer-researcher joined the caregivers in their training sessions to observe the learning activities being delivered. The trainers facilitated the training sessions and they introduced the designer-researcher to the participants. The caregivers were further briefed about the purpose of the designer-researchers' participation in their training sessions. Details about the dates and duration of design activities were made known to the caregivers and they were willing to participate. As the designer-researcher, I made a self-introduction and explained the purpose of this study and my intentions for participating in their training sessions. The research details were well received by the participants. They indicated their interest to participate willingly, share ideas and contribute to this study.

Figure 6.25: Observing caregivers at training sessions (Top)
Figure 6.26: Caregivers engaging in learning activities (Bottom)

The designer-researcher sat in the training sessions and observed caregivers and trainers. A conscious effort was made not to interfere with the activities of the caregivers during their training sessions. In this learning environment, the designer-researcher occasionally made notes, took photos and video recordings of the caregivers' activities (Figures 6.25–6.26). At the training sessions, there were lunch breaks, which was a great opportunity for further friendly interactions with caregivers. Participants were more relaxed during lunch and tea breaks which made it easier to obtain relevant data for this study.

Caregivers were a bit shy, at the initial stages, to interact and to share ideas. Later, they eventually opened up and engaged with the designer-researcher in friendly conversations over tea and coffee breaks. In a friendly atmosphere, we both interacted and shared our personal life stories such as family, career paths, future plans and goals. In the process of these informal conversations, caregivers communicated aspects of their work activities with the designer-researcher. They shared first-hand information on some of the challenges that confront them in their daily work activities in the Grabouw community and communicated the aspects in which they desired improvement. Some of these included better working conditions, salary improvement, and opportunities for further studies.

6.7.7 Activity VI: Training Caregivers for Health Education Activities

The training sessions of caregivers, as part of their preparations for health education campaigns in the Grabouw community, were closely observed in this setting. The lessons delivered by trainers in these sessions were mainly characterised by practical activities that included planning and preparing materials for health education in the Grabouw community (Figures 6.27–6.28). The lessons were first delivered by the instructors to the caregivers. Caregivers were given the needed information by their trainers to prepare their own health campaigns. At the end of the training sessions, caregivers were expected to make presentations of their plans for health education activities in the various communities.

Figure 6.27: Caregivers engaging in design activities for health education (Top)
Figure 6.28: Caregivers and their trainers in class sessions (Bottom)
(Source: Author)

Next, caregivers worked in teams that consisted of 4–6 people working collaboratively on a specific topic for the health education campaign (6.27–6.28). Some of the health topics they selected included *measles, diabetics, coughing, diarrhoea,* and *impetigo*. Presentations for the health campaigns by the various teams followed after they had completed their planning processes. The presentation sessions were characterised by questions and answers from the trainers and the caregivers. In some situations, the trainer made remarks on how caregivers could improve their health promotion activities. In this setting, the designer-researcher observed that caregivers were passionate about their work and enjoyed their planning exercises for the health education activities. These lively presentations generated much excitement amongst the other caregivers, making their learning more enjoyable.

6.7.8 Activity VII: M-Learning Programme for Caregivers

Another training session that was observed at the Elgin Learning Foundation was the m-Learning programme. Caregivers were being introduced to m-Learning so that they could use technology as part of their learning and professional work practice in remote areas in Grabouw. At the time of this study, the m-Learning concept was in the pilot stages and caregivers were being trained to use and access information through mobile learning platforms. The training programme was a way of ensuring that caregivers acquaint themselves with the m-Learning system before it was implemented (Figure 6.29).

In this setting, it was observed that there were one or two facilitators at a time during the training sessions. Sometimes, depending on the subject, the facilitators were changed according to the lesson being taught. The caregiver's lessons were mainly delivered in a face-to-face situation. The lessons were delivered by the trainers, who used the caregiver trainer's manual as a point of reference. All caregivers have a workbook that contains all the exercises that correspond with a particular lesson being taught. The caregivers worked on their exercises in these books when required, which was then reviewed and assessed by the facilitators at the end of each training session. Both trainers and caregivers expressed their enthusiasm towards the introduction of the m-Learning programme because of the potential to facilitate the training of caregivers. As such, they indicated that all training materials have been digitised into PDF formats to make information accessible to caregivers. The availability of digital information enables caregivers to read their lessons on mobile phones, at their own pace, when they are not at the training centre. As part of the m-Learning programme, caregivers are provided with mobile devices to enable them to access information, interact with patients and to communicate with stakeholders in the Grabouw community (Figure 6.29–6.30).

Figure 6.29: m-Learning programme for caregivers in Grabouw (Left)

Figure 6.30: Example of mobile devices used by Caregivers for training (Right)

Yet, caregivers indicated that the screens of the mobile phones were quite small. Hence, it was challenging to read PDF training materials on their phones because of the small screen size (Figure 6.30). Also, they indicated that the mobile devices were temporally owned by them and would be returned to the service providers after their training sessions on the m-Learning programme which ended in 2014. However, coordinators and trainers at Elgin indicated that solar powered mobile tablets would be provided to the caregivers at the implementation stage of the m-Learning programme. As such, the mobile tablets could provide better view-ability and read-ability of the training materials. Also, it is projected that the mobile tablets would facilitate interaction with patients and stakeholders during care services in the Grabouw area. At present, the programme has come to an end and the funding required to provide the devices is not readily available at the moment. Future work is required to explore alternative ways of expanding training programmes in Elgin and to provide the necessary technologies to facilitate the work of home-based caregivers in Grabouw.

6.8 DESIGN MILIEUS: MAJOR CO-DESIGN ACTIVITIES

Co-design activities were organised in the major design milieus with caregivers and other stakeholders to probe further into their health information and educational needs. These co-design activities were organised as a follow-up from the user shadowing activities with caregivers and other health intermediaries in the community. These co-design activities were organised in different design milieus to obtain additional information from the various service contexts. Design tools such as **user-journey mapping, context mapping, user personas, role-playing, storytelling, storyboards, illustrations, photography, video recordings, and diaries** served as a means to engage with participants during co-design activities. These design tools and processes served as a means to generate visual and textual data from participants. The use of these designerly tools helped in minimising the presence of the designer- researcher in the co-design activities. Additionally, **informal conversational interviews** and **user shadowing** (participant and non-participant observations) were used to obtain additional data, when feasible, before and during co-design activities. Also, other visual elements such as sticky notes, glue, colour pencils and felt pens were provided so that participants could use them for ideation. Equipment such as projectors and screens were used to project information in the various venues for the design activities. The various design milieus in which the co-design activities were conducted, are described subsequently.

6.9 MILIEU I: STAKEHOLDERS IN GRABOUW – BASELINE STUDIES

The design sessions organised in this milieu formed part of the baseline studies to make contacts with the correct persons and to gain insights about the research context. The first co-design session was organised with different stakeholders to solicit their views on home-based care services in the Grabouw community. The second session was held with caregivers, co-coordinators and a few managers at the Elgin Learning Foundation (ELF). There were 22 participants in this milieu and 10 of them served as facilitators from the ISD4D team. There were12 participants from the Elgin Learning Foundation. Participants from Elgin consisted of 10 caregivers, 1 manager and 1 coordinator. The caregivers were divided into two major groups consisting of 5 participants each so that it was easier to manage the activities in the session. Also, in-depth conversational interviews were organised with the selected Elgin staff during the co-design sessions. After several iterations in the co-design activities, insights were derived about the work activities of caregivers in the Grabouw area. Information obtained from these design sessions covered thematic areas such as: the important people and places in the Grabouw community; healthcare services in the community; caregiving processes; healthcare services; categories of care, communities where care services are provided; challenges in the caregiving process and identifying opportunities for development in the community. After these baseline studies, several co-design sessions were conducted to explore sustainable solutions to emerging problems in caregiving services in the Grabouw area.

6.10 MILIEU II: CO-DESIGNING WITH CAREGIVERS

The co-design sessions with the caregivers was undertaken in two different settings. The major ones were organised at the Elgin Learning Foundation and subsequent ones were organised at the home-based care offices in the Grabouw Township. Preliminary co-design sessions were conducted with caregivers in the Grabouw Township as part of the pilot phases of the co-design activities. These initial co-design activities served as a foundation for the designer-researcher to gain insights into organising the next co-design activities.

The major co-design activities began after all the various elements in the design milieus had been organised. The sessions commenced with the introduction of the designer-researcher to the caregivers in the various milieux. There were approximately sixty (60) participants present at the co-design sessions. There were 15-20 participants present at a time, within each co-design session. The participating caregivers sat in groups of four-five per team in every design session (Figure 6.31). The main agenda and purpose of each design activity for each day was discussed with those participants present (see related paper, [Debrah, De la Harpe & M'Rithaa, 2015:72]).

Figure 6.31: Caregivers engaged in designerly activities in various milieus II

The total number of co-design sessions organised with caregivers were ten (10), which were organised at different periods. These co-design sessions were organised with caregivers who were being trained from both Level 2 and 3. Whereas the other co-design sessions were organised with caregivers who were already practising in the field in the Grabouw townships. There were eight (8) major co-design sessions that were organised for both training levels 2 and 3. The following two co-design sessions were always follow-up sessions from the previous activity to allow for questions that were not well covered in previous sessions.

The co-design activities lasted for approximately 2 hours per session with the participants. The co-design sessions where characterised by active brainstorming activities on major topics under discussion with participants in the design milieus. The facilitation was done by the designer-researcher with the assistance of trainers and coordinators at Elgin. The trainers translated some of the information from the English language into Afrikaans to clarify some aspects of the topics and activities to the participants. Meanwhile, the atmosphere in the design milieus was characterised by singing and at some point dancing before and during breaks and after some of the major design activities. As the design processes evolved, the interest of the caregivers in the co-design activities heightened. In the process, interesting results were obtained based on observations and ideas shared by caregivers in the various design milieus. Some of the major activities conducted during the co-design sessions with the caregivers are described in the following headings.

6.10.1 Activity I: Information Needs of Caregivers

Co-design sessions were organised with caregivers to identify their information needs and sources. The caregivers indicated their information needs and sources using the design tools and probes provided (Figure 6.32). They indicated that they predominantly obtain health information from government sources and from their training centre in Elgin. The caregivers made suggestions as to what information they hoped for in their health education activities. These included maternal health-related topics such as signs and symptoms, treatment procedures of various diseases and other preventive measures to be undertaken by women as first aiders. Additional health topics where information objects are required included family planning, antenatal care, breast examination, and breast-feeding. In addition, information was required in treatment procedures for chronic diseases such as cervical cancer and “womb cancer”. Caregivers also provided some ideas as to what the visual images could look like in order to facilitate interaction between them and their patients during health education activities. These major healthcare topics are to be designed further to facilitate health education activities (Figure 6.32).

Figure 6.32: Caregivers engaged in design activities

6.10.2 Activity II: Symbol Design for Patient Education

In this co-design activity, caregivers explored Afrikan symbols as part of health education activities. These Afrikan symbols were selected from countries such as South Africa (Bantu Symbols), Ghana (Adinkra symbols), and Nigeria (Nsibidi symbols). The motivation for exploring these symbols was that from the prehistoric days till present, symbols serve as a means to express ideas in many Afrikan communities (Mafundikwa, 2004; Debrah, M'Rithaa & Mafundikwa, 2015). The use of these indigenous Afrikan symbols served as inspiration and as an alternative system to express health-related ideas within an Afrikan context. In the co-design activities, the caregivers experimented with a number of Afrikan symbols for communication. Participants explored the re-designing of some of these symbols as part of their toolkits for future health education activities in the Grabouw community. Caregivers contextualised and simplified some of the selected symbols in a way that would be meaningful to their information receivers (Figures 6.33–6.34). Caregivers explored these symbols as information objects (icons/emoji symbols) that could be used for interaction. They also investigated an interface design for mobile applications. Additionally, they suggested that these symbols could be further explored as part of a toolkit in the form of knowledge cards for health education activities. These symbols could be used to express specific ideas to women with low literacy levels in the Grabouw area. The carers expressed that the symbols could enable them and their patients recall information during their training and health education activities (Debrah, M'Rithaa & Mafundikwa, 2015).

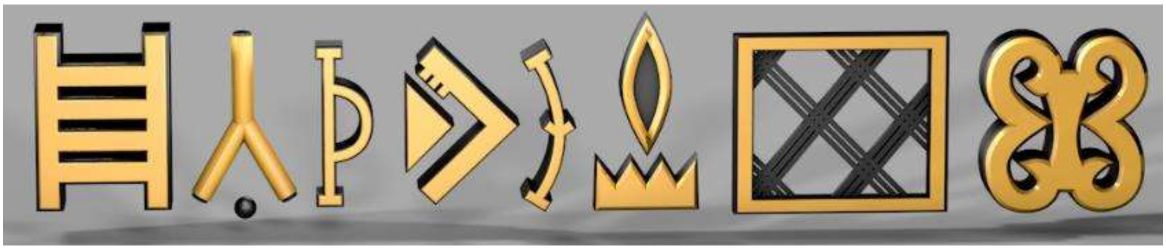


Figure 6.33: 3D visualisation of selected Afrikan symbols for communication (Top)

Figure 6.34: Co-designing Afrikan symbols for health education (Bottom)

6.10.3 Activity III: Designing Health Instructions

In this co-design activity, caregivers were asked to explore the possibility of designing their own healthcare instructions. The participants were given drawings with minimal details. They were tasked to complete these drawings based on the selected health topics they had identified. The topics were distributed among the various teams, with each group working on a different aspect of the selected health theme. The distribution of the different health topics to the various teams was a valuable way of obtaining feedback from participants (Figures 6.35–6.36).

The outcomes obtained from the first iteration of the design activity were mounted on display boards and the best ones were collectively nominated by participants for future development. In the second design activity, the drawings were interchanged within every team in order to obtain variations in the completed information design. Each participant had a different illustration to develop which resulted in a variety of outcomes (Figures 6.35–6.36).

Figure 6.35: Caregivers developing health information (Top – Left)

Figure 6.36: Caregivers co-creating health information in the design milieus (Top – Right)

Figure 6.37: Caregivers interacting in the design milieu (Top – Left)
Figure 6.38: Role-play activities in the design milieu (Top – Right)

Furthermore, in the co-design activities, it was observed that learning through the art of play creates an enabling environment for creativity. Caregivers created facial arts as part of the design sessions that generated much excitement in the design milieus. The facial arts mainly represented the emotions of caregivers or simply what made them happy in their professional practice. These facial arts ranged from images such as animals, insects, flags of their favourite countries and indigenous Afrikan symbols (See Debrah, M'Rithaa & De la Harpe, 2015:para 1-2). The carers indicated that they use facial arts as a means of obtaining the attention of children for health education purposes in the Grabouw community. The facial arts brought some positive energy to the co-design milieu for the following design activity (Figure 6.39–6.40).

Figure 6.39: Caregivers in role-play activities after body painting sessions (Top Left to Right)

Figure 6.40: Caregivers painting their faces during co-design activities (Bottom)

In these subsequent design activities, caregivers became more confident in designing the health information. The completed illustrations were then mounted again on display boards. The participating teams selected their favourite illustration and the best team was rewarded for their hard work and efforts. The selection activity generated much discussion and excitement. These drawings were then rendered graphically, using the feedback from the caregivers as a point of reference to improve the initial drawings. Computer assisted software such as Adobe Creative Suite was used to improve the sketches developed by the participants. The drawings were then viewed and appreciated collaboratively by all participants. These drawings were later presented as ice breakers in subsequent design sessions (Figure 6.41).

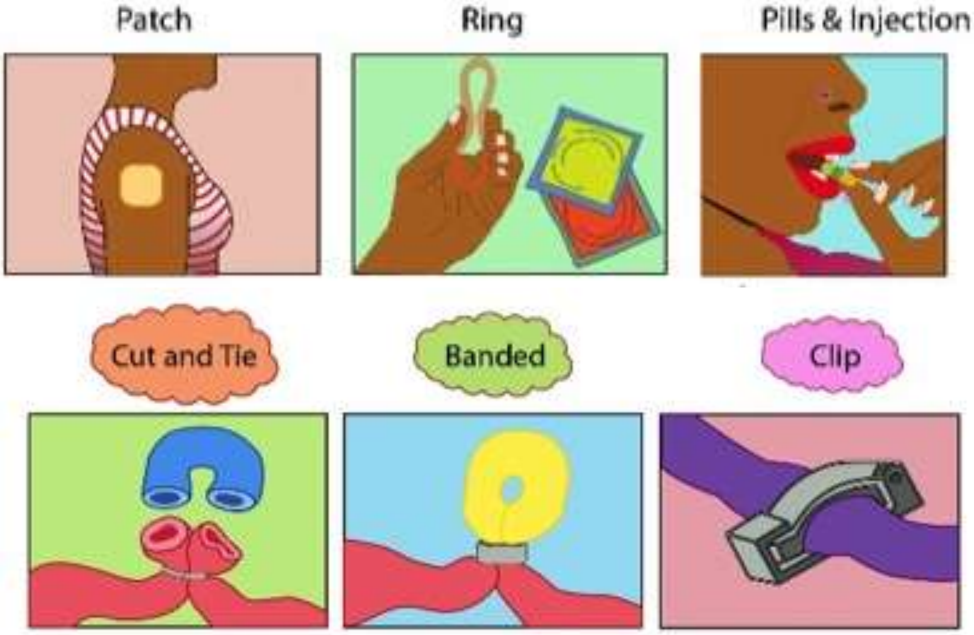


Figure 6.41: Sample illustrations from caregiver activities in the design milieu

6.10.4 Activity IV: Appraising Health Information

In this co-design activity, participants explored the analysis of health instructions. Caregivers worked in teams and they were briefed on the processes involved in analysing health instructions. The selected images for discussion were projected on a wall to generate discussions around the health instructions. Some of the questions used for the discussions were: *What do you see in these images? What does this (image) mean? Where can this image be used? When can it be used? Why should it be used? How might it be re-designed? What would you like to add or change? How might the illustration be improved?*

Caregivers brainstormed on the answers in response to these questions in their various teams. The feedback was then based on shared understanding between the team members (Figures 6.41–6.43). The outcomes from this design activity showed that caregivers did appreciate the images that were being analysed. All participants were able to make sense of the images projected and identified how they could be applied in their health education activities. The designer-researcher observed that caregivers enjoyed participating and creating their own health education materials during the co-design activities. Future researchers are encouraged to include caregivers and other health intermediaries in the information design process. The involvement of potential information users in the design process will impact the information quality for patient education positively.

Figure 6.42: Samples - maternal healthcare instructions for patient education

Figure 6.43: Caregivers at work in the design milieu

6.10.5 Activity V: Designing a Mobile Application

This co-design activity explored the design of a mobile application for information sharing and exchange within the Grabouw area. The design was explored using the information needs of caregivers and women to form the content of the application. The interface design for the mobile application was inspired by available mobile applications such as **WhatsApp** and **Facebook**. The design was modelled after these applications because caregivers were familiar with using these applications for interaction as part of their work activities. Caregivers were involved in the design process in order to make the technology-enabled solution useable and more sustainable for healthcare service delivery in the Grabouw community. The caregivers co-designed the interface of the mobile application and indicated how users could experience the application to achieve the desired outcomes. Participants worked collaboratively to propose ideas for the interface design in their various teams. Participants used visual methods such as role-playing and illustrations to share the results from their ideation activities (see Figure 6.44 for prototype interface design). The proposed interface designs served as probes for further enquiry during the design and development phases of the maternal healthcare software artefact as part of the larger project (ISD4D). These proposed ideas were further developed by designers and developers at a later stage to shape the ideas proposed by participants.

Your name and location are used for identification

Benjamin Prempeh
Hello! Have you visited your patients today?

Chris Helle
Am a bit late, but I'll be there soon.

Ralitsa Debrah
Please contact the supervisor now!

Arnold Kinn

Women often start feeling tired and have a more difficult time breathing as the uterus expands up. They may get varicose veins — blue or red swollen veins most often in the legs — or hemorrhoids — varicose veins of the rectum. Hemorrhoids can be painful and itchy and cause bleeding. Women may also get stretch marks where skin has been expanded. Braxton-Hicks contractions, heartburn, and constipation may continue. Women may urinate a bit when sneezing or laughing because of pressure from the uterus on the bladder. Hormones may make hair appear fuller and healthier.

The growing fetus places more and more strain on a pregnant woman's body. Common pregnancy symptoms continue through the end of pregnancy, including fatigue, trouble sleeping, trouble holding urine, shortness of breath.

Women often start feeling tired and have a more difficult time breathing as the uterus expands up. They may get [illegible] shortness of breath.

Figure 6.44: Conceptualising and prototyping healthcare system (MCH App)
(The proposed system can serve as probes for information sharing and exchange)

6.11 VALIDATING CASES (SERVICE CONTEXT A)

6.11.1 Design Milieu III: Intensive Course

In this design milieu, an intensive course was organised through the CPUT Kujali Lab as part of the larger project (ISD4D). These co-design activities in the intensive course were designed for validation purposes of initial insights derived from caregivers in the Grabouw community. Participating members were from diverse backgrounds such as design, information technology and education/academia who worked with health intermediaries as part of the intensive course. Health intermediaries who participated included midwives, caregivers, nurses and doctors (Figure 6.45). There were three major co-design activities organised in this milieu with the participants. The first design activity was to gain insights about the research context. The second co-design activity was to interact with people and caregivers in the Grabouw community to gain insights about the community. The third co-design session was characterised by brainstorming sessions and presentation of proposed solutions to identified problems. Participants in these co-design activities explored the integration of technology-enabled solutions to improve healthcare services in the Grabouw community.

Figure 6.45: Intensive course participants interacting in the Grabouw community

As part of the outcomes from these activities, caregivers emphasised the need for more exciting educational materials to facilitate patient education. Caregivers indicated that multimedia information objects would be useful tools to facilitate health education activities in the Grabouw area. Some of the participants in this intensive course proposed solutions such as using digital storytelling as a tool to promote health education. Other participants suggested radio drama and the production of television programmes for patient education in the Grabouw community. Overall, the insights derived through this intensive course resonated with outcomes from the major co-design activities conducted in the early stages of this study. Additional insights obtained through these co-design activities highlighted the potential of technology-enabled solutions for health education activities in the Grabouw community.

6.11.2 Design Milieu IV: Co-Designing with Women in Grabouw

The co-design activities in Grabouw began with an introduction between the participants and the designer-researcher. In this session, only one major co-design activity was organised with three participants. This session lasted about 2 - 3 hours. At the start of the co-design session, participating women were briefed on the purpose of the co-design activity and this offered them some insight as to what to expect during the session. Design toolkits and probes were designed to facilitate the enquiry process during co-design activities with the participating women. These visual-based toolkits consisted of health-related themes that generated discussions between participants and facilitators (Debrah *et al*., 2017:2128-2130).

Some of the thematic areas for the enquiry were based on initial information obtained from the context analysis with caregivers (information providers) in Grabouw. Participants were guided by facilitators through the co-design process using the visual-based tools. Participants expressed their ideas using sticky notes to share their thoughts and to respond to questions asked. The design process continued through an iterative cycle to obtain visual-based data on the information needs of women in the Grabouw area (Figures 6.46–6.47).

The co-design session ended with a lunch party that was characterised by merry making and photo taking. Some of the outcomes emerging from the design activity showed that women obtain information from different sources. Some of their information sources include family, community leaders, elderly women, clinics, and health intermediaries. Participants expressed the need for more health information to enable them make informed choices for themselves and their children. Thus, the provision of relevant health information would enable them to improve upon their health and wellbeing in the Grabouw community.

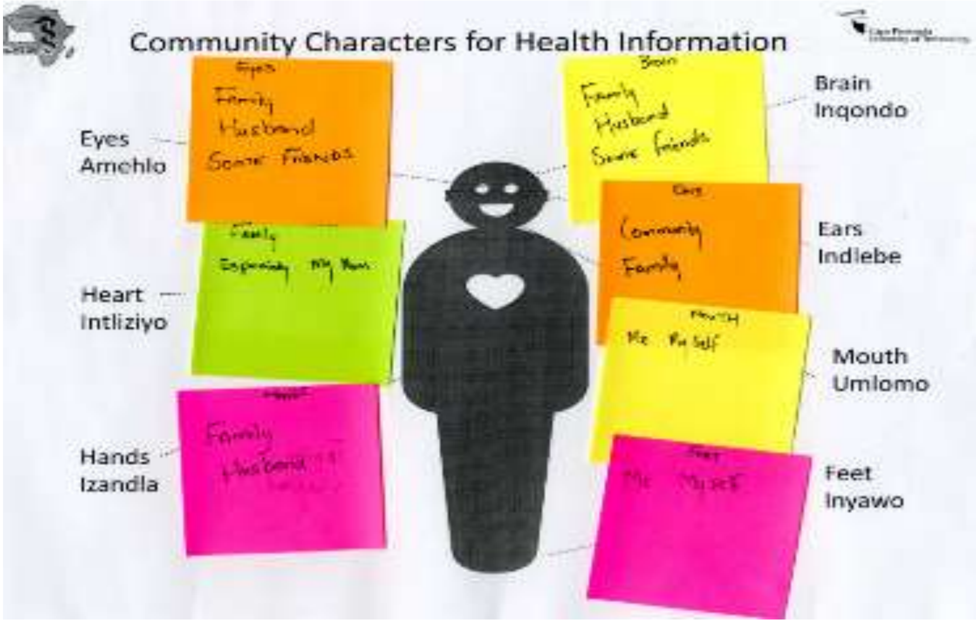


Figure 6.46: Community character tool (Top)
(Source: Debrah *et al.,* 2017:2129-2130)
Figure 6.47: Mothers engaging in design activities in Grabouw (Bottom)
(Source: Author)

6.11.3 Design Milieu V: Information Needs of Learners

In this co-design activity, the design probes and toolkits generated for the information needs enquiry was applied in a different context. The co-design processes in this milieu were conducted with participating students from the University of Technology (UoT) in Cape Town, South Africa. Participants in this design activity were in their first year and were full time students. The participants were from disciplines such as Public Relations (PR) and Design and Information Technology (Figure 6.48). There was a good balance of male and female students and their ages ranged between 18 years–32 years. The majority of the participants were South Africans and they could all speak at least one of the following languages: English, Afrikaans and IsiXhosa.

Figure 6.48: Participating students in the information needs design milieu (Source: Author)

The co-design session was co-facilitated by two of their educators from the University of Technology. There were approximately twelve participants in this session. The participants were grouped into teams of 3-4 students in each co-design activity. The activities were designed for participants to identify their health information needs and sources. In addition, they had to identify their future aspirations and the status of their wellbeing. The design probes and toolkits were developed as a result of the initial co-design activity organised as part of the outcomes of this study (see Debrah, De la Harpe *et al.,* 2019:1).

The emerging design probes and toolkits served as a means to enquire about the information needs and sources of the participants. Additional visual-thinking tools were adopted from other sources that served as empathy maps to facilitate brainstorming activities. Participants were briefed about the activities so that they had some idea of what to expect during the co-design sessions. Facilitators guided the participants through the major activities until the session was completed. In this design session, it was observed that some aspects of the toolkit challenged participants to provide responses. These barriers were experienced because the probes and toolkits were insufficient to cover all aspects of the questions being asked. Consequently, the challenges with these probes were resolved through further explanations from facilitators to the participants. Participants then obtained clarity and provided feedback to the questions using the design probes and toolkits as a medium to express their thoughts (Figure 6.49).

Figure 6.49: Participating learners in the design session
(Source: Author)

Participants indicated thematic areas where they would require relevant information (Figure 6.49). Some of the topical areas included information to: *Achieve Goals; Get Support; Acquire Skills; Find Direction; Health and Wellness;* and *Connect with Others*. Furthermore, participants indicated that they use tools such as mobile devices to obtain information from online sources and from their peers. They also connect with people through social media such as WhatsApp, Facebook and other search engines such as Google applications. Hence, further research could consider how to improve the design probes and toolkits. These would have to be Contextualised with the requisite affordances for potential participants in future.

6.12 EMERGING DESIGN ATTRIBUTES

6.12.1 Future Design Principles for Development

Information objects are designed for many purposes, one of them is to facilitate interaction between individuals within a particular context. In this study, *information objects* refer to visual communication systems and tools, which serve as mediators for interaction. Additionally, in this research case, information *object* is used interchangeably with the term *Information Communication Objects* (ICOs). This refers to visual communication tools that could be used to facilitate interaction. Information objects can be a representation of a real-world situation, which is presented in the form of images such as photos, illustrations and other technology-enabled mediated artefacts, which operates within a particular system. These information objects are usually obtained by or delivered to information seekers within a particular setting (Gorichanaz, 2016:7-8; Pluye *et al.*, 2019:11). Information objects for communication purposes may either be in print, electronic, and sometimes 3D formats. However, in some cases a combination of the three forms or more may be integrated to serve a particular purpose and meet user information needs in a specified context. Available information objects for communication are assimilated in forms such as newspapers, websites, films, books and other 3D integrated objects or systems (Leonardi, 2011:147; Robson & Robinson, 2013:178). Further, it has been discovered that information objects could be made up of multiple features. These are complemented by values and attributes, which defines the parameters of that particular tool of communication and makes it suitable for use (Figure 6.50).

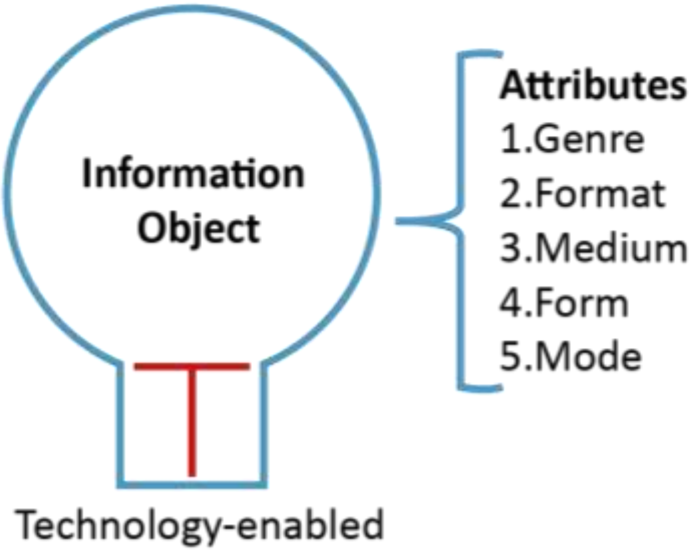


Figure 6.50: Proposed attributes of information object in a healthcare system

As part of this study, a prototype *information object* was designed to facilitate interaction within caregiving services in an underserved context. The prototype information object is designed to facilitate communication during health education and promotion activities by caregivers within the Grabouw community. However, the proposed information object is perceived as a *multimodal cryptographer (InfoShare [brand name])*, which would serve as a *translator* for health messages to patients within the selected context. These information object would operate within a product-service system designed for sustainability in underserved context (Boehm & Thomas, 2013:252; Ceschin *et al.*, 2014:17-22; Foglieni *et al.*, 2018:7-9). The envisioned product-service system in this case, is the caregiving services in which the information object would operate to facilitate caregiving services in Grabouw, South Africa. The proposed information object is enabled by technology to enhance communication between health intermediaries and patients in underserved contexts. Further, this proposed solution presents adjustable emerging design attributes, which could serve as a foundation to inform future design and development principles for multimodal information objects. These were drawn from proposed attributes of information objects as described by Gorichanaz (2016:7-8). Reflecting on this study, these emerging attributes have been adapted and mapped unto the characteristics of the proposed IT solution *(InfoShare)—one of the tangible outcomes of this* *investigation. These attributes* have been presented graphically as Figure 6.50 and further elaborated upon in Table 6.1 below.

Table 6.1: Mapping the attributes of information object to the research context to inform future design principles (Source: Adapted from Gorichanaz; 2016:7-8)

<table>
<tr><td colspan="2">Attributes of proposed Information Communication Object (ICOs), facilitated by technology for health education and promotion activities in Grabouw are described in this section. The descriptions presented here are based on the researcher's interpretations of these attributes of information objects as proposed by Gorichanaz (2016:7-8). These attributes of information objects have been adapted and Contextualised for this study reflecting on the findings obtained from the research context. Although, these attributes are interrelated, they have been elaborated upon, so that it could inform future design principles on the various aspects of information object design for use in a product- service system.</td></tr>
<tr><td>1. GENRE
A means of categorising a material</td><td>Genre refers to the type of content or information object to be designed for activities within a specified context.
In this study, the genre refers to the health education and promotion materials (Information objects) for patient education.</td></tr>
<tr><td>2. FORMAT
A description of objects physical arrangement</td><td>The format refers to the formal package of the information object. In this sense, one needs to consider the appropriate medium in which the information needs to be presented. The format should serve the purpose of the design and improve user experience within a particular service context.</td></tr>
<tr><td>3. MEDIUM
Process of conveying information through an object</td><td>The medium refers to the physical structure of the information object. The materials in which the information is to be presented in all forms, needs to be considered. In this case, the medium refers to all available communication channels such as websites, books, 3D models and so on.</td></tr>
<tr><td>4. FORM
A description of physical shape or attributes of an object</td><td>The form refers to the description of the physical shape and attributes of the information object, which must be context specific. Context becomes relevant to the form and function of the information object design as conditions might change for particular users within the space of time. However, based on the context of the service users in this research case, the prototype information object is designed in the form of a multimodal cryptographer, which is enabled by technology. It is made up of basic adjustable attributes which are stated as follows:
I) visual-based information communication object which is accompanied by
II) Sound and it is
III) Simple; and it has a
IV) Flexible navigation system that is more resilient and sustainable, within a specified context.</td></tr>
</table>

5. MODE **Mode refers to how an object is created, presented, experienced or used**	Mode can be described as how an object can be transmitted to the information recipient/ audience. The mode used for an information communication service should take into consideration factors such as the ***context*** and user expectations to inform the design of relevant information objects. In this research case, a prototype technology-enabled solution was developed with multimodal functions to operate within a health information service. The proposed solution – *InfoShare* is envisioned to facilitate interaction during health education activities within a product-service system of caregiving designed for sustainability in an underserved context.

The attributes, which have been described in Table 6.1, was further Contextualised and explored further in the design and development processes of the prototype IT solution (InfoShare). Attributes such as the **Form** as elucidated in Table 6.1 above were reflected upon which guided the development processes of the proposed solution. The procedures that were followed in prototyping the information object have been described in the subsequent headings that follow.

6.13 SERVICE PROPOSITION – DESIGN AND DEVELOPMENT PROCESSES

6.13.1 Design Milieu VI: Designing a Prototype Solution

In this milieu, co-design activities were conducted with the core ISD4D team. This was organised after all the major service design activities had been completed and adequate insights had been obtained in the Western Cape Province, South Africa (Service Context A). These co-design sessions were organised in the Kujali Lab at CPUT with the goal of exploring tangible solutions to facilitate information sharing and exchange in the Grabouw area. Insights derived from the **discover** and **define** phases of the Double Diamond design process (Diamond 1) were deliberated upon to inform the next design stage (Diamond 2) (Debrah, De la Harpe & M'Rithaa 2015:72-73; Du Preez, 2018:24). Information obtained from the context analysis at the forefront of this study provided insights, which led to **develop** and **deliver** phases of the design process (Diamond 2). Insights derived from the service design tools and processes generated many propositions for future design and development possibilities in the underserved context of the study. A technology-enabled solution that could facilitate health information services in the Grabouw community was identified for design and development. Health intermediaries desired a sustainable health information system that could facilitate health education activities in the Grabouw area.

Figure 6.51: Co-design session with the larger ISD4D project team - (Top)

Figure 6.52: Desktop walkthroughs of design processes with research team (Bottom)

At this stage of the study, co-design activities were intensified at the **develop** and **deliver** phases (Diamond 2). Four major co-design activities were organised with the participating ISD4D core team. This team consisted of designers, programmers, and developers. There were approximately 10–12 participants working collaboratively during these co-design activities (Figure 6.51–6.52). These design sessions were predominantly characterised by reflection processes that were conducted iteratively through the Double Diamond design process. After several deliberations, design considerations for the proposed health information system were identified. The design brief for the design and development of the prototype healthcare system was proposed, with the requisite specifications. Next, the development of the prototype healthcare system began, predominantly designed by programmers and developers. They worked collaboratively with the design-researcher and the core ISD4D team, to design the hard-coded prototype. After each major iterative design process, the outcome of the design process was shared with other community stakeholders for feedback and further improvements. The design and development processes continued iteratively until hard-coded prototypes were at a desired state for pre-testing processes with potential users. The fully developed hard-coded prototype resulted in a **multimodal cryptographer – a healthcare system, which** has been labelled, **InfoShare** (Figure 6.53). This healthcare system is designed to facilitate information sharing and exchange between health intermediaries and their patients in the Grabouw area.

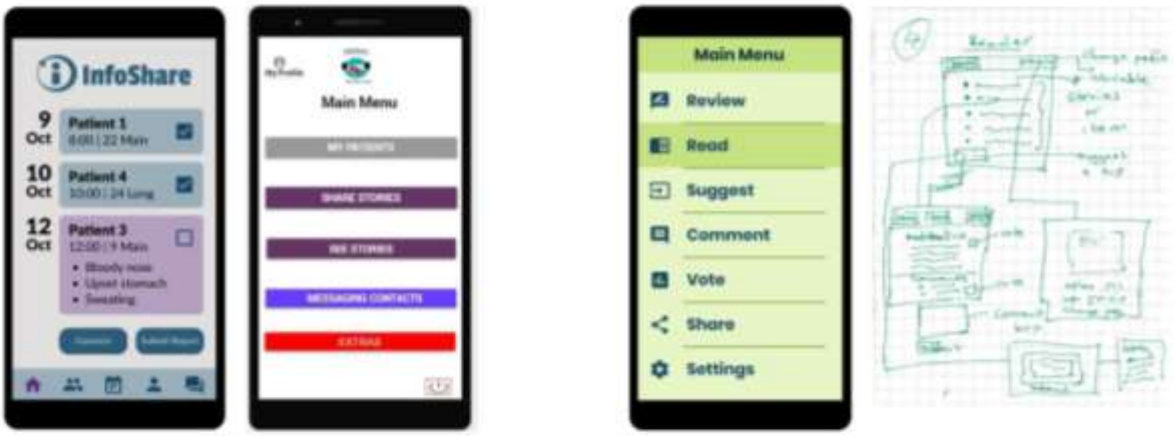


Figure 6.53: Sample designs and prototype for the healthcare system (The healthcare system [InfoShare] was developed collaboratively by transdisciplinary [ISD4D team] researchers. The team included community members, designers, programmers and developers in the CPUT Kujali Lab (Source: CPUT Kujali Lab)

6.13.2 Form and Function of Service Proposition: The Multimodal Cryptographer (InfoShare)

The multimodal (cryptographer) healthcare system – **InfoShare,** is designed in the form of a mobile application (App) with several functions to facilitate health education and information services in the Grabouw area (see sample designs in Figure 6.45). The proposed healthcare system is part of a socially responsive design ethos to give back to society. As such, the proposed solution was designed to improve health education towards promoting a health-literate society. The design and development of this healthcare system is still being developed at the Kujali Lab. The prototype is undergoing constant refinement to make the system more robust for future implementation in the Western Cape Province, South Africa.

This healthcare system was intended to help health intermediaries share information with their patients, hence, the brand name **InfoShare.** This was to be accomplished by providing a means to upload healthcare tips, categorised by health topics. These health tips could consist of both text and images to assist interaction between health intermediaries and their patients. There were plans to expand on this and to allow more complex multimedia information to be uploaded. Users were to rate these health tips in the multimodal healthcare system. The multimodal system would then present health tips based on their popularity by the users.

Also, the system would offer a means to search for more specific health tips. This built-in mechanism would help facilitate the growth of knowledge within the Grabouw community. There was a mechanism in place to moderate the health tips in the system, thereby avoiding incorrect, badly communicated or damaging information from spreading. This health information system was to be manual but hidden from the health intermediaries' user experience. This function necessitated the moderator to actively monitor any new content. In addition to this, there was going to be a recommendation system that would help users find similar health tips. In the last build, I observed programmers uploading health tips only supported by text. The popularity and recommendation system is expected to be implemented in future with built in multimedia features to facilitate interaction among caregivers and their patients in Grabouw. This proposed multimodal system is embedded with multimodal functions with the requisite affordances to facilitate health information sharing and exchange in the Grabouw area.

6.13.3 Design Action: Considerations for Speculative Futures Scenarios

In the speculative futures scenarios**, InfoShare** will operate on mobile devices with fewer boundaries. The mobile devices will have to be simplified and incorporated with features of *"frugal innovation"* to alleviate any threats that might jeopardise the lives of caregivers in the Grabouw area. This is because the crime rate in Grabouw as of the time of this research is high. As such, devices with less sophistication (without boundaries) may prevent caregivers from potential attacks from inimical persons (thieves and robbers) while carrying out their duties in the community. In order to facilitate the design of future multimodal systems, the following basic adjustable design attributes are proposed: a) **Visual-based** information accompanied with b) **sound**; c) it should be **simple** and d) a **flexible navigation** system that is more **resilient** and **sustainable** in a **specified context** within a particular **space in time.** This multimodal system, which serves as an information object, is to be designed with the requisite affordances. So that users can attain the desired value from the proposed health information and education services in underserved contexts in sub-Saharan Afrika (Figure 6.54).

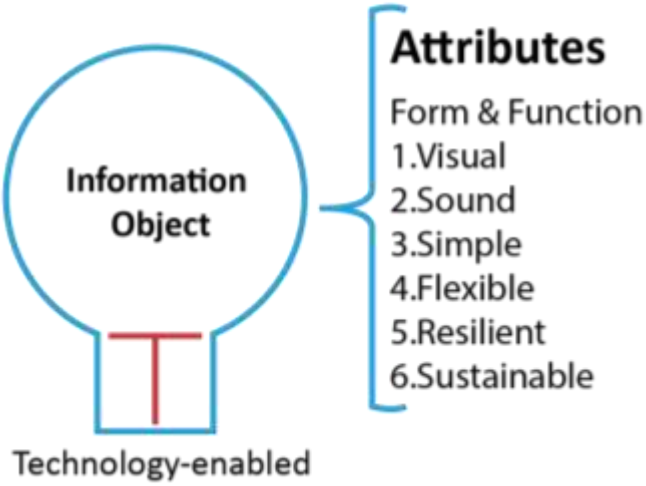


Figure 6.54: Proposed attributes of multimodal cryptographer
(Technology-enabled proposition as part of health information service innovation. The service solution is an information object and a healthcare system, designed to facilitate interaction between intermediaries and women in underserved communities)

6.14 SENSEMAKING: INSIGHTS DERIVED – SERVICE CONTEXT A

The service design activities were undertaken as part of this study to gain insight into the research context. The design sessions were organised to identify solutions that could facilitate health information and education activities in the Grabouw area. Participants were mainly stakeholders and caregivers in the Grabouw area. Some of the insights derived showed that caregivers required relevant information to enable them to inform and educate their patients in the Grabouw area. In addressing some of these problems, a technology-enabled solution has been proposed to facilitate health information and education services in the Grabouw area. Although, the healthcare system has been proposed, there are still pressing challenges in the provision of healthcare services, requiring innovative solutions (Appendix 14: [click to view sample – [14]**context mapping**]). Some of the areas where challenges present opportunities for designing sustainable innovative solutions are described as follows:

I. Caregivers expressed their challenges with commuting on foot to remote areas in the Grabouw area. They indicated that due to the absence of a suitable means of transport, they are unable to execute their work in a faster and efficient manner. Also, the carers indicated the need for better uniforms (warmer clothes), shoes, bags and health supplies which would enable them to provide better services. Additionally, it was evident that caregivers were passionate about their work. They indicated that an increment in their salaries would motivate them to deliver better services in the Grabouw area.

II. It was identified that information objects and toolkits for health education activities were lacking during health campaigns in the Grabouw area. As such, relevant health information objects will be required to facilitate interaction between caregivers and patients during health education activities in the Grabouw area.

III. Caregivers indicated that there were some limitations with the health education materials they use during their campaigns in the communities eg. condoms. For instance, in one of the informal conversations, caregivers indicated that the government-distributed condoms are not often used by people in the community. This is due to the poor aesthetic appeal and other attributes that undermine user value. Also, health education campaigns encouraging the youth to use condoms present many challenges. This is because the youth are resistant to co-operate due to inherent socio-cultural norms and practices in the community that undermine the use of condoms. Caregivers expressed that the youth normally acknowledge popular platitudes that state: **"God did not give condoms"** (Zyl, 2014:1-5). It was clear that the youth do not appreciate the need to use condoms even though this may increase the risk of contracting HIV/AIDS and cause unwanted pregnancies in the Grabouw community.

IV. Patients are not willing to receive caregivers in their homes during health education activities in the community. Caregivers expressed the resistance from patients to receive them in their homes for the purposes of health education. As a result, they are sometimes unable to meet their planned targets for their work activities.

V. Mobile devices and television sets are commonly available to caregivers and patients for communication in the Grabouw area. Also, mobile phones serve as a medium to send health messages to patients from the South African Department of Health (DOH) to women. These health messages are usually reminders to women about their pregnancy status. They also inform women when they are required to visit the hospital or clinic for antenatal care. However, these messages are disseminated as text messages that require some level of literacy to comprehend and act upon health instructions. Health intermediaries indicated the need for an alternative solution so that low-literate mothers can comprehend this health information and improve their health behaviour.

VI. The capturing of patient information by caregivers and other health intermediaries is written manually, using paper-based forms. Participants indicated the need for a technology-based system that could facilitate the capturing of patient data as part of their work activities in the Grabouw area.

VII. Caregivers indicated that they are confronted with a number of social issues on a daily basis. These included crime, youth unemployment, and other environmental issues relating to sanitation and housing that required urgent solutions from community stakeholders and the government. The challenges identified in the research context present opportunities for design researchers to explore possible ways of proposing interventions for development in the Grabouw community. Sustainable solutions could be identified through further research to address some of these identified challenges and opportunities in the Grabouw area.

6.15 EMERGING DESIGN PROCESS: THE ISD4D LIFE CYCLE

In this section, a summary of this study is demonstrated using the Double Diamond design process: Diamond 1 – **discover** and **deliver**; Diamond 2 – **develop** and **deliver**. The major areas in which the co-design activities were conducted were mainly through **Diamond 1,** which provided insights to inform the next stages of the design process in **Diamond 2**. Programmers and developers within the core ISD4D team designed the proposed technology-enabled solution collaboratively. The exploration of this sustainable health information service solution resulted in an emerging design process dubbed **ISD4D Life cycle** (Figure 6.55). Projections are that future researchers could **adapt** and **adopt** the emerging design process when working in similar settings in Afrikan sub-regions.

6.15.1 Diamond One: Discover and Define

- **PREPARE PHASE:** this study was conducted as part of the larger project, INDEHELA ISD4D. The investigation started at the prepare phase with the **user request.** The deliberations at this phase resulted in the main **project proposal** that was taken forward to the next stage for the **co-analysis** process.

- **CO-ANALYSIS PHASE:** this stage started with the **project proposal** obtained from the preparatory phase. The co-design activities with team members resulted in **project specifications** to conduct research in the Grabouw community. Next, external and community stakeholders who could contribute to the study were identified. Preparations were then made to conduct the study within Grabouw that is located in the Western Cape Province of South Africa.

- **CO-DESIGN PHASE:** at this stage, the **project specifications** obtained formed the basis upon which to plan the co-design processes. The design process unearthed many opportunities for technology-enabled solutions that could be integrated into healthcare services in the Grabouw area. The outcome of the co-design phase was a **project design brief** and (low-functional) **paper-based prototypes,** with specifications of the proposed technology-enabled solution (Figure 6.55).

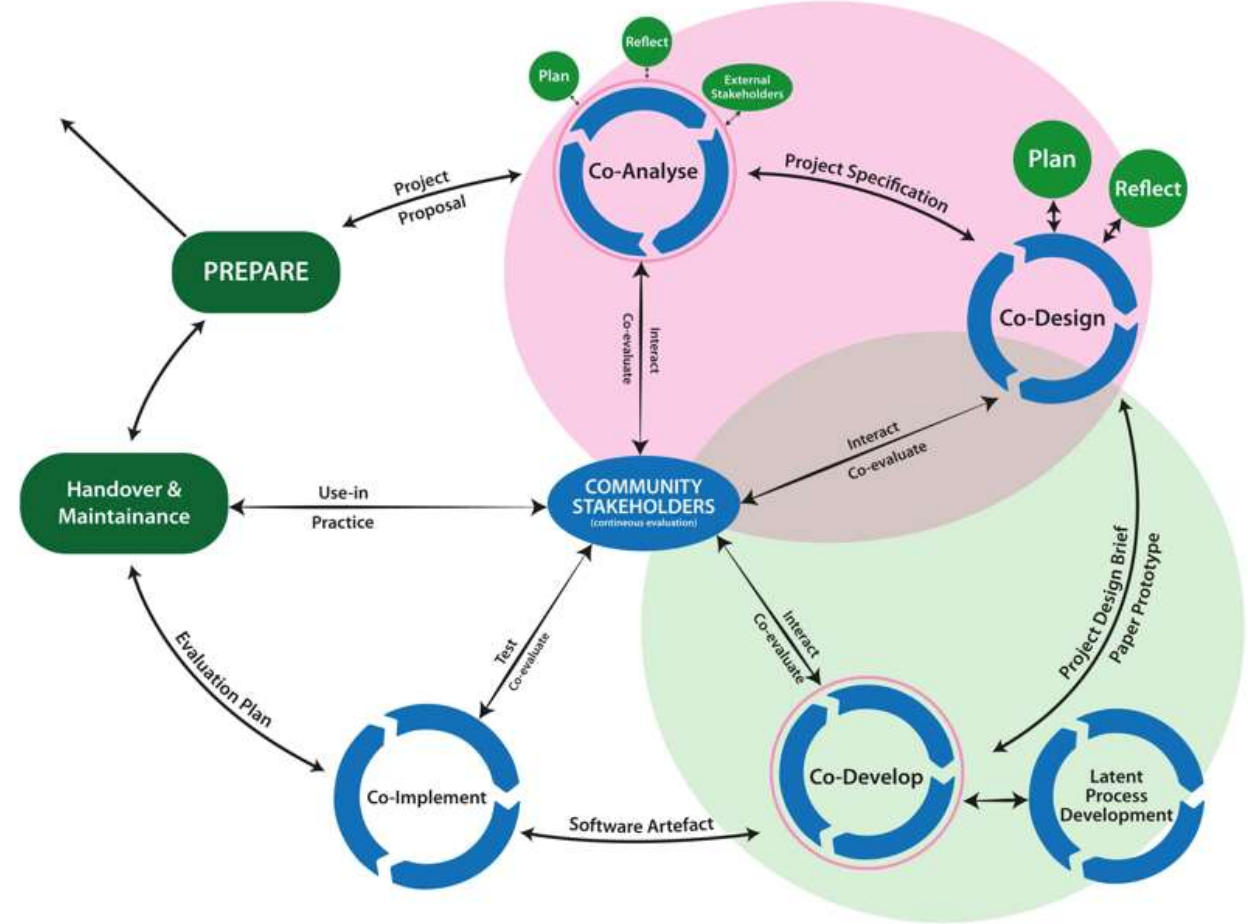


Figure 6.55: Emerging latent design process – ISD4D life cycle (Source: Collective ISD4D construct based on Authors' own visualization) (in *Forthcoming* - Guidebook) (Source: De la Harpe *et al.*, 2016:25)

6.15.2 Diamond Two: Develop and Deliver

- **CO-DEVELOP PHASE:** the **design briefs** obtained from the co-design stage were used as the blueprints to inform the design and development processes. The outcome of the co-develop phase was a **software artefact** (hard-coded prototype). This software artefact is in the form of a healthcare system (InfoShare) that is envisioned to facilitate health information services in the Grabouw community.

- **CO-IMPLEMENT PHASE:** at this phase, plans were made for future implementation and evaluation of the proposed healthcare system in the community. As a result of the Co-Implement process, a future **Evaluation Plan** was suggested. This was followed by the Handover and Maintenance phase.

- **HANDOVER AND MAINTENANCE PHASE:** at this stage in the ISD4D life cycle, it is projected that the healthcare system would be ***handed over*** to stakeholders and users in the selected community. Also, plans for future **maintenance** were specified so that the proposed technology-enabled service solution in the underserved community would be sustained.

Service Design Activities

Validation Cases

In Service Context B

6.16 SERVICE DESIGN ACTIVITIES: SERVICE CONTEXT B – GHANA

6.16.1 Piloting the Research Activities

The co-design activities were further extended to Kumasi, Ghana. Kumasi is a farming community that is located in the Ashanti region in Ghana (Figure 6.56). This study was extended to this different context as a way of piloting some aspects of the main study. Also, these activities were designed for validation purposes of outcomes obtained in Service Context A (South Africa). These service design activities were conducted to test some of the research outcomes from South Africa in Ghana. In this service context, informed consent was obtained from all participants prior to any design activity. Design sessions were organised in such a way to identify opportunities and challenges in the selected community. These activities included design tools and processes such as user shadowing and co-design. In this service context, three main co-design sessions were organised to gain insights with regards to context. Some of the activities conducted in this milieu are described under the subsequent headings.

Figure 6.56: Map of Kumasi, Ghana
(Source: Google Maps, 2019)

6.17 MILIEU VII: BASELINE STUDIES

6.17.1 Activity 1: First Connections

The co-design activities in this milieu started by making contacts with the main stakeholders in the selected community in Kumasi. A private clinic was selected in the Bomso area in the Kumasi metropolis. Contacts were made with the right persons at the clinic and the research purpose was communicated to them. After obtaining their buy-in, preparations were made for the co-design activities. There were 12 participants in total and they completed the requisite documents to indicate their informed consent prior to any design activity. The research team in this context consisted of designers, health intermediaries, and patients who worked collaboratively at the selected clinic (Figure 6.57). The first session was characterised by the identification of opportunities and challenges in delivering healthcare services in the community. Some of the areas that required improvement included improving the wards for patients, sending regular information to mothers, and providing additional technologies to facilitate interaction between patients and other health intermediaries. After this session, follow-up observations were made at the clinic and it was noted that the waiting areas for patients required some improvements. After several reflection activities with the design team and participants, many suggestions emerged. These were further explored in subsequent co-design activities.

Figure 6.57: Participating health intermediaries and researchers, Service Context B (Source: Author)

6.17.2 Activity II: Exploring Healing Art

Co-design activities were explored with participating health intermediaries and researchers in this context (Figure 6.49). In this session, the design activities were aimed at improving patient experiences in waiting areas and wards at the clinic. Also, in these activities, the aesthetic side of healing, using photography as a healing art, was explored. Participants experimented with photography and multimedia installation concepts as part of the healing art activities at the clinic. Participants photographed interesting scenes in the Kumasi metropolis. These were later installed in the waiting areas and wards at the clinic (Figure 6.58–6.59). These images were installed with the goal of minimising patients' anxiety while waiting for care at the clinic (Debrah, *et al.,* 2013:171).

Figure 6.58: Participants installing technology-enabled images in hospital spaces (Top)
Figure 6.59: Health intermediaries interacting with technology-enabled information (Bottom)

Furthermore, exploration was done to integrate technology-enabled solutions into healthcare services at the selected clinic. In this case, a re-designed ward with technology-enabled therapeutic installations was proposed and visualized for future implementation. Also, health intermediaries experimented using mobile devices such as tablets to experience the proposed art installations (Figures 6.58–6.59). They also explored the possibilities of using mobile devices to improve their work at the clinic. These design activities showed that artistic installations in the hospital environment have the potential to improve patient experiences. Further research is required to explore healing art and technology-enabled solutions to improve patient experiences in similar Afrikan settings (Figures 6.60–6.61).

Figure 6.60: Maternity ward without technology-enabled installations

Figure 6.61: Speculative futures scenarios with technology-enabled installations

6.18 MILIEU VIII: INFORMATION NEEDS AND SOURCES OF WOMEN

The co-design sessions were organised with participating women from the Bomso and Ayigya community in Kumasi. Five women participated in this session that was designed to identify their health information needs and sources. Also, this session was organised in this service context to validate some aspects of the emerging tools and probes for future information-needs enquiry. In this context, modifications were made to emerging design toolkits and probes to accommodate the local languages of the participants. Participants were introduced to the main purpose of the session to give them an idea of what to expect. They were provided with the relevant tools and materials for the design activities and explanations were provided in the challenging areas. Participants were guided through the design activities until all the major questions were completed. The session was brought to a close with a snack party and photo taking. However, due to the contextual differences of participants, it is not possible to generalise findings obtained in this service context. In future enquiries, modifications would be required to contextualise the design tools and processes to achieve the desired results in the selected communities in Afrika (Figure 6.62).

Figure 6.62: Design probes and toolkits for information needs (These designerly tools were used for co-design activities in Service Context A) (Ghana) (Source: Author)

6.19 SUMMARY

The service design activities were conducted to gain insights about the various research contexts in South Africa and Ghana. In these service design activities, many observations were made while working with the participants. It was observed that an enabling environment facilitates creativity in the design milieus. The introduction of music, dancing, design tools and other creative activities helped in breaking down barriers that could have inhibited participants from engaging in design activities. Participants were delighted to engage in these co-design sessions and indicated their interest in future design activities. After the major co-design sessions, participants indicated some feedback. These are indicated as follows:

- "We are very happy with the design activities you have organised with the caregivers. It is evident that they enjoyed the sessions and your activities integrated well with our home-based care lessons and topics under discussion. These design activities have given us an idea of how to modify our teaching strategies to prepare caregivers for health education activities in the Grabouw area" – Instructors at Elgin
- "I saw the outcome of the brainstorming sessions of the caregivers displayed on the walls. I like these new ways of learning and we will be glad if you can extend this to the other training levels of the home-based carergivers" – Administrators and managers at Elgin
- "We are very grateful to have the opportunity to participate in this project; we really enjoyed ourselves and we would like to do this with you and your team over and over again!" – Caregivers
- "We enjoyed these design sessions and will be happy to participate in future activities! – Women and other participants

6.20 IMPLICATIONS FOR FUTURE WORK

This study unearthed several areas with challenges for the healthcare services in the Grabouw area. These challenges present opportunities for future design interventions. As a result of these design activities, several outcomes were derived and these included: a technology-enabled solution (InfoShare); a set of design probes and toolkits and an emerging design framework - ISD4D Life cycle has been proposed to guide future work. Although some solutions were proposed as part of the study, other emerging questions requiring further research are:

- *What are the alternative ways of improving the working conditions of caregivers and other health intermediaries in the Grabouw area?*
- *What mobile technologies would be suitable to support caregivers in sharing information in the Grabouw area without making them susceptible to robbers and thieves?*
- *How can caregivers improve the recording of patient data?*

- *How might the challenges confronting caregivers, when moving on foot in the community, be addressed?*
- *How can the clothes of caregivers be re-designed to accommodate all weather conditions in their community?*
- *How can training opportunities be made available to caregivers to enable them to advance in their career?*
- *How can the digital literacy skills of caregivers be developed to facilitate the use of technology in healthcare service delivery?*
- *How might the general environmental and sanitation conditions in the Grabouw community be improved to facilitate a healthy society?*
- *What are the alternative ways of addressing some of the social problems such as youth unemployment, crime, teenage pregnancy and the likes in the Grabouw community?*

Thus, future work in other underserved contexts in Afrikan sub-regions is encouraged, to test the design and development processes as stipulated in this study. Future researchers are encouraged to explore sustainable design interventions that could improve the general standard of living in the Grabouw area. A list of suggested areas for future work is presented as Appendix 9 (click to view sample – [9] [**Design briefs and tools**]). Additional insights derived in the Western Cape Province, South Africa, is described in **Phase II** in Chapter Seven of this study.

Data obtained in

Phase II

Service User Surveys

CHAPTER SEVEN

PHASE II – PRESENTATION OF RESULTS AND DISCUSSION

FINDINGS OBTAINED FROM SERVICE USER SURVEYS

"A confident client will see your confidence as strength not as arrogance" – Diti Katona

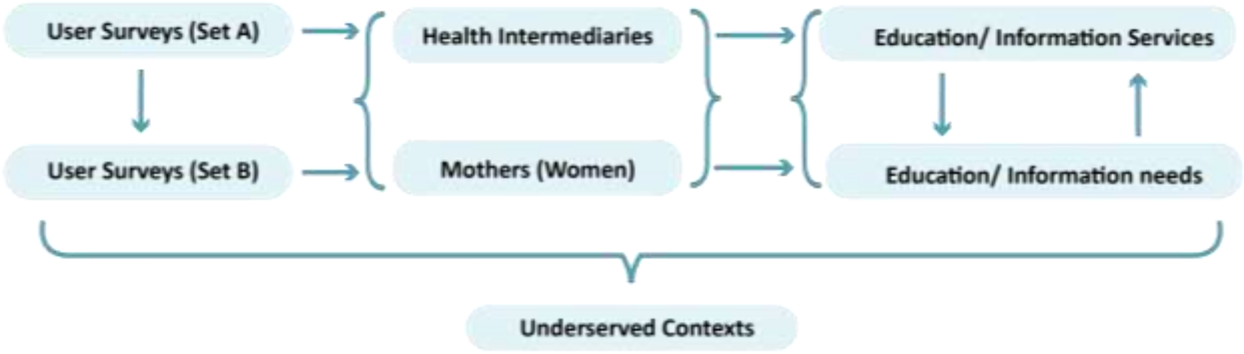


Figure 7.1: Major concepts discussed in Chapter Seven

7.1 INTRODUCTION

In this chapter, data obtained from the service user surveys (user surveys) distributed to respondents are presented (Figure 7.1). There were two major categories of the user surveys, which were completed by respondents. The first categories, of the user surveys (Set A) were, completed by health intermediaries in South Africa (Service A). Next, the second category of the user surveys (Set B) was completed by mothers (women) in both South Africa (Service Context A) and in Ghana (Service Context B). In the first section of the chapter all data obtained from health intermediaries are described. On the other hand, the second section of the chapter covers information obtained from participating mothers from the various contexts of the study. The data obtained from the user surveys were analysed using SPSS data analysis software. The software helped in compiling and analysing the close-ended sections of the user surveys. Whereas the open-ended responses obtained from the user surveys were recorded and grouped thematically for further discussion in the study. Feedback obtained from this user surveys is in response to one of the research questions in this study, which is stated as: **"What are the alternative ways of assisting health intermediaries in disseminating information to support pregnant women in making informed decisions during prenatal, antenatal, neonatal and postnatal periods?"**

The purpose for obtaining this information from participants was to gain understanding of their contexts and identify some of the gaps that may exist in health information dissemination activities.

Some of the empirical questions that guided the investigation is as follows:

- *What would be the preferences of health intermediaries when designing health information for patient education?*
- *What are the major areas in maternal healthcare that information would be required for patient education?*
- *What are the available ICT tools that health intermediaries prefer to use to facilitate interaction when educating their patients?*
- *What are some of the barriers to health information communication to women in underserved contexts?*

In a word, the chapter concludes with a summary of insights derived from all the responses obtained from health intermediaries, mothers, and implications for future work in underserved contexts in Afrikan sub-regions.

7.2 ANALYSING DATA – SERVICE USER SURVEYS (SET A)

7.2.1 Brief Description of the Service User Surveys

The preliminary part of the user surveys mainly consisted of the *biographical data* of the respondents, whereas the other questions were related to information and communication concepts. The biographical data (biodata) included health areas of specialisation and work experience. The biodata obtained, provided insight into the professional practice and work experience of the respondents. This served as a foundation, giving clarity to the feedback obtained from the health intermediaries.

Also, health intermediaries' professional practices in some of the healthcare settings overlap. Therefore, the questions in the other sections for this inquiry were purposively designed such that it was made up of both close-ended and open-ended sections. The closed-ended sections of the user surveys were multiple choices and therefore respondents could choose more than one answer at a time (Appendix 6: [click to view sample – [6] **survey - HCWs**]).

7.3 DESCRIPTION OF RESPONDENTS

The respondents were mainly health intermediaries in the Western Cape, South Africa. There were **123** respondents in total that provided feedback to the various questions in this inquiry (Set A – user surveys). The total distribution of the respondents per the valid responses obtained in relation to the inquiry on their **"occupation"** yielded the following results: Midwives - 28 (26%); Doulas - 4(4%); Home-based carers - (HBC) 32 (30%); Medical doctor – 1 (1%); Nursing sisters - 35 (33%) and childbirth educator 6 - (6%). However, ***17 (13.8%)*** out of the ***123 (100%)*** responses were missing, making the total valid responses **106** representing **82.6%** (Figure 7.2).

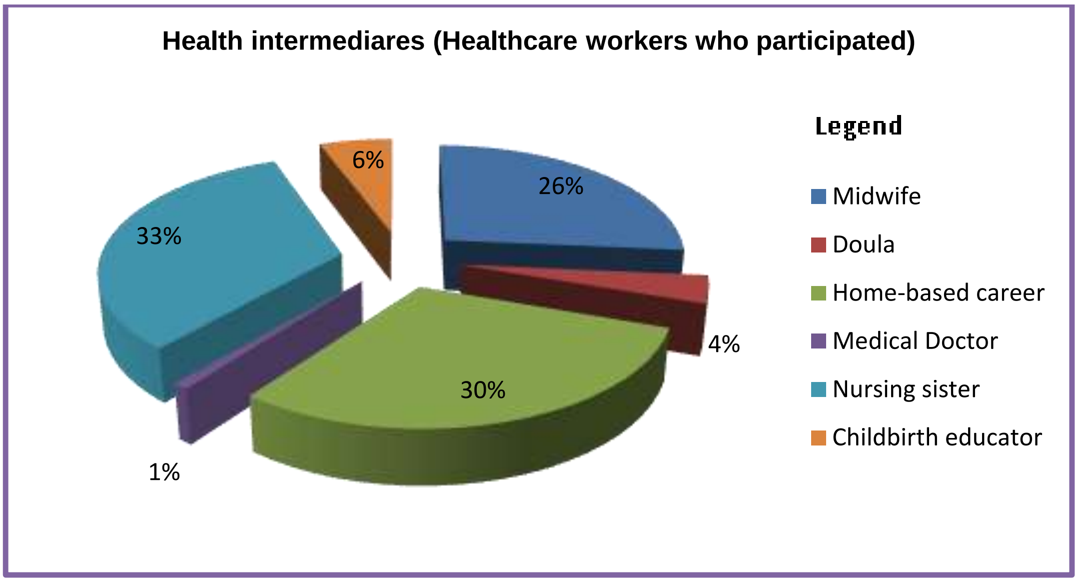


Figure 7.2: Percentage distribution of participating health intermediaries

Additionally, the various specialisations and roles of the participating health intermediaries in South Africa are described in the next lines that follow:

- **Midwife:** they mainly deal with maternal and childbirth issues.
- **Doula:** Plays the role of an assistant to the Midwives and provides the needed personal support to mothers as may be required.
- **Home-based caregivers:** work in the community, mainly in underserved contexts in South Africa. Their role in the healthcare system is to provide caregiving in homes to chronic patients as well as health campaigns to assist women and newborn babies to complement health services being provided in major hospitals and clinics in their communities.
- **Nurses:** the nurses who participated are mainly general nurses, but they also take care of women and children in the hospitals.
- **Childbirth educators:** they usually work in the clinics and hospitals. They educate women on how to take care of themselves and their children, through educational programmes.
- **Others:** these comprised of all other health intermediaries such as doctors and other related professionals who equally interact with women on a daily basis and provide healthcare.

7.4 OUTCOMES OF STATISTICAL ANALYSIS – USER SURVEYS (SET A)

In this section, I present the analysis based on the feedback obtained from respondents who completed the user surveys. However, the results presented in this section are based on the feedback obtained from health intermediaries. Participants' responses to questions *five (5)* to *seventeen (17)* of the user surveys are discussed in this section. The strategy for analysing the data, was to *pair* the major findings obtained using descriptive statistics with the biographical data as specified in ***Section "A"*** of the user surveys (Appendix 6: [click to view sample – [6]**survey - HCWs**]). The data pairing and the descriptive statistics made it possible to identify some of the challenges that confront health intermediaries based on their professional experiences. The results from the major questions were paired with the *current occupation; years of experience; sector of employment and unit of work. Additionally, current areas of specialisation* of respondents were analysed in order to obtain similar or contrasting results. In the sections where the questions were open-ended, the feedback obtained were summarised and categorised thematically.

7.5 CATEGORISING RESPONDENTS FOR STATISTICAL ANALYSIS

Health intermediaries who participated in this study provided substantial feedback to the questions, which were presented in the user surveys. Their responses were categorised to facilitate the data analysis process. Yet, not all the responses were valid for the analysis as per the user surveys retrieved and the frequencies generated. However, health intermediaries who obtained higher and valid responses in relation to their **"occupation"** were selected as the main categories of respondents for the analysis. The total number of health intermediaries who were selected for the analysis due to the valid responses are presented as follows: Midwives - 28 (29%); Home-Based Carers (HBCs) - 32 (34%) and Nursing sisters - 35 (37%). Thus, the selected participants equalled **95** representing **100%** (approximately 100%) as per the valid responses obtained from the selected health intermediaries (Figure 7.3). The outcomes obtained from these respondents are discussed in the subsequent sections of this document.

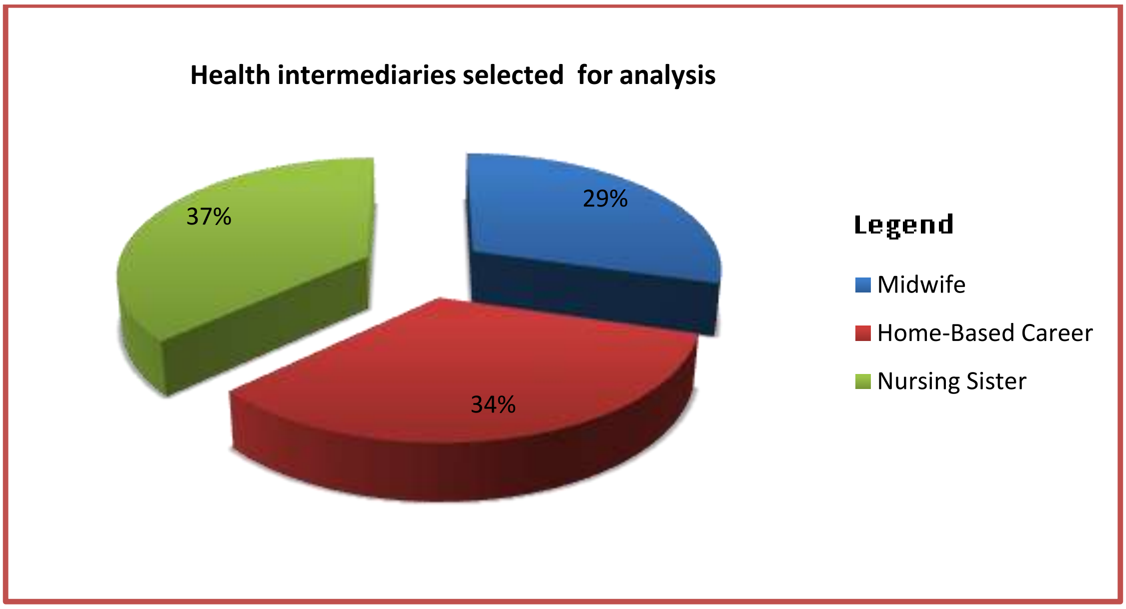


Figure 7.3: Selected respondents with valid responses for the analysis

7.6 PRESENTATION AND DISCUSSION OF RESULTS – SET A

- **Question Six (Q6A): What other communication tools do you use to supplement or replace verbal communication?**

The responses were analysed by paring the variables in this question with information communication tools identified and the present occupation of health intermediaries. The probing was done to identify the various categories of health intermediaries and their preference towards the suggested information communication tools. Additionally, the probing was done to identify the preferred communication tools that could facilitate communication between health intermediaries and women in healthcare settings.

The questions presented in the user surveys were multiple choices as such respondents could ***tick more*** than one answer. This was necessary because health intermediaries use more than one tool to supplement or replace verbal instruction. The results obtained are graphically presented subsequently (Figure 7.4–7.9).

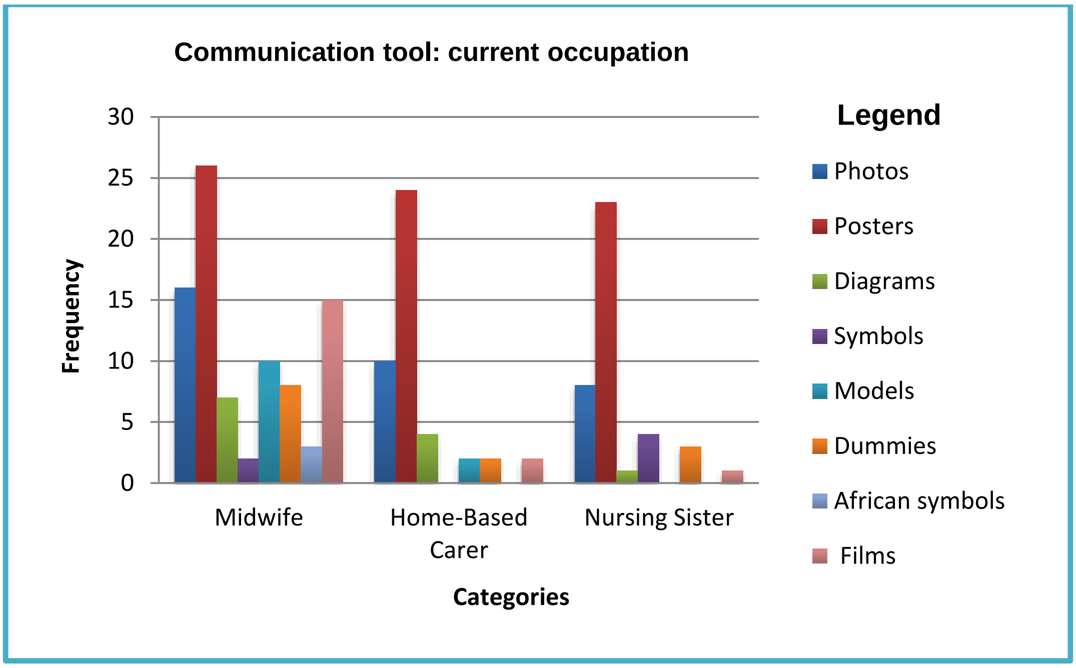


Figure 7.4: Communication tools in healthcare

Midwife

The results obtained from midwives regarding their preference to particular communication tools are: Photographs - 16 (57.1%); Posters - 26 (92.9 %); Diagrams - 7 (25.0%); Symbols - 2 (7.1%); Models - 10 (35.7%); Dummies - 8 (28.6%); Afrikan pictographs and symbols - 3 (10.7%) and Documentaries or Films - 15 (53.6%).

Home-Based Carer (HBCs)

In the category of HBCs the following results were obtained: Photographs- 10 (37.0%); Posters 24 - (88.9%); Diagrams - 4 (14.8%); Models - 2 (7.4%); Dummies - 2 (7.4 %%); and Documentaries or Films - 2 (7.4%) and in the category of Afrikan pictographs and symbols a null set was obtained since no response was obtained from health intermediaries.

Nursing Sister

The responses obtained in the Nursing sisters category are the following: Photographs - 8 (33.3%); Posters - 23 (95.8 %); Diagrams - 1 (4.2%); Symbols- 4 (16.7%); Dummies - 3 (12.5%); Documentaries or Films - 1 (4.2%); Models, Afrikan pictographs and symbols recorded a null set since no feedback was obtained in this category.

- **Question six (Q6B): Paring results to the sector of employment – public or private workers**

The results obtained from **question six (Q6A)** were analysed further by comparing participants' feedback to the sector of employment. The essential aim was to ascertain whether the variables from the previous **question six (Q6A)** have any significance regarding respondents sector of employment. The findings obtained on the sector of employment and communication tools have been graphically presented below (Figure 7.5).

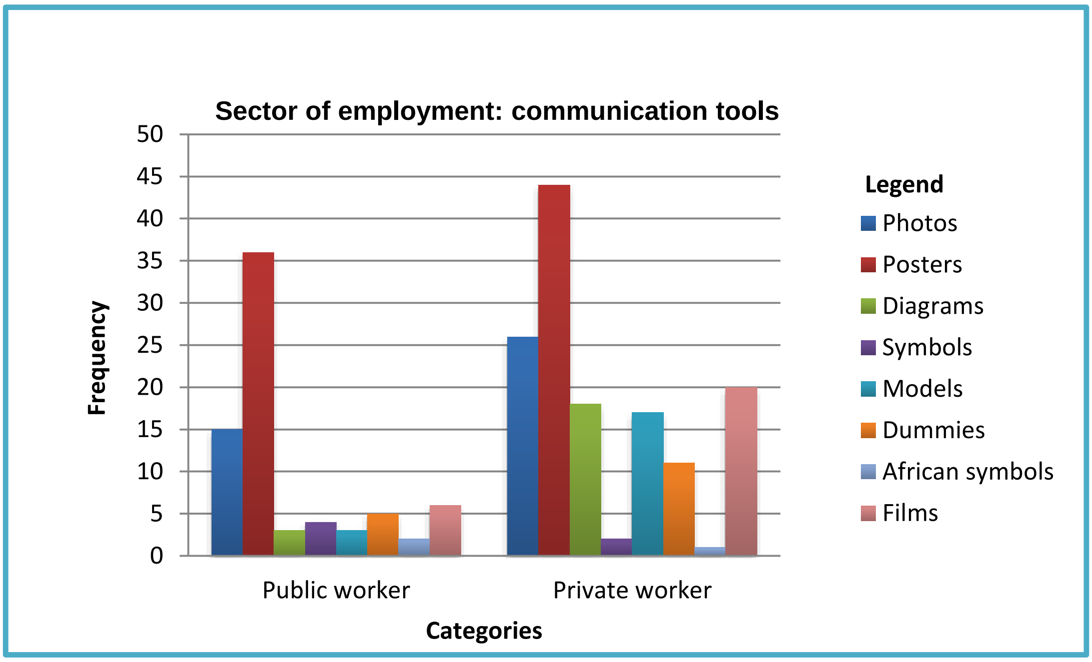


Figure 7.5: Sector of employment – communication tools

Public worker

The results obtained from public workers regarding their preference to particular communication tools are as follows: Photographs - 15 (37.5%); Posters - 36 (90.0 %); Diagrams - 3 (7.5%); Symbols - 4 (10.0%); Models - 3 (7.5%); Dummies - 5 (12.5%); Afrikan pictographs and symbols - 2 (5.0%) and Documentaries or Films - 6 (15.0%).

Private workers

Private workers indicated their responses to the various communication tools they use and these include tools such as: Photographs 26 - (49.1%); Posters - 44 (83.0%); Diagrams - 18 (34.0%); Symbols - 2 (3.8%); Models - 17 (32.1%); Dummies - 11 (20.8%); Afrikan pictographs and symbols - 1 (1.9%) and Documentaries or Films - 20 (37.7%).

- **Question six (Q6C): Comparing data set with the years of experience**

Additionally, further comparison was made based on the data obtained. In this case, the work experiences of health intermediaries were compared with the type of tools they use for communication. The purpose was to ascertain whether the work experience of respondents have any correlation to the feedback obtained regarding the most preferred tools for communication (Figure 7.6).

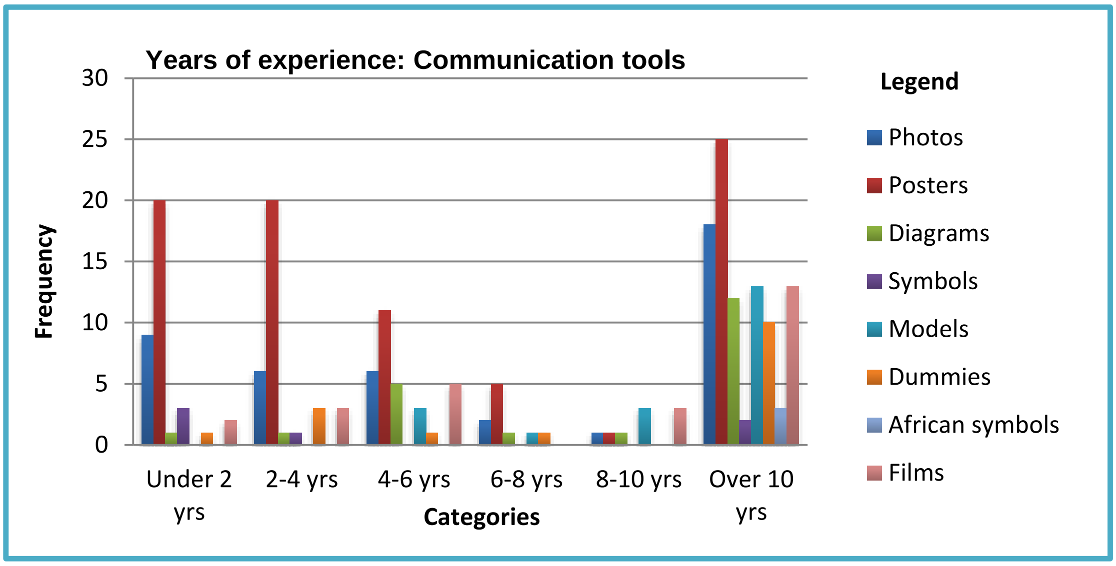


Figure 7.6: Years of experience – communication tools

Under 2 years

Health intermediaries with under 2 years of experience indicated these responses: Photographs - 9 (40.9%); Posters - 20 (90.9%); Diagrams - 1 (4.5%); Symbols - 3 (13.6%); Dummies - 1 (4.5%); Documentaries or Films - 2 (9.1%); Models, Afrikan pictographs and symbols category recorded a null set since no feedback was obtained.

2 to 4 years

Health intermediaries with 2 to 4 years of experience indicated following responses: Photographs - 6 (27.3%); Posters - 20 (90.9%); Diagrams - 1 (4.5%); Symbols - 1 (4.5%); Dummies - 3 (13.6%); Documentaries or Films - 3 (13.6%); Models, Afrikan pictographs and symbols category recorded a null set since no feedback was obtained.

4 to 6 years

Health intermediaries with 4 to 6 years of experience stated these responses: Photographs - 6 (46.2%); Posters - 11 (84.6%); Diagrams - 5 (38.5%); Dummies - 1 (7.7%); Documentaries or Films - 3 (13.6%); Models - 3 (23.1%); Symbols and Afrikan pictographs and symbols category a null set was obtained since no feedback was provided by respondents.

6 to 8 years

In this category, health intermediaries with 6 to 8 years of experience indicated these responses: Photographs - 2 (40.0%); Posters - 5 (100%); Diagrams - 1 (20.0%); Dummies - 1(20.0%); Models and Afrikan pictographs, Symbols and Documentaries or Films category recorded a null set since no responses were provided to these categories.

8 to 10 years

The respondents with 8 to 10 years of experience stated their preference as: Photographs - 1 (25.0%); Posters - 1 (25.0%); Diagrams - 1 (25.0%); Models - 3 (75.0%); Documentaries or Films - 3 (75.0%); Symbols, Dummies and Afrikan pictographs and Symbols category recorded a null set since no responses were provided in these categories.

Over 10 years

Health intermediaries with over 10 years of experience indicated these responses: Photographs - 18 (62.1 %); Posters - 25 (86.2%); Diagrams - 12 (41.4%); Symbols - 2 (6.9%); Models - 13 (44.8%); Dummies - 10(34.5%); Afrikan pictographs and Symbols - 3 (10.3%) and Documentaries or Films 13 (44.8%).

- **Question six (Q6D): Comparing data set with employment status**

In this analysis, the possible tools for communication were further matched with the employment status of health intermediaries. The purpose was to identify similar or contrasting results based on respondents feedback to this particular question. The results are presented in the diagram below (Figure 7.7).

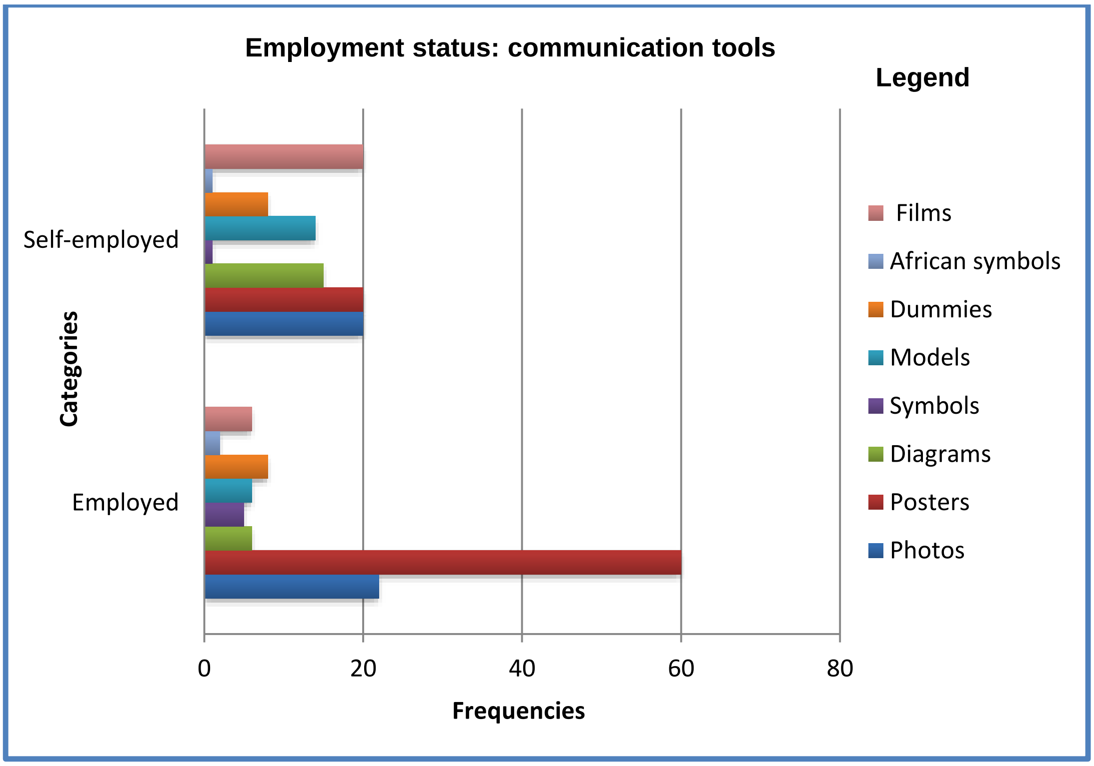


Figure 7.7: Employment status – communication tools

Employed

Feedback obtained from respondents are presented after the analysis as follows: Photographs - 22 (34.4%); Posters - 60 (93.8%); Diagrams - 6 (9.4%); Symbols - 5 (7.8%); Models - 6 (9.4%); Dummies - 8 (12.5%); Afrikan pictographs and Symbols - 2 (3.1%) and; Documentary or Films - 6 (9.4%).

Self-employed

The results that were obtained from health intermediaries who are self-employed are the following: Photographs were 20 - (69.0%); Posters - were 20 (69.0%); Diagrams - 15 (51.7%); Symbols - 1 (3.4%); Models - 14 (48.3%); Dummies - 8 (27.6%); Afrikan pictographs and Symbols - 1 (3.4%) and; Documentary or Films - 20 (69.0%).

- **Question Six (Q6E): Comparing data set with unit of work**

The feedback obtained regarding the communication tools that was obtained was further paired with the unit of employment of health intermediaries. In this category, the analysis was meant to ascertain which particular tool health intermediaries in various health units prefer. The results from the statistical analysis are represented in the diagram below (Figure 7.8).

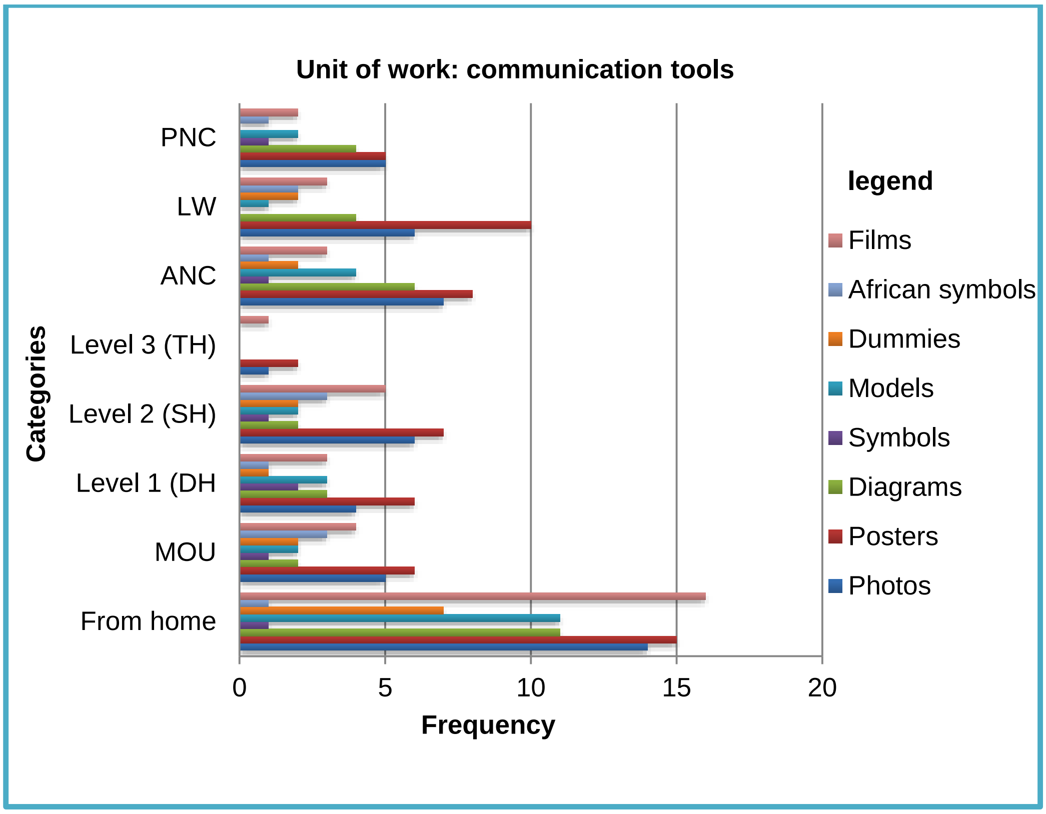


Figure 7.8: Unit of work – communication tools

Unit: from home

Health intermediaries working from home provided their results as follows: Photographs - 14 (29.2%); Posters - 15 (25.4%); Diagrams - 11 (34.4%); Symbols - 1

(14.3%); Models - 11 (44.0%); Dummies - 7 (43.8%); Afrikan pictographs and Symbols - 1 (8.3%) and; Documentary or Films - 16 (43.2%).

Unit: Midwifery and Obstetric Unit (MOU)

Health intermediaries from the midwifery and obstetric unit shared these responses: Photographs - 5 (10.4%); Posters - 6 (10.2%); Diagrams - 2 (6.3%); Symbols - 1 (14.3%); Models - 2 (8.0%); Dummies - 2 (12.5%); Afrikan pictographs and symbols - 3 (25.0%) and; Documentary or Films - 4 (10.8%).

Unit: Level 1 (District hospital)

Health intermediaries practicing from Level 1 (District hospital) provided these responses: Photographs - 4 (8.3%); Posters - 6 (10.2%); Diagrams - 3 (9.4%); Symbols - 2 (28.6%); Models - 3 (12.0%); Dummies - 1 (6.3%); Afrikan pictographs and symbols - 1 (8.3%) and; Documentary or Films - 3 (8.1%).

Unit: Level 2 (Secondary hospital)

Health intermediaries working at Level 2 (Secondary hospital) provided the responses that follows: Photographs - 6 (12.5%); Posters - 7 (11.9%); Diagrams - 2 (6.3%); Symbols - 1 (14.3%); Models - 2 (8.0%); Dummies - 2(12.5%); Afrikan pictographs and symbols - 3(25.0%) and documentary or Films - 5(13.5%).

Unit: Level 3 (Tertiary hospital)

Health intermediaries from Level 3 (Secondary hospital) responded as follows: Photographs - 1 (2.1%); and Posters - 2 (3.4%). No feedback was obtained for the use of diagrams, symbols, models, Dummies, Afrikan pictographs and symbols. There was 1 (2.7%) response obtained in the category of Documentary or Films for communication.

Unit: Antenatal Clinic (ANC)

Health intermediaries operating from ANC unit responded as follows: Photographs - 7 (14.6%); Posters - 8 (13.6%); Diagrams - 6 (18.8%); Symbols - 1 (14.3%); Models - 4 (16.0%); Dummies - 2 (12.5%); Afrikan pictographs and symbols - 1 (8.3%) and; Documentary or Films - 3 (8.1%).

Unit: Labour Ward (LW)

Health intermediaries from LW unit responded as follows**:** Photographs - 6 (12.5%); Posters - 10 (16.9%); Diagrams - 4 (12.5%); however, no feedback was obtained from the use of symbols; Models - 1 (4.0%); Dummies - 2 (12.5%); Afrikan pictographs and symbols - 2 (16.7 %) and documentary or Films - 3 (8.1%).

Unit: Postnatal Clinic (PNC)

Health intermediaries working from PNC unit responded as follows**:** Photographs - 5 (10.4%); Posters - 5 (8.5%); Diagrams - 4 (12.5%); Symbols - 1 (14.3%); Models - 2 (8.0%); Dummies recorded a null set since no feedback was obtained from health intermediaries operating from this unit. Afrikan pictographs and symbols was 1 (8.3%) and; Documentary or Films - 2 (5.4%).

- **Question six (Q6F): What other communication tools do you use to supplement or replace verbal communication?**

In order to obtain the desired results for question six (Q6), the biodata of health intermediaries were paired with the various responses for the analysis. These were Current Occupation; Sector of employment (public or private workers); Years of experience of health intermediaries; Employment status; and Unit of work of health intermediaries. The results from this analysis indicated that posters were the commonly used tools to supplement or replace verbal instruction. Also, the findings showed that some health intermediaries use photographs to facilitate information communication. Additionally, the results obtained from further analysis from health intermediaries practicing from *home* revealed that; documentaries or films are equally useful tools which health intermediaries can use to facilitate information communication.

- **Question six (Q6G): feedback obtained from open sections**

Additional responses obtained from the open sections of the user surveys are described here. Health intermediaries indicated that they use information communication tools such as PowerPoint presentations, pamphlets, DVD's, support groups/ peer referrals, birth books; loan materials for demonstration; writing/ articles/ papers and YouTube videos. Others indicated that they use WhatsApp groups whereas other health intermediaries expressed that *"WhatsApp is – used for mother-to-mother support and I facilitate starting the groups"*. Other health intermediaries stated "*I draw on paper, use women's health screening tools and storytelling*" to supplement or replace verbal instruction".

- **Question six and twelve (Q6 & Q12): How do you communicate health information to women, in a face-to-face situation, before, during and after pregnancy?**

  Paring data from question six and twelve (Q6 & 12A)

Question six (Q6) was designed to inquire from health intermediaries the most common and basic mode of communication they use when disseminating health information to mothers, before, during and after pregnancy. The options were mainly for them to provide responses on whether they prefer verbal, written or both modes as a means of communication. The goal was to investigate the extent to which health intermediaries combine these modes of communication, and what communication tools are often used in a face-to-face situation of communication.

Participants had the leverage to choose more than one question in order to obtain as many responses as much as possible. The feedback obtained from this question was analysed by pairing it with the data set found from the previous question stated as: ***What other communication tools do you use to supplement or replace verbal communication?*** In order to obtain desirable result, these responses were paired with the types of communication tools used by health intermediaries and their basic modes of communication. The resulting statistics as obtained from their responses are graphically presented as Figure 7.9.

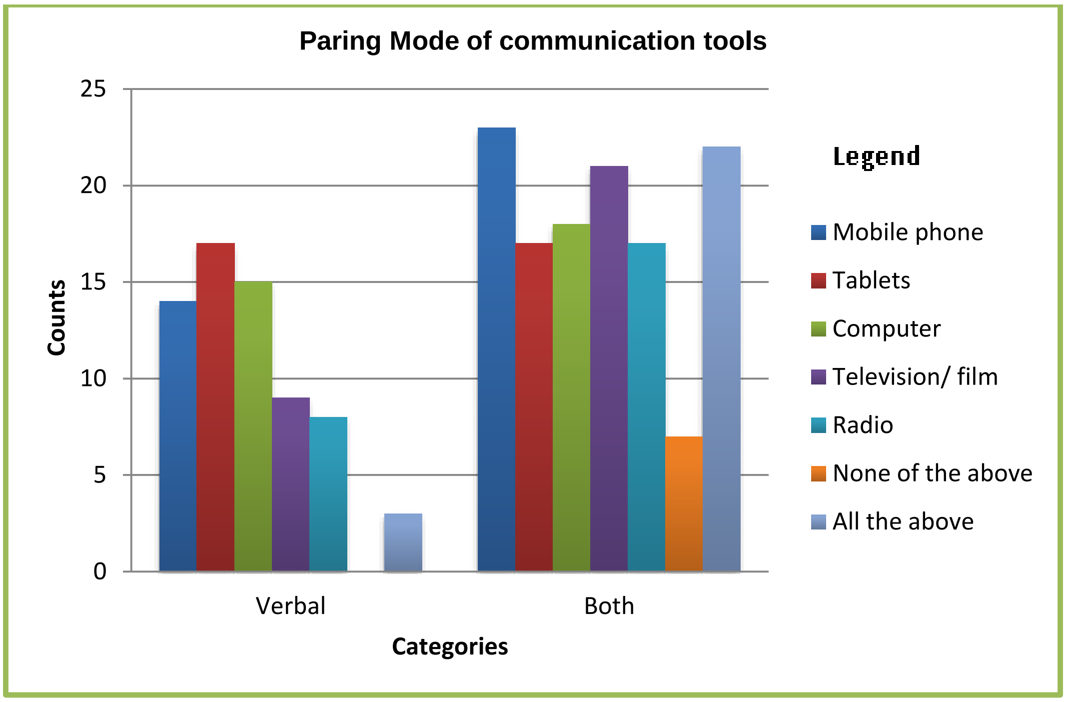


Figure 7.9: Mode of communication

Verbal communication only

The results obtained from the analysis in this category, indicated the results as follows: Mobile phones - 14 (33.3%); Tablets - 17 (40.5%); Computer (desktop or laptop) - 15 (35.7%); television or film - 9 (21.4%); Radio - 8 (19.0%); in the case of "All the above" category, there were 3 (7.1%) responses generated. Whereas in the case of "none of the above" recorded a null set in this category.

Both verbal and face-to-face situation

In this category, health intermediaries were asked if they combine any of the aforementioned communication tools with both verbal and face-to-face mode of communication. The results that were recorded per the analysis are the following: Mobile phones - 23 (40.4%); Tablets - 17 (29.8%); Computer (desktop or laptop) - 18 (31.6%); Television or Film - 21 (36.8%); Radio - 17 (29.8%) and; "All the above" category, there were 22 (38.6%) responses generated. Whereas in the case of the "none of the above" there were 7 (12.3%) responses obtained in this category.

7.6.1 Summary: question six

The results obtained from this analysis showed that, health intermediaries use both verbal and written mode of communication together with the following: mobile phones, tablets, computers such as desktops or laptops, television or films and radio. Also, It was evident that most health intermediaries sampled predominantly, use *mobile phones* and *tablets* as one of the most commonly used platform among all the ICT tools available for communication. Therefore, designing health information and sharing them using these various platforms could help communicate health information to women.

- **Question seven (Q7): What barriers do you experience when communicating information to woman, in a face-to-face situation, before, during and after pregnancy?**

The purpose for this question was to identify the kind of barriers that are commonly experienced by health intermediaries, when communicating health information with women. Feedback obtained from respondents helped to identify areas where visual communication can be used to supplement or replace verbal instruction. Here again, the respondents have the option to tick more than one response. Therefore, for each category, there is a possibility for it to be selected more than once by respondents. The feedback from the respondents were analysed by comparing the various backgrounds of the health intermediaries with the results obtained.

- **Question Seven (Q7A): Comparing data set obtained with their current occupation**

A considerable amount of feedback was obtained from health intermediaries who received the user surveys. As such, the information obtained in relation to the possible barriers of communication was analysed by comparing the data with the biodata of the health intermediaries. The feedback that was obtained from the analysis is represented in the diagram below (**Figure 7.10)**.

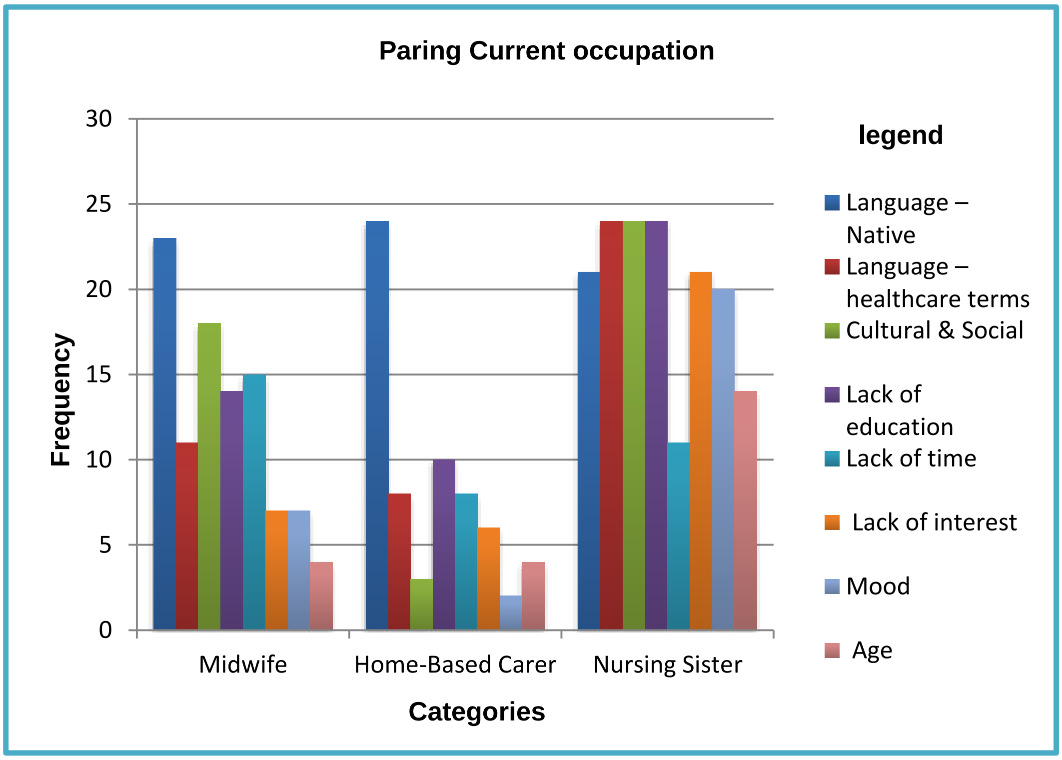


Figure 7.10: Current occupation – communication barrier

Midwifes

The responses obtained from midwives regarding barriers to communication are as follows: Language (different home languages) - 23 (82.1%); Lack of understanding of healthcare terms - 11 (39.3%); Cultural and social (different cultural, religious beliefs and experiences) - 18 (64.3%); Lack of education - 14 (50%); lack of time (insufficient time to explain fully) - 15 (53.6%); Lack of interest - 7 (25.0%); Emotional/ mood - 7(25.0%); and Age - 4(14.3%).

Home-Based Carer (HBC)

The results obtained from home-based carers regarding communication barriers are the following: Language (different home languages) - 24 (75.0 %); Lack of understanding of healthcare terms - 8 (25.0%); Cultural and social (different cultural, religious beliefs and experiences) - 3 (9.4%); Lack of education - 10 (31%); lack of time (insufficient time to explain fully) - 8 (25.0%); Lack of interest - 6 (18.8%); Emotional/ mood - 2 (6.3%); and Age - 4(12.5%).

Nursing sisters

Nursing sisters indicated these responses: Language (different home languages) - 21 (65.6 %); Lack of understanding of healthcare terms - 24 (75.0%); Cultural – (different cultural, religious beliefs and experiences) - 24 (75.0%); Lack of education - 24 (75.0%); Lack of time (insufficient time to explain fully) - 11 (34.4%); Lack of interest - 21 (65.6%); Emotional/ mood - 20 (62. 5%) and Age - 14(43.8%).

- **Question Seven (Q7B). Paring data with sector of employment (a public or private worker)**

The possible communication barriers as obtained from the field data were further evaluated by paring the responses obtained with the sector of employment (public/private). This inquiry was to ascertain the particular sector in which health intermediaries often experience some of the barriers to communication. The results obtained from the analyses are represented in the subsequent diagram (Figure 7.11).

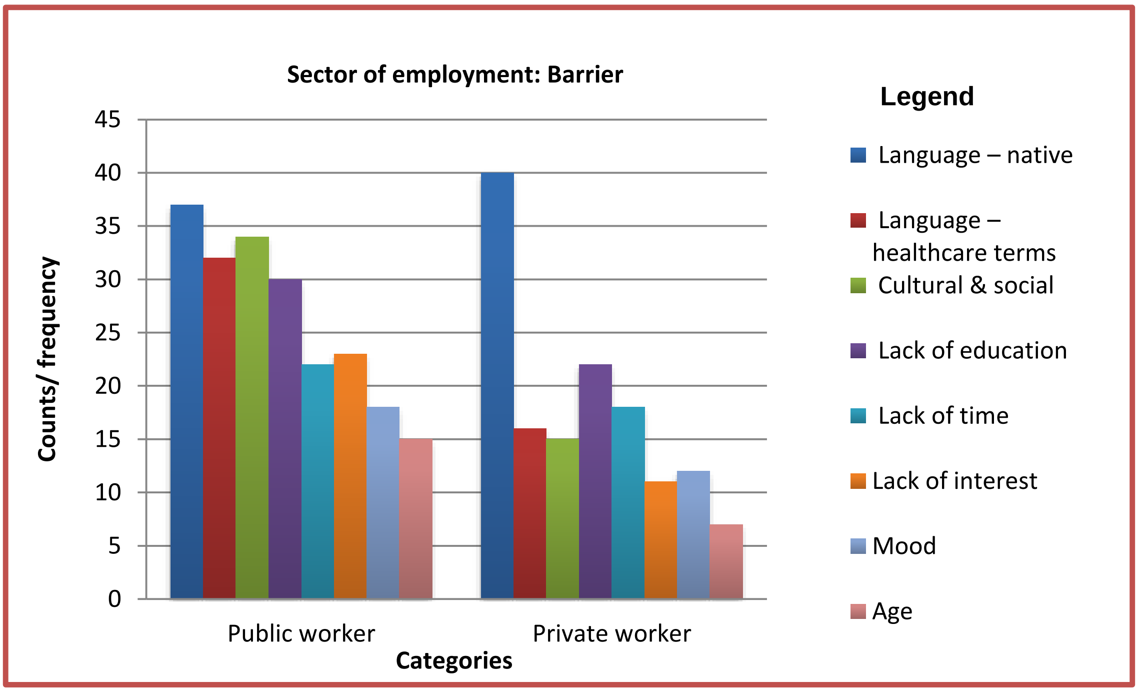


Figure 7.11: Sector of employment – communication barrier

Public workers

The public workers who participated, indicated their responses as follows: Language (different home languages) 37 (75.5%); Lack of understanding of healthcare terms - 32 (65.3%); Cultural and social (different cultural and religious beliefs and experiences) - 34 (69.4%); Lack of education - 30 (61.2%); lack of time (insufficient time to explain fully) - 22 (44.9%); Lack of interest - 23 (46.9%); Emotional/ mood - 18 (36. 7%); and Age - 15 (30.6%).

Private workers

The responses obtained from private health intermediaries in this case are: Language (different home languages) - 40 (70.2%); Lack of understanding of healthcare terms - 16 (28.1%); Cultural - (different cultural and religious beliefs and experiences) - 15 (26.3%); Lack of education - 22 (38.65%); lack of time (insufficient time to explain fully) - 18 (31.6%); Lack of interest - 11 (19.3%); Emotional/ mood - 12 (21.1%); and Age - 7 (12.3%).

- **Question Seven (Q7C): Paring data with employment status**

The responses obtained from health intermediaries were further analysed by pairing it with their employment status. The categories were employed or self-employed which were paired with the communication barriers identified. The feedback obtained from respondents are indicated in the diagram below (Figure 7.12).

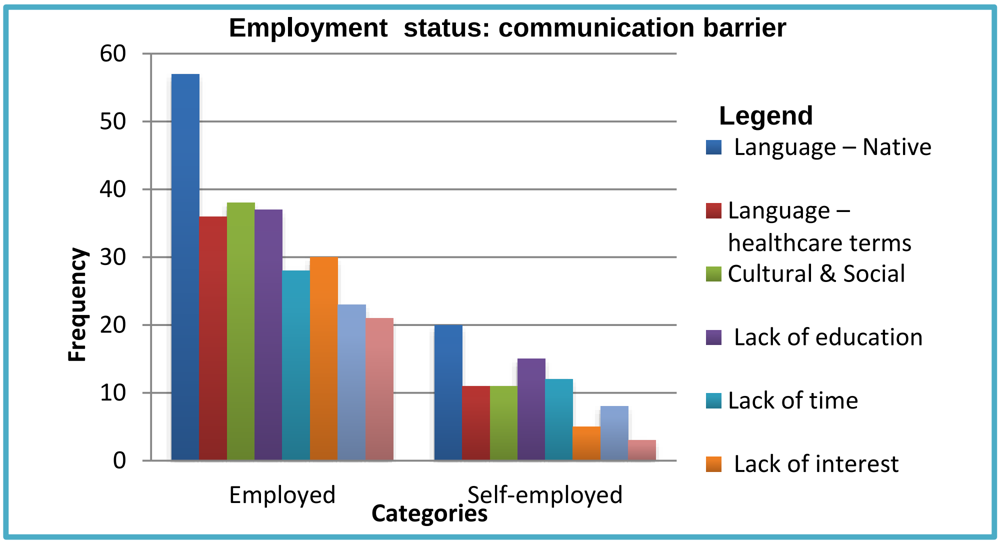


Figure 7.12: Employment status – communication barrier

Employed

The employment status which is stated as: "*Employed*" in this analysis refers to any healthcare worker who is employed by any health organisation in South Africa. The results from the statistical analysis is as follows: Language (different home languages) - 57 (75.0%); Lack of understanding of healthcare terms - 36 (47.4%); Cultural and social (different cultural, religious beliefs and experiences) - 38 (50.0%); Lack of education - 37 (48.7%); Lack of time (insufficient time to explain fully) - 28 (36.68%); Lack of interest - 30 (39.5%); Emotional/ mood - 23 (30.3%) and Age - 21 (27.6%).

Self-employed

The employment status, which is stated as: "*Self Employed*" in this analysis refers to any healthcare intermediaries who are self-employed but might be working for other health organisations in South Africa. The results from the statistical analysis is as follows: Language (different home languages) - 20 (66.7%); Lack of understanding of healthcare terms - 11 (36.7%); Cultural and social (different cultural, religious beliefs and experiences) - 11 (36.7%); Lack of education - 15 (50.0%); lack of time (insufficient time to explain fully) - 12 (40.0%); Lack of interest - 5 (16.7%); Emotional/ mood - 8 (26.7%); and Age - 3 (10.0%).

Question seven (Q7D): Paring data obtained with the unit of employment

The feedback obtained in this case, was analysed by comparing it with the various communication barriers and the unit of work. This analysis was done to identify the various units where communication barriers can be identified. The results have been graphically presented in the diagram that follows (Figure 7.13).

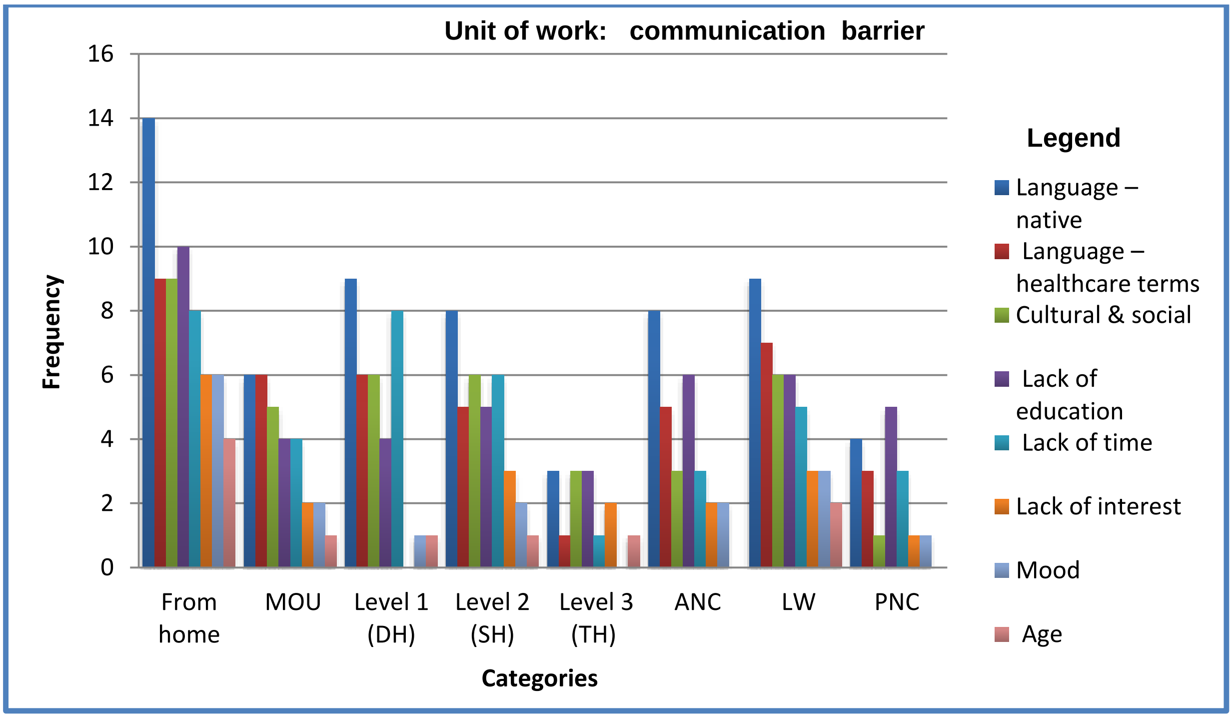


Figure 7.13: Unit of work – communication barrier

Unit: From home

In analysing the data with the unit of employment, Health intermediaries working *from home*, indicated these feedback which is indicated as follows: Language (different home languages) - 14 (23.0%); Lack of understanding of healthcare terms - 9 (21.4%); Cultural and social (different cultural, religious beliefs and experiences) - 9 (23.1%); Lack of education - 10 (23.3%); lack of time (insufficient time to explain fully) -

8 (21.1%); Lack of interest - 6 (31.6%); Emotional/ mood - 6 (35.3%); and Age - 4 (40.0%).

Unit: Midwifery Obstetric Unit (MOU)

Health intermediaries working from the MOU indicated the following responses: Language (different home languages) - 6 (9.8%); Lack of understanding of healthcare terms - 6 (14.3%); Cultural and social (different cultural, religious beliefs and experiences) - 5 (12.8%); Lack of education - 4 (9.3%); lack of time (insufficient time to explain fully) - 4 (10.5%); Lack of interest - 2 (10.5%); Emotional / mood - 2 (11.8%); and Age - 1 (10.0%).

Unit: Level 1 (District Hospital [DH])

Health intermediaries working from the **Unit** – **level 1 (DH)** indicated the following responses: Language (different home languages) - 9 (14.8%); Lack of understanding of healthcare terms - 6 (14.3%); Cultural and social (different cultural, religious beliefs and experiences) - 6 (15.4%); Lack of education - 4 (9.3%); lack of time (insufficient time to explain fully) - 8 (21.1%); no response was obtained in the Lack of interest category as a result of this a null set was obtained. Whereas in the case of Emotional/ mood - 1 (5.9%) and Age - 1 (10.0%) was recorded.

Unit: Level 2 (Secondary Hospital [SH])

Health intermediaries working from the **Unit** – **level 2 (SH)** indicated the following feedback: Language (different home languages) - 8 (13.1%); Lack of understanding of healthcare terms - 5 (11.9%); Cultural - (different cultural, religious beliefs and experiences) - 6 (15.4%); Lack of education - 5 (11.6%); lack of time - (insufficient time to explain fully) - 6 (15.8%); Lack of interest - 3 (15.8%); Emotional/ mood - 2 (11.8%) and Age - 1 (10.0%).

Unit: Level 3 (Tertiary Hospital [TH])

Health intermediaries working from the **Unit** – **level 3 (TH)** indicated the following responses: Language (different home languages) - 3 (4.9%); Lack of understanding of healthcare terms - 1 (2.4%); Cultural - (different cultural, religious beliefs and experiences) - 3 (7.7%); Lack of education - 3 (7.0%); lack of time - (insufficient time to explain fully) - 1 (2.6%); Lack of interest - 2 (10.5%); No feedback was obtained from this Emotional/ mood category and therefore a null set was obtained; Age - 1 (10.0%) .

Unit: Antenatal Clinic (ANC)

Health intermediaries working within the **Unit** – **ANC** indicated the following: Language (different home languages) - 8 (13.1%); Lack of understanding of healthcare terms - 5 (11.9%); Cultural - (different cultural and religious beliefs and experiences) - 3 (7.7%); Lack of education 6 (14.0%); lack of time - (insufficient time to explain fully) - 3 (7.9%); Lack of interest 2 (10.5%); Emotional/ mood - 2 (11.8%); and in the case of Age, a null set was recorded because no feedback was obtained in this category.

Unit: Labour Ward (LW)

Health intermediaries working within the **Unit** – **LW** indicated the following responses: Language (different home languages) 9 (14.8%); Lack of understanding of healthcare terms - 7 (16.7%); Cultural (different cultural and religious beliefs and experiences) - 6 (15.4%); Lack of education 6 (14.0%); lack of time - (insufficient time to explain fully) - 5 (13.2%); Lack of interest 3 (15.8%); Emotional/ mood - 3 (17.6%); Age 2 (20.0%).

Unit: Postnatal Clinic (PNC)

Health intermediaries working within the **Unit** – **PNC** indicated the following responses: Language (different home languages) - 3 (7.1%); Lack of understanding of healthcare terms - 1 (2.6%); Cultural - (different cultural and religious beliefs and experiences) - 5 (11.6%); Lack of education - 5 (11.6%); Lack of time - (insufficient time to explain fully) - 3 (7.9%); Lack of interest 1 (5.3%); Emotional/ mood - 1 (5.9%); In the case of Age: a null set was recorded because no feedback was obtained in this category.

- **Question Seven (Q7E): Paring years of experience with communication barriers**

The responses obtained from the analysis regarding the barriers to communication during interactions between health intermediaries and their patients is described in this section. The feedback was analysed by pairing it with respondents' years of experience and the feedback obtained to this question. The results obtained from the statistical analysis are captured in the graphically below (Figure 7.14).

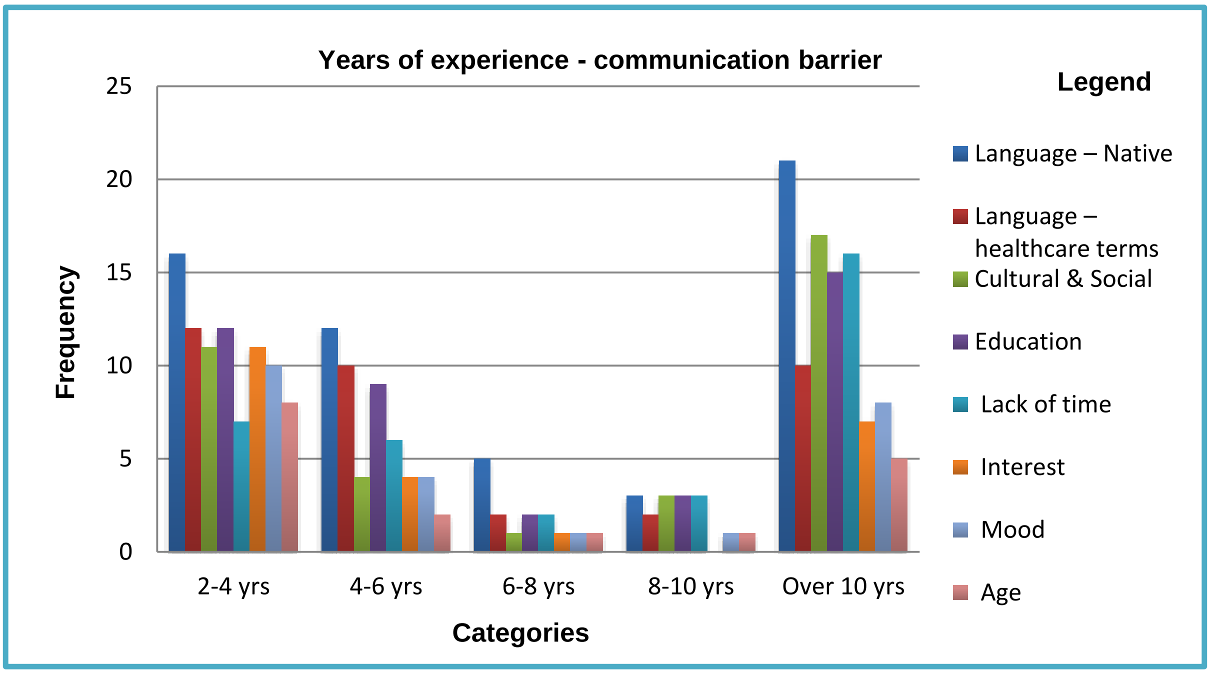


Figure 7.14: Years of experience – communication barrier

Under 2 years

The results obtained from health intermediaries with under **2 years** of experience indicated these results: Language (different home languages) 22 (78.6%); Lack of understanding of healthcare terms -14 (50.0%); Cultural - (different cultural and religious beliefs and experiences) - 16 (57.1%); Lack of education 13 (46.4%); lack of time - (insufficient time to explain fully) - 8 (28.6%); Lack of interest - 14 (50.0%); Emotional/ mood - 9 (32.1%) and; Age – 7 (25.0%).

Under 2 to 4 years

The results obtained from health intermediaries with under **2 to 4years** of experience are: Language (different home languages) 16 (61.5%); Lack of understanding of healthcare terms - 12 (46.2%); Cultural and social - (different cultural, religious beliefs and experiences) - 11 (42.3%); Lack of education 12 (46.2%); Lack of time - (insufficient time to explain fully) - 7 (26.9%); Lack of interest 11 (42.3%); Emotional/ mood - 10 (38.5%); Age 8 (30.8%).

Under 2 to 6 years

Health intermediaries with under **2 to 6years** of experience indicated these responses: Language (different home languages) 12 (75.0%); Lack of understanding of healthcare terms - 10 (62.5%); Cultural and social (different cultural and religious beliefs and experiences) - 4 (25.0%); Lack of education 9 (56.3%); lack of time - (insufficient time to explain fully) - 6 (37.5%); Lack of interest 4 (25.0%); Emotional/ mood - 4 (25.0%); Age 2 (12.5%).

6 to 8 years

The results obtained from health intermediaries with **6 to 8 years** of experience are: Language (different home languages) 5 (100%); Lack of understanding of healthcare terms - 2 (40.0%); Cultural and social (different cultural and religious beliefs and experiences) - 1 (20.0%); Lack of education 2 (40.0%); lack of time - (insufficient time to explain fully) - 2 (40.0%); Lack of interest 1 (20.0%); Emotional/ mood - 1 (20.0%); Age 1 (20.0%).

8 to 10 years

Participants with **8 to 10 years** of experience provided the following responses: Language (different home languages) 3 (60.0 %); Lack of understanding of healthcare terms - 2 (40.0%); Cultural and social (different cultural and religious beliefs and experiences) - 3 (60.0%); Lack of education 3 (60.0%); Lack of time - (insufficient time to explain fully) - 3 (60.0%); Lack of interest: a null set was recorded in this category because no feedback was obtained; Emotional/ mood -1 (20.0%); Age 1 (20.0%).

Over 10 years

The results obtained from health intermediaries with over **10 years** of experience are: Language (different home languages) 21 (72.4 %); Lack of understanding of healthcare terms - 10 (34.5%); Cultural and social (different cultural, religious beliefs and experiences) - 17 (58.6%); Lack of education 15 (51.7%); lack of time -

(insufficient time to explain fully) - 16 (55.2%); Lack of interest 7 (24.1%); Emotional/ mood - 8 (27.6%); Age 5 (17.2%).

- **Question seven (Q7F): summary of feedback obtained from open sections**

Further, the health intermediaries who provided responses to this question stated, "Knowledge deficit of the patient's own anatomy" is a major factor as a communication barrier. Also, respondents expressed that; lack *of understanding* in the medical profession on the importance of breastfeeding and the duration thereof; old wives tales, cultural boundaries, taboos and social pressures are some of the barriers experienced during interaction with their patients (mothers).

7.6.2 Summary: Question Seven

Feedback from this question was analysed by comparing the biodata of health intermediaries with the responses obtained from the possible communication barriers, which persist in the professional practice of health intermediaries. The statistical analysis from the various categories revealed that the presence of *many native languages* is a major barrier to communication. This barrier disrupts the efficient communication of health information to women in underserved contexts. Other indicators, such as *language (healthcare terms), lack of education, social cultural factors, lack of interest* and *time* was identified as the additional barriers to communication between health intermediaries and women.

- **Question Eight (Q8): In which areas of women's healthcare do you think other communication tools are suited to supplement or replace verbal communication?**

The probing was to ascertain the specific stage in women's health where a specific communication tool will be required to supplement or replace verbal instruction. The responses obtained in this question (Q8), was analysed by pairing the present *occupation* and the various *units of care* where health intermediaries operate(Figure 7.15). The specific periods in women's health that the health intermediaries provided responses is as follows: Pre-Conception Care (PCC), Antenatal Care (ANC), Intra-Natal Period (INP), Post-Natal Period (PNP) and Neo-Natal Period (NNP).

- **Question eight (Q8A): Pairing data set with current occupation**

In this segment, responses obtained were analysed by comparing the feedback obtained from the selected health intermediaries with the various units in women's health. This inquiry was to obtain the views of participating health intermediaries and the periods in women's health where communication tools are suitable.

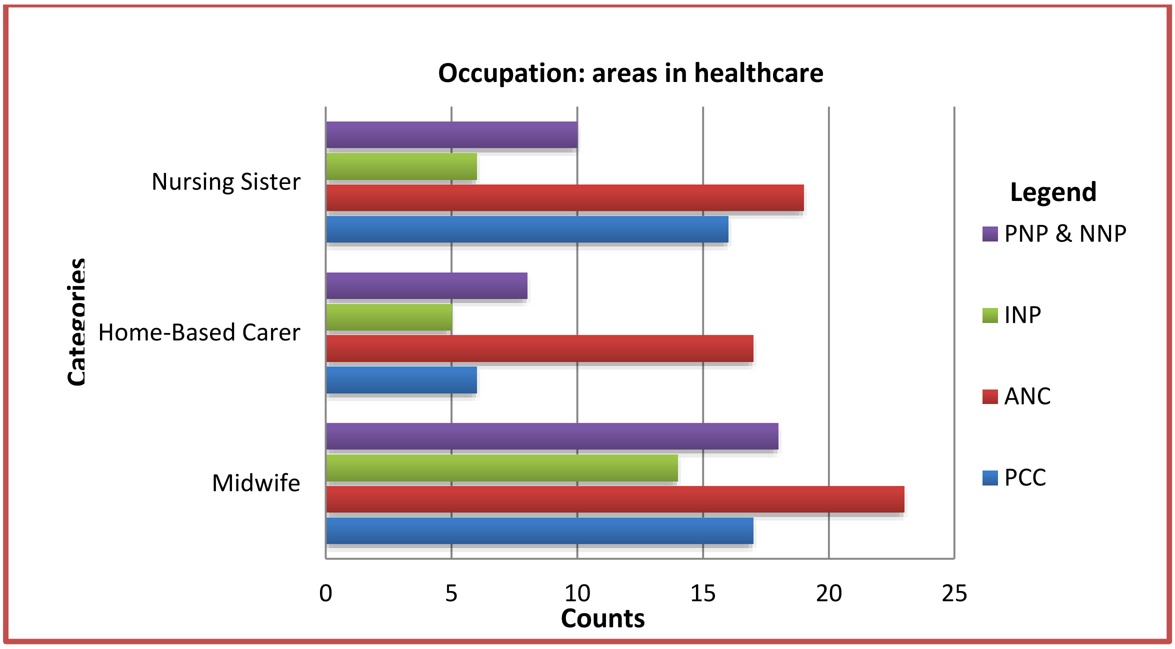


Figure 7.15: Occupation – areas in healthcare

Midwife

In responding to this question, midwives provided the following responses: PCC - 17 (60.7%); ANC - 23 (82.1%); INP - 14 (50.0%) and PNP & NNP - 18 (64.3%). Based on the responses provided by midwives, ANC and PNP & NNP period obtained the highest scores. The inference from this analysis is that ANC, PNP and NNP are the most significant periods for relevant health information sharing and exchange with mothers. Yet, the ANC period received the highest score in this category.

Home-Based Carers (HBC)

Based on the statistical analysis, HBCs indicated the following responses; PCC - 6 (33.3%); ANC - 17 (94.4%); INP - 5 (27.8%) and PNP & NNP - 8 (44.4%). In this analysis, HBCs indicated that ANC, PNP & NNP are very significant periods to provide information to women. Still, ANC period become the most significant period in maternal care where mothers require relevant health information.

Nursing Sister

Nursing sisters, who responded to this question, provided these responses: PCC - 16 (61.5%); ANC - 19 (73.1%); INP - 6 (23.1%) and PNP & NNP - 10 (38.5%). The result from this case indicates that ANC and PCC are very significant areas to provide information to women. Regardless, ANC period recorded the highest responses among the nursing sisters who participated in this investigation. This implies that ANC period is the critical stage for mothers to obtain relevant information to care for themselves and their children.

- **Question eight (Q8B): Pairing data set with sector of employment (Public or Private sector)**

A further analysis was conducted where the responses obtained on the various periods in women's health was paired with the sector of employment (public or private) of health intermediaries. The purpose was to ascertain any similarities or differences in the results obtained from the subsequent analysis (Figure 7.16).

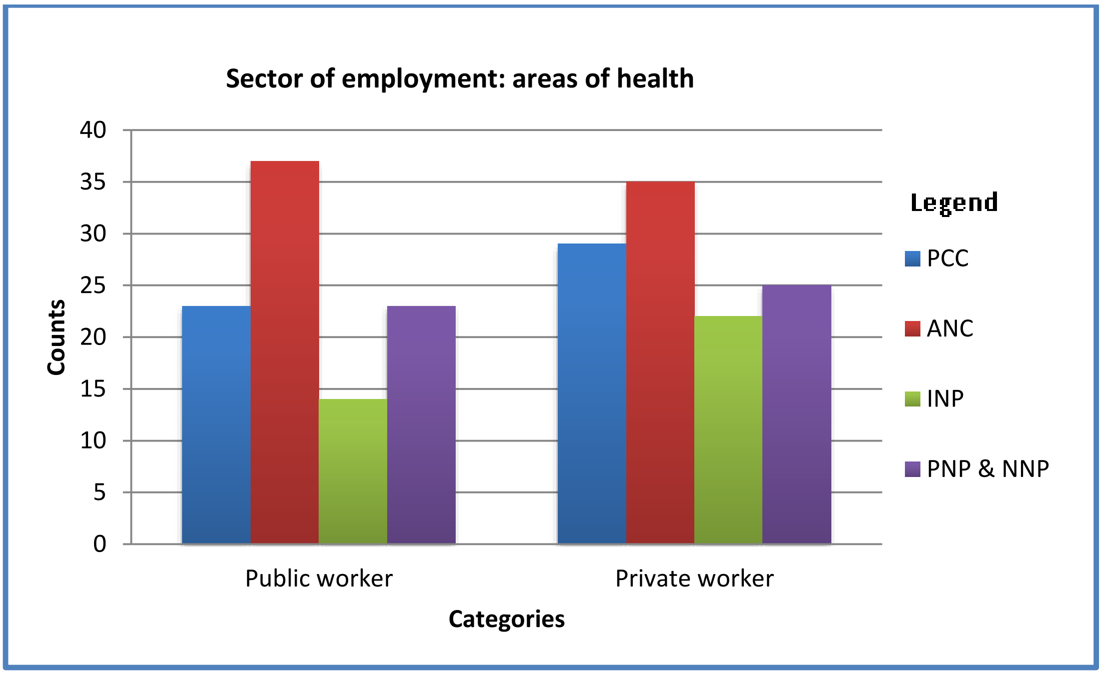


Figure 7.16: Sector of employment – areas in healthcare

Public worker

Public workers who provided responses to this question indicated these results: PCC - 23 (54.8%); ANC - 37 (88.1%); INP - 14 (33.3%) and PNP & NNP - 23 (38.5%). The result from this case indicates that PCC, ANC and PNP & NNP are all relevant areas in women's health where information must be provided to women. Yet, ANC received the highest score regarding the period in women's health, which required relevant information.

Private worker

Public workers who provided responses to this question indicated the following results from the analysis: PCC - 29 (65.9%); ANC - 35 (79.5%); INP - 22 (50.0%) and PNP & NNP - 25 (56.8%). Although the other areas obtained significant feedback, ANC and PCC periods obtained the highest responses. However, ANC recorded the highest response among all the categories, which indicates the period as the most significant area to provide information.

- **Question Eight (Q8C): Paring data set with unit of work**

The various units of health intermediaries were analysed by comparing it with the stated periods in women's health. This analysis was to provide a much deeper insight into the various periods in women's health where suitable communication tools would be required to supplement or replace verbal instruction. The results obtained from the statistical analysis to this question are indicated below (Figure 7.17).

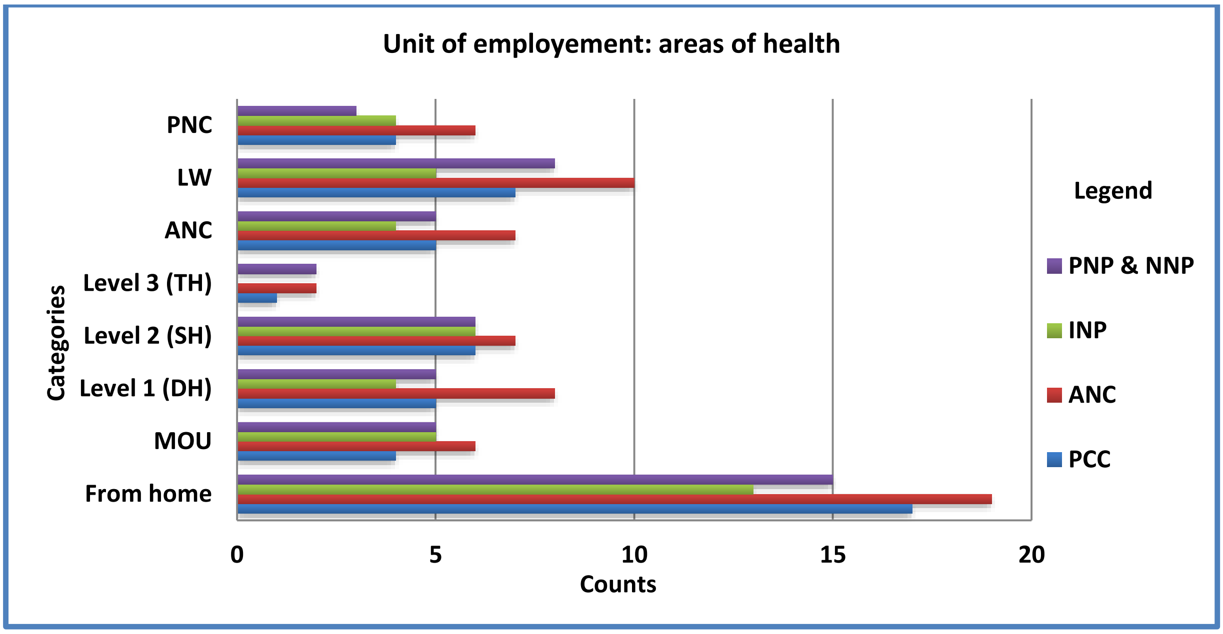


Figure 7.17: Unit of employment – areas of healthcare

Unit: From home

Health intermediaries working *from home* provided these responses: PNC - 17 (34.7%); ANC - 19 (29.2%); INP - 13 (31.7%) and PNP & NNP - 15 (30.6%). Based on the number of responses obtained, ANC category received the highest feedback. The inference that could be made from this analysis is that, Antenatal period is one of the critical areas in women's where information objects would be required to supplement or replace verbal instruction.

Unit: Midwifery Obstetric Unit (MOU)

Health intermediaries working from *MOU* provided the following responses: PCC - 4 (8.2%); ANC - 6 (9.2%); INP - 5 (12.2%) and PNP & NNP - 5 (10.2%). ANC period recorded the highest response in this category making the most significant period to provide information to mothers.

Unit: Level 1 (District Hospital [DH])

Health intermediaries working *from DH* provided these responses: PCC - 5 (10.2%); ANC - 8 (12.3%); INP - 4 (9.8%) and PNP & NNP - 5 (10.2%). The results show that ANC period recorded the highest response from *Level 1(DH)* health intermediaries.

Unit: Level 2 (Secondary hospital)

Health intermediaries working *from Level 2 (SH)* provided these responses: PCC - 6 (12.2%); ANC - 7 (10.8%); INP - 6 (14.6%) and PNP & NNP - 6 (12.2%). Based on the feedback obtained, ANC period received the highest responses in this category.

Unit: Level 3 (Tertiary Hospital [TH])

In the Level 3 Tertiary Hospital (TH), health intermediaries who are allocated within this particular unit responded as follows: PCC - 1 (2.0%); ANC - 2 (3.1%); INP: no feedback was obtained in this category, therefore a null set was obtained; PNP & NNP - 2 (4.1%). Although few people responded from Level 3 (TH), ANC period recorded the highest responses in this category.

Unit: Antenatal Unit (ANC)

Health intermediaries working in the ANC unit provided the following responses: PCC - 5 (10.2%); ANC - 7 (10.8%); INP - 4 (9.8%); PNP & NNP - 5 (10.2%). In this statistical analysis ANC period recorded the highest feedback making it the most critical period to provide health information to mothers.

Unit: Labour Ward (LW)

Respondents who work in the *Labour ward* provided the following responses: PCC - 7 (14.3%); ANC - 10 (15.4%); INP - 5 (12.2%); PNP & NNP - 8 (16.3%). ANC obtained the highest responses in this category, which shows that providing information during this period is very relevant for women's health.

Unit: Postnatal Clinic (PNC)

Health intermediaries in the *postnatal clinic* provided the following responses: PCC - 4 (8.2%); ANC - 6 (9.2%); INP - 4 (9.8%); PNP & NNP - 3 (6.1%). ANC obtained the highest responses in this category, which shows that providing information during this period is very relevant for women's health.

- **Question Eight (Q8D): Pairing data set with years of experience**

The data obtained for this question was paired with the years of experience of health intermediaries. The purpose was to find out whether there will be any significant difference based on the years of experience of health intermediaries and the periods in women's health where information is required (Figure 7.18).

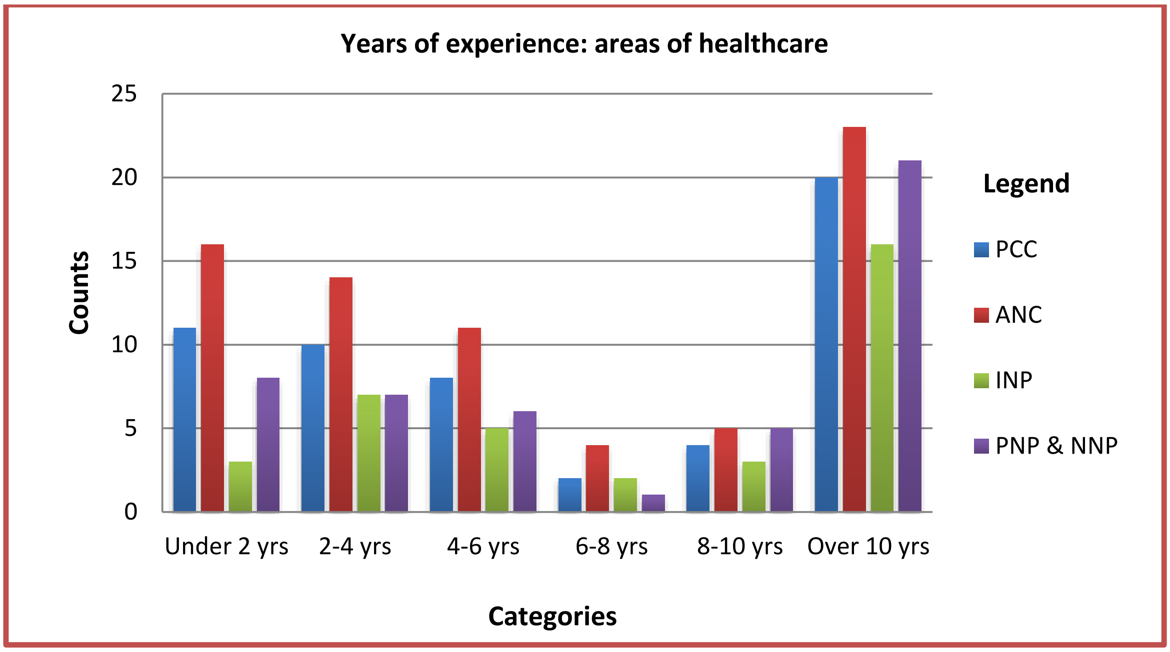


Figure 7.18: Years of experience – areas of healthcare

Under 2 years

Health intermediaries in the *postnatal clinic* provided the following responses: PCC 11 - (47.8%); ANC - 16 (69.6%); INP - 3 (13.0%); PNP & NNP - 8 (34.8%). Within this category, ANC period recorded the highest response.

2 to 4years

Health intermediaries in the *postnatal clinic* provided the following responses: PCC - 10 (66.7%); ANC - 14 (93.3%); INP 7 - (46.7%); PNP & NNP - 7 (46.7%). The statistics indicated here shows that ANC period is a very critical point to give information to women.

4 to 6 years

Respondents with 4 to 6 years of provided the following responses: PCC - 8 (66.7%); ANC - 11 (91.7%); INP - 5 (41.7%); PNP & NNP - 6 (50.0%). Within this category, ANC period recorded the highest response.

6 to 8 years

The feedback obtained from health intermediaries with 6 to 8 years of experience is as follows: PCC - 2 (50.0%); ANC - 4 (100%); INP - 2 (50.0%); PNP & NNP - 1 (25.0%). Based on the results ANC period recorded the highest response in this category.

8 to 10 years

Responses obtained from health intermediaries with 8 to 10 years of experience are as follows: PCC - 4 (80.0%); ANC - 5 (100%); INP - 3 (60.0%); PNP & NNP - 5 (100.0%). ANC and PNP & NNP obtained the highest responses. The inference is that, these three categories are important periods to provide health information to, mothers.

Over 10 years

The responses obtained from health intermediaries in this category are: PCC - 20 (66.7%); ANC - 23 (76.7%); INP - 16 (53.3%); PNP & NNP - 21 (70.0%). Based on the statistics obtained, ANC period recorded the highest response making it the most critical period to provide mothers with relevant health information.

- **Summary of open parts of question eight (Q8)**

Additionally, health intermediaries who responded indicated, "education for women in all areas of their health such as preconception, antenatal, intranatal, neonatal and postnatal periods will be relevant. Health intermediaries expressed that it will enable women to know and have an understanding of what they will face the first time during labour. This can be achieved using non-commercial websites/ YouTube videos, education at schools and on TV-which is currently on going. In addition, they suggested that any relevant health information object to supplement the information communication process would facilitate information sharing and exchange when educating patients.

7.6.3 Summary: Question Eight

There are various units within women's health where health information will be required to promote health and wellness. As such, it was crucial to find out from the perspective of health intermediaries which areas of women's healthcare might require relevant information objects/ communication tools. Projections are that, these tools could supplement or replace verbal instruction when educating and informing mothers. In all the evaluation and responses generated, it was identified that ANC period received the highest scores of the feedback obtained. However, other relevant areas as indicated by health intermediaries that would require health information are postnatal care, preconception and neonatal periods. Providing health information in these periods would provide relevant information to mothers to make informed decisions for themselves and their children. The findings obtained per the analysis could inform future design considerations towards designing relevant health information objects to facilitate communication in underserved communities.

- **Question nine (Q9A): How do you make health information objects (materials) available to women?**

The goal of this inquiry was to identify the available mediums used by health intermediaries to facilitate information communication. The responses on possible mediums for communication were analysed by pairing it with their various demographics and specialised fields in healthcare. The responses obtained from health intermediaries were paired with the available information communication mediums. The various categories that were used, with its corresponding graphs and description are presented in this section (Figure 7.19–7.23).

- **Question nine (Q9B): Pairing data set with current occupation**

The responses obtained were further analysed by comparing it with the possible information communication objects and the current occupation of the health intermediaries. The analysis was undertaken to identify which particular information communication objects (tools) are the most preferred by the health intermediaries when communicating health information to women (Figure 7.19).

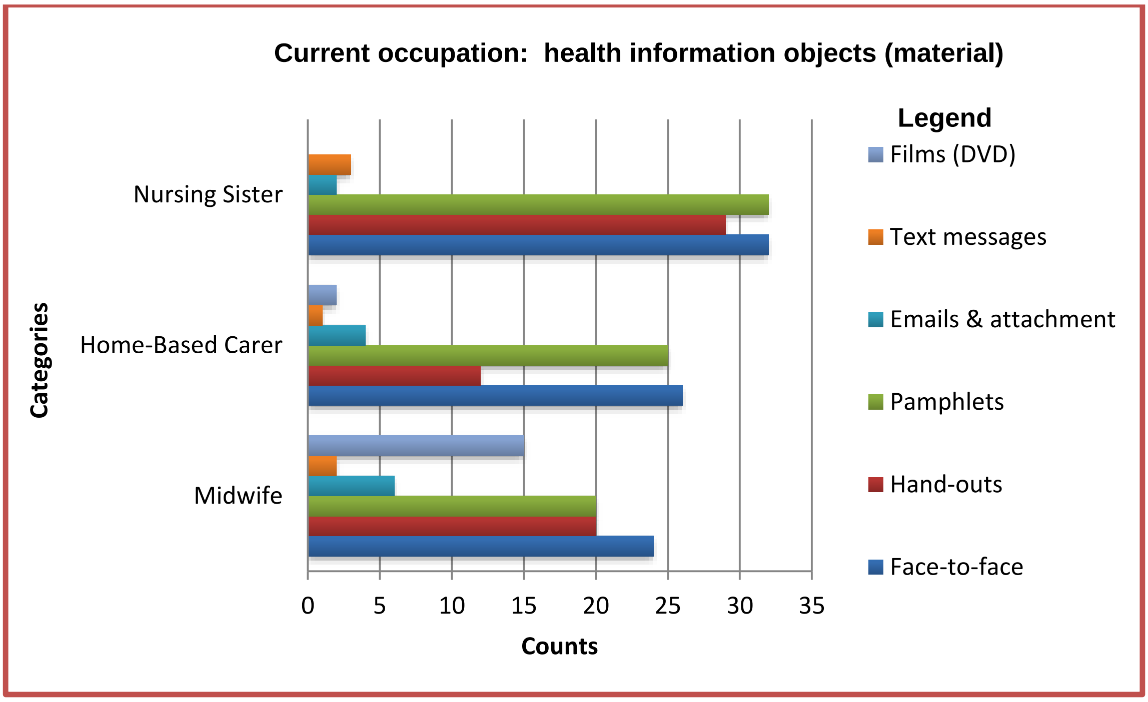


Figure 7.19: Current occupation – health information material

Midwife

The results obtained from the statistics are the following: in the face-to-face situation - 24 (85.7%); Handouts - 20 (71.4%); Pamphlets, Brochures or Leaflets - 20 (71.4%); Posters - 15 (53.6%); Emails with attachments - 6 (21.4%); Text or WhatsApp messages - 2 (7.1%) and Digital Films (DVD) 15 - (53.6%). The results indicated that face-to-face, Handouts and Pamphlets (brochures or leaflets) are the commonest mediums used by midwives to provide health information to women.

Home-Based Carer (HBC)

The results obtained from HBCs in response to this are as follows; face-to-face situation - 26 (83.9%); Handouts - 12 (38.7%); Pamphlets (brochures or leaflets) - 25 (80.6%); Posters - 12 (38.7%); Emails with attachments - 4 (12.9%); Text or WhatsApp messages - 1 (3.2%) and Digital Films (DVD) - 2 (6.5 %). The results showed that face-to-face and pamphlets (brochures or leaflets) are the most predominant modes of communicating with women.

Nursing Sister

The statistical analysis that was done using the feedback from the category of nursing sisters provided the following results; face-to-face situation - 32 (100%); Handouts - 29 (90.6%); Pamphlets (brochures or leaflets) - 32 (100.0%); Posters - 24 (75.0%); Emails with attachments 2 - (6.3%); Text or WhatsApp messages - 3 (9.4%) and in the Digital Films (DVD) category no feedback was obtained in this case therefore a null set was recorded. The face-to-face mode of communication and pamphlets (brochures or leaflets) has been identified as the most predominant modes of communicating with women.

- **Question nine (Q9C): Pairing data set with sector of employment (public or private)**

Further analysis was conducted by paring the data set obtained, with the sector of employment. The data obtained from respondents were paired with the various sectors of employment, which is the *public or private worker category with the* available modes and tools for communication (Figure 7.20).

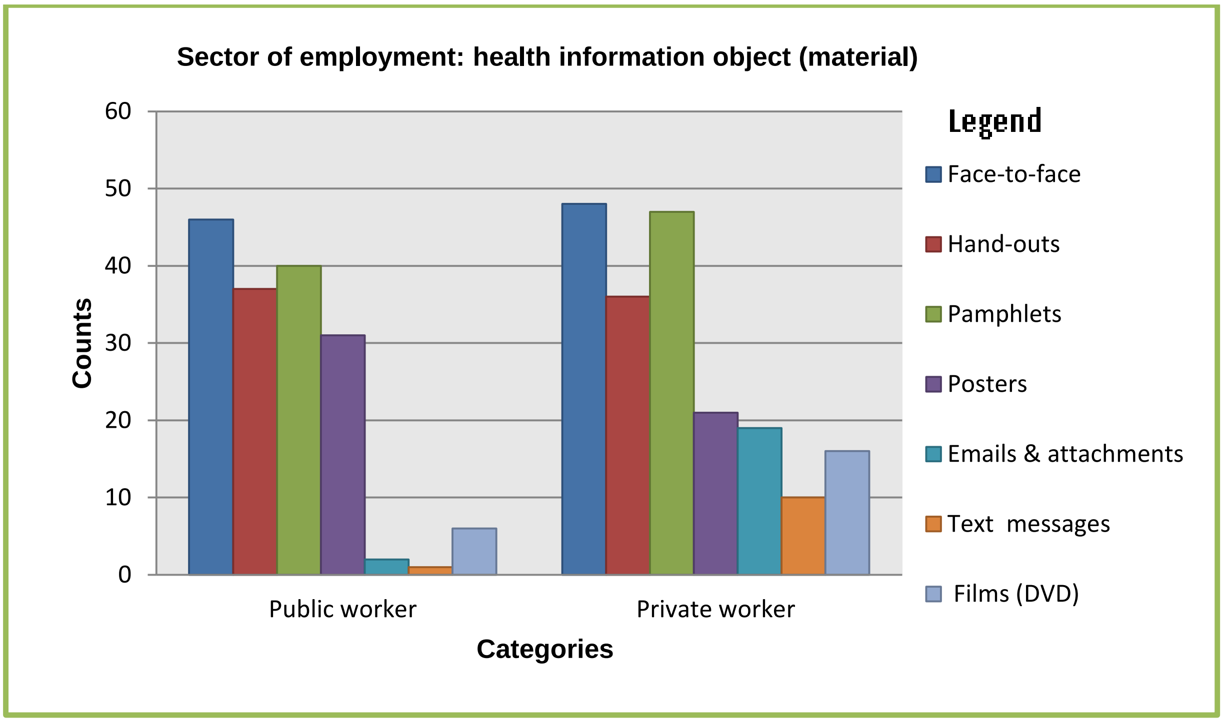


Figure 7.20: Sector of employment – healthcare material

Public worker

The statistical analysis which was conducted based on the feedback obtained from nursing sisters provided the following results; face-to-face situation 46 (93.9%); Handouts - 37 (75.5%); Pamphlets, Brochures or Leaflets - 40 (81.6%); Posters - 31 (63.3%); Emails with attachments - 2 (4.1%); Text or WhatsApp messages - 1(2.0%) and Digital Films (DVD) - 6(12.2%). Communicating using face-to-face and Pamphlets (Brochures or Leaflets) obtained the highest responses in this category.

Private workers

The private workers in healthcare provided the following responses to the question; face-to-face situation - 48 (84.2%); Handouts - 36 (63.2%); Pamphlets (Brochures or Leaflets) - 47 (82.5%); Posters - 21 (36.8%); Emails with attachments - 19 (33.3%); Text or WhatsApp messages - 10 (17.5%); Digital Films (DVD) - 16 (28.1%). Using face-to-face and pamphlets (brochures or leaflets) as a mode of communication obtained the highest response in this category.

Paring data with Employment status (employed, self-employed)

In this category, the data were analysed by evaluating the communication modes and tools with the employment status of respondents. This was aimed at identifying similarities or contrasting results regarding the feedback obtained from respondents (Figure 7.21).

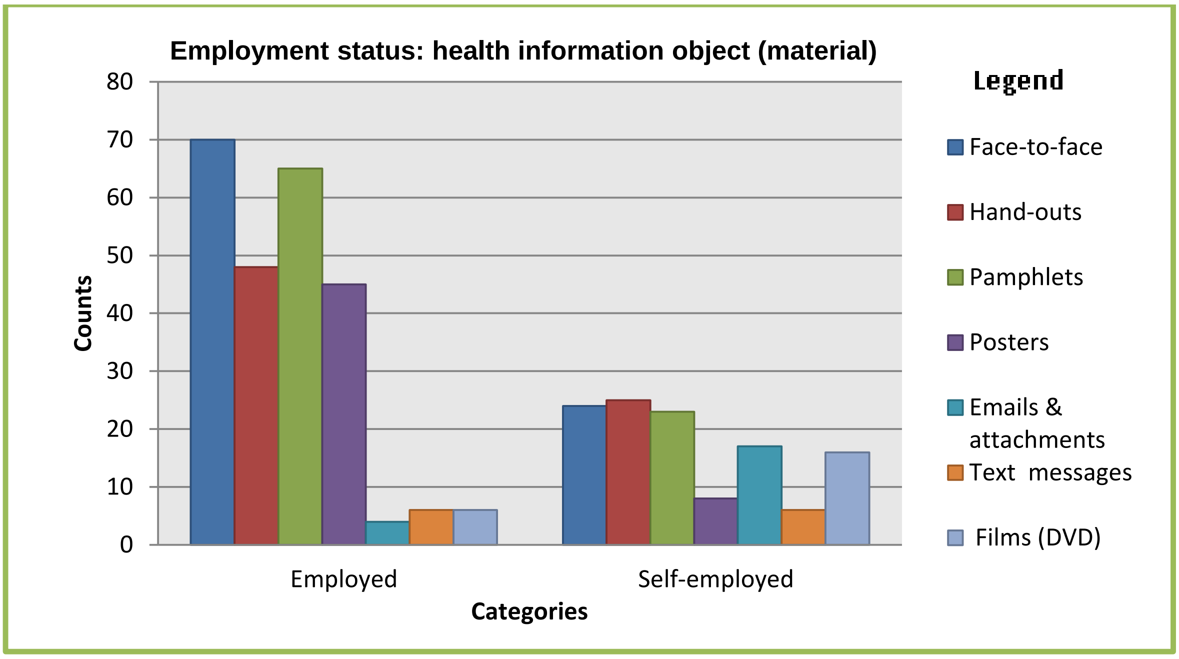


Figure 7.21: Employment status – healthcare material

Employed

Health intermediaries who are employed provided the following responses; face-to-face situation - 70 (92.1%); Handouts - 48 (63.2%); Pamphlets, (Brochures or Leaflets) - 65 (85.5%); Posters - 45 (59.2%); Emails with attachments - 4 (5.3%); Text or WhatsApp messages - 6 (7.9%); Digital Films (DVD) - 6 (7.9%). The categories which received the highest score in the analysis was the combination of face-to-face and Pamphlets (Brochures or Leaflet) as a means for communication.

Self-employed

Health intermediaries who are self-employed responded as follows; face-to-face situation - 24 (80.0%); Handouts - 25 (83.3%); Pamphlets (Brochures or Leaflets) - 23 (76.7%); Posters - 8 (26.7%); Emails with attachments - 17 (56.7%); Text or WhatsApp messages - 6 (20.0%); Digital Films (DVD) - 16 (53. 3%). Using handouts and face-to-face as a medium of communication obtained the highest feedback in this category.

- **Question nine (Q9D): Pairing data set with unit of employment**

The information was further paired with the unit of employment of health intermediaries. The purpose was to identify which of the units in healthcare use a particular mode of communication. The results are graphically presented below (Figure 7.22).

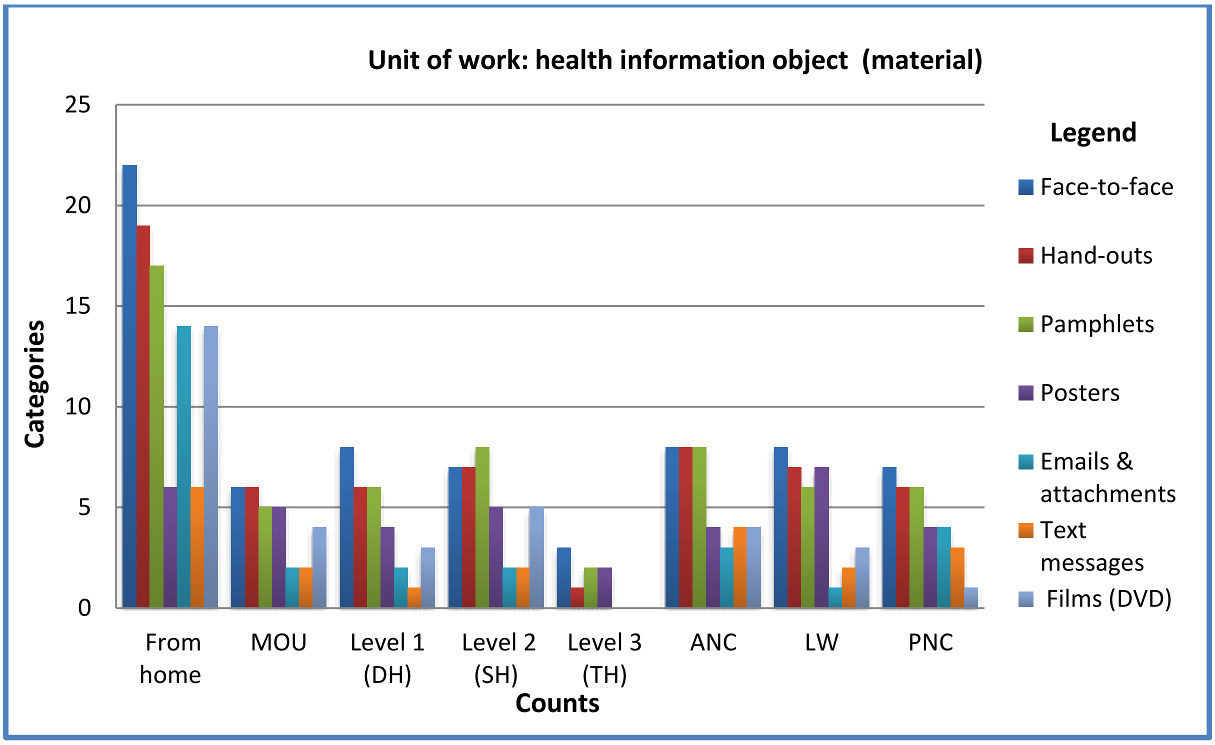


Figure 7.22: Unit of work, health information object (material)

Unit: from home

Health intermediaries working *from home*, provided the following responses; face-to-face situation 22 - (31.9%); Handouts - 19 (31.7%); Pamphlets (Brochures or Leaflets) - 17 (29.3%); Posters 6 - (16.2%); Emails with attachments - 14 (50.0%); Text or WhatsApp messages - 6 (30.0%); Digital Films (DVD) - 14 (41.2%). Health intermediaries working from home use a combination of handouts and face-to-face as their most preferred medium for communication.

Unit: Midwifery Obstetric Unit (MOU)

The respondents who work from the unit – MOU, provided the following responses: face-to-face situation - 6 (8.7%); Handouts - 6 (10.0%); Pamphlets (Brochures or Leaflets) - 5 (8.6%); Posters - 5 (13.5%); Emails with attachments - 2 (7.1%); Text or WhatsApp messages - 2 (10.0%); Digital Films (DVD) - 4 (11.8%). In the MOU at hospitals a combination of face-to-face and handouts was identified as the most preferred medium for communication in this category.

Unit: Level 1 (District Hospital [DH])

Health intermediaries working at the unit - level 1 (DH) provided the following responses: face-to-face situation - 8 (11.6%); Handouts - 6 (10.0%); Pamphlets (Brochures or Leaflets) - 6 (10.3%); Posters - 4 (10.8%); Emails with attachments - 2 (7.1%); Text or WhatsApp messages - 1 (5.0%); Digital Films (DVD) - 3 (8.8%). Face-to-face, Handouts and Pamphlets (Brochures or Leaflets) received the highest response in this category.

Unit: Level 2 (Secondary Hospital [SH])

In the level 2 [SH], health intermediaries provided the following responses: face-to-face situation - 7 (10.1%); Handouts - 7 (11.7%); Pamphlets (Brochures or Leaflets) - 8 (13.8%); Posters - 5 (13.5%); Emails with attachments - 2 (7.1%); Text or WhatsApp messages - 2 (10.0%); Digital Films (DVD) - 5 (14.7%). The outcome of the analysis showed that, face-to-face, handouts and Pamphlets (Brochures or Leaflets) recorded the highest responses in this category.

Unit: Level 3 (Tertiary Hospital [TH])

In the level 3 (TH) health intermediaries provided the following responses: face-to - face situation - 3 (4.3%); Handouts - 1 (1.7%); Pamphlets (Brochures or Leaflets) - 2 (3.4%); Posters - 2 (5.4%); no feedback was obtained in the Emails with attachments, Text or WhatsApp messages and Digital Films (DVD) category as such a null set was obtained.

Unit: Antenatal Clinic (ANC)

Health intermediaries from the ANC unit provided the following responses: face- to-face situation - 8 (11.6%); Handouts - 8 (13.3%); Pamphlets (Brochures or Leaflets) - 8 (13.8%); Posters - 4 (10.8%); Emails with attachments - 3 (10.7%); Text or WhatsApp messages - 4 (20.7%); Digital Films (DVD) - 4 (11.8%). Face-to-face, handouts and Pamphlets (Brochures or Leaflets) recorded the highest responses in this category.

Unit: Labour Ward (LW)

Health intermediaries working from the LW unit provided the following responses: face-to-face situation - 8 (11.6%); Handouts - 7 (11.7%); Pamphlets (Brochures or Leaflets) - 6 (10.3%); Posters - 7 (18.9%); Emails with attachments – 1 (3.6%); Text or WhatsApp messages - 2 (10.0%); Digital Films (DVD) - 3 (8.8%). Face-to-face, handouts and Pamphlets (Brochures or Leaflets) recorded the highest responses in this category.

Unit: Post-Natal Care (PNC)

Health intermediaries from the Labour Ward provided the following responses: face-to-face situation - 7 (10.1%); Handouts - 6 (10.0%); Pamphlets (Brochures or Leaflets) - 6 (10.3%); Posters - 4 (10.8%); Emails with attachments - 4 (14.3%); Text or WhatsApp messages - 3 (15.0%); Digital Films (DVD) - 1 (2.9%). Face-to-face, handouts and Pamphlets (Brochures or Leaflets) recorded the highest responses in this category. Yet face-to-face category recorded the highest feedback, which makes it the most convenient way for health intermediaries to communicate with mothers during PNC period.

- **Question Nine (Q9E): Pairing data set with years of experience**

The responses obtained from health intermediaries were paired in this analysis with the number of years, modes and the tools available for the communication process.

The results obtained from the statistical analysis are presented in the graphic image below (Figure 7.23).

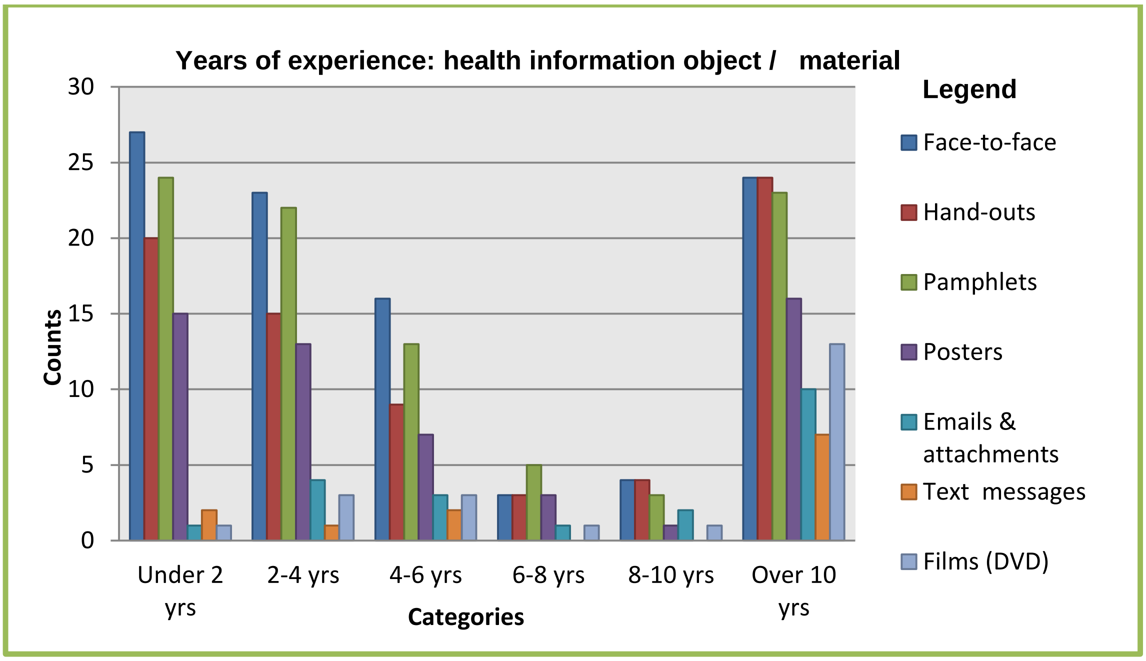


Figure 7.23: Years of experience – healthcare information material

Under 2 years

Health intermediaries with under 2 years of experience provided these responses: face-to-face situation - 27 (96.4%); Handouts - 20 (71.4%); Pamphlets (Brochures or Leaflets) - 24 (85.7%); Posters - 15 (53.6%); Emails with attachments - 1 (3.6%); Text or WhatsApp messages - 2 (7.1%); Digital Films (DVD) - 1 (3.6%). Face-to-face, Handouts and Pamphlets, Brochures or Leaflets recorded the highest responses in this category.

Under 2 to 4 years

Health intermediaries with 2 to 4 years of experience provided these responses: face-to-face situation - 23 (92.0%); Handouts - 15 (60.0%); Pamphlets (Brochures or Leaflets) - 22 (88.0%); Posters - 13 (52.0%); Emails with attachments - 4 (16.0%); Text or WhatsApp messages - 1 (4.0%); Digital Films (DVD) - 3 (12.0%). Face-to-face and Pamphlets (Brochures or Leaflets) recorded the highest responses in this category.

4 to 6 years

Health intermediaries with 4 to 6 years of experience provided these responses: face-to-face situation - 16 (100%); Handouts - 9 (56.3%); Pamphlets (Brochures or Leaflets) - 13 (81.3%); Posters - 7 (43.8%); Emails with attachments - 3 (18.8%); Text or WhatsApp messages - 2 (12.5%); Digital Films (DVD) - 3 (18.8%). Face-to-face, handouts and Pamphlets, Brochures or Leaflets recorded the highest responses in this category.

6 to 8 years

Health intermediaries with 6 to 8 years of experience provided these responses: face-to-face situation - 3 (60.0%); Handouts - 3 (60.0%); Pamphlets, Brochures or Leaflets - 5 (100.0%); Posters - 3 (60.0%); Emails with attachments - 1 (20.0%); Text or WhatsApp messages recorded a null set since no feedback was obtained in this category. Digital Films (DVD) - 3 (18.8%). Face-to-face, handouts and Pamphlets, Brochures or Leaflets recorded the highest responses in this category.

8 to 10 years

Health intermediaries with 8 to 10 years of experience provided these responses: face-to-face situation 4 (80.0%); Handouts 4 (80.0%); Pamphlets, Brochures or Leaflets - 3 (60.0%); Posters - 1 (20.0%); Emails with attachments - 2 (40.0%); Text or WhatsApp messages recorded a null set since no feedback was obtained in this category. Digital Films (DVD) - 1 (20.0%). Face-to-face, handouts and Pamphlets (Brochures or Leaflets) recorded the highest responses in this category.

Over 10 years

Health intermediaries with over 10years of experience provided these responses: face-to-face situation - 24 (80.0%); Handouts - 24 (80.0%); Pamphlets (Brochures or Leaflets) - 23 (76.7%); Posters - 16 (53.3%); Emails with attachments - 10 (33.3%); Text or WhatsApp messages - 7 (23.3%); Digital Films (DVD) - 13 (43.3%). Face-to-face, Handouts and Pamphlets (Brochures or Leaflets) recorded the highest responses in this category.

- **Summary of responses from open parts of Question Nine (Q9): How do you make health information objects (materials) available to women?**

Health intermediaries indicated that they make information available to women when they attend classes. Health education information are provided to women through other sources, processes and tools such as: models, games, quizzes, training films, books (birth books, lending of library books), relevant websites and blog sites, group gatherings, Facebook, radio, Dropbox and through the watching of audio visual materials at the clinics.

7.6.4 Summary: Question Nine

In this question, health intermediaries were to identify the available mediums they make health information available to women. In all the results, it was identified that health intermediaries usually share information to women in a face-to-face situation. Other significant mediums/tools where information is made available to women are through handouts and pamphlets. The findings from the analysis show that face-to-face communication is a viable means for information sharing and exchange between health intermediaries and their patients. Health information objects in print formats such as pamphlets (brochures and leaflets) and electronic formats such as films can be used to compliment face-to-face mode of communication.

- **Question ten (Q10): How would you improve your existing practice in providing health information objects (material) to women?**

Substantial feedback was obtained from health intermediaries who participated in this study. Responses obtained from the participants are summarised and captured in this section. The thematic areas emerging from their responses have been categorised and summarised as follows:

Personal desires of health intermediaries: "I need to move into social communication with ease in the community. This will require more classes and training. The problem is lack of "time" on my part. I will like to educate the women more in the community to promote health and wellness.

Tools: health intermediaries indicated they would like to use tablets, laptops, and computers for interaction. Also, participants indicated they would like to increase the use of mobile technology and other ICT tools in healthcare.

Information desired: relevant visual-based information objects/ tools are needed to facilitate health information dissemination. Also, more health information is required for newborn care and breastfeeding. All relevant health information should be made available in print media such as leaflets, pamphlets, and booklets. Health intermediaries expressed, they will like to change or update some of the already existing health-related information. They expressed that they would like to make more presentations, which is accompanied by print media such as posters, handouts, and pamphlets (brochures and leaflets) at clinics, hospitals, healthcare centres and community.

In addition to this, they expressed that they would like to make use of different kinds of information communication objects facilitated by technology. An improved version of health information/ educational materials with contributions from healthcare workers would facilitate health education activities in their communities. Translating health information into the different spoken languages within the various communities would facilitate information dissemination and patient education. More posters must be available in both words/imagery on certain subjects and the information would have to be updated regularly.

Also, the use of relevant web references is to be provided to facilitate patient education. Available health information should be more practical and simple information to facilitate interaction between care workers and patients. A variety of this information should be provided without language barriers and should be simplified information to make it easier to comprehend. Also, an electronic format of health information is suggested and should be made available on suitable social media platforms and websites that should be updated regularly with relevant information.

Evaluation of health information: additionally, there should be a streamlining of information instead of individual requests. Providing a system that could regulate the information sharing and exchange would facilitate equitable accessibility and provision of information. The information should be evaluated on a regular basis to check for information quality to avoid misinformation.

Multimedia messages: health intermediaries suggested there should be a provision for more information for women (with special needs) on DVDs and other electronic formats, which should contain additional visuals.

Improving healthcare experience in hospitals: further, some of the health intermediaries suggested that patients could watch health information from DVDs while waiting to see their doctor in the healthcare settings. The health topics should cover critical areas of healthcare, before, during and after pregnancy. They suggested that the audio-visual materials should not have boundaries in terms of language for easy accessibility of information and use by mothers in underserved communities.

Continuing Professional Development (CPD)

In responding to these questions, health intermediaries indicated the following responses:

- Health intermediaries indicated they would like to learn more about healthcare practices; acquire practical skills on providing health education to women; enrol for further studies and training; improve health education when attending to people in the various health facilities; be social ready for community healthcare activities.
- In order to achieve the aforementioned goals, some suggestions were made by health intermediaries and these are described as follows: it is suggested that health intermediaries in clinics and hospitals work together to promote health and wellness. They can collaborate on organising regular events and workshops that could promote behavioural change and preventive measures to avoid diseases.
- Also, health intermediaries indicated they would like to improve upon the information they have acquired as part of their training and provide the correct information to their patients and other people who need healthcare.
- Again, health intermediaries expressed that they would like to study in order to gain more experience & knowledge about women's health. Whereas others expressed that they would like to advance their knowledge, gain more experience to teach women about healthcare in their local communities. So that women who do not know much about their health will be better informed. Additional knowledge on how to manage pregnant women during their health education activities in their communities will make them deliver better healthcare services in their communities.
- Other healthcare workers indicated that there is a need to employ more midwives in the 2nd Level hospital (secondary hospital) to improve maternal healthcare services. Women and their families will require more individual care and relevant health information during face-to-face interactions. Health education will enable mothers to live a healthy life for themselves and their children.

Challenges related to patients

Health intermediaries identified some challenges related to mothers and these are as follows:

- There should be better prioritising of maternal issues in clinics so that women can be given the needed attention.
- There is a need to capture mothers earlier in their pregnancy so that follow-ups can be made to minimise mothers coming too late to hospitals as that might lead to complications.
- More support groups are needed for mothers in their communities. These may include; outreach groups; online courses; webinars; planned education sessions, face-to-face interactions, questions and answers sessions, religious or church meetings, more conference exchange to keep-up with current research trends in maternal care.
- In all the above responses provided, one of the healthcare workers expressed that in her opinion, health information provided were sufficient in her healthcare sector. As such the information available was adequate for patient health education in her healthcare setting.

Challenges related to healthcare

The responses obtained from health intermediaries in this category include:

- Lack of time (due to the use of voluntary workers)
- Many private hospitals employ their own lactation consultants; doctors do not refer mothers to us in the community (caregivers) and this poses a challenge for follow-ups
- Young mothers have very little information about breastfeeding and support on maternal birthing in their communities
- Lactation consultants charge a fee, which discourages young parents who are without medical aids or have little money to patronise their services. There is a need for fees to be waived so that mothers can patronise their services. Funding is required to minimise these challenges, which are attainable from donor agencies, government support systems, and other global partners such as WHO and UNICEF.

7.6.5 Summary: Question Ten

The purpose of the inquiry was to investigate how health intermediaries would like to improve their existing practice in providing healthcare information to women. Based on the feedback provided, it was identified that many challenges persist from the perspective of both health intermediaries and patients. The responses were categorised into themes and they are as follows: *Personal Desires of Health Intermediaries; Communication Tools; Information Desired; Continuing Professional Development (CPD); Healthcare and Patient related challenges*. The personal aspirations of health intermediaries among other factors included: getting more educated to better inform mothers. Also, other communication challenges identified include; language barriers; insufficient health information for patient education. There were economic factors such as lack of funding to support mothers for frequent check-ups. Other challenges associated with patients such as late booking by women and lack of patients' interest in health education. Also, there is a lack of relevant health education materials, which undermine health information sharing and exchange. In summary, participants indicated that the provision of adequate funding and relevant health information would help improve their professional practice.

- **Question 11 (Q11): What are the challenges you experienced when communicating health information to women before, during and after pregnancy?**

The responses provided by health intermediaries are summarised thematically based on the themes recurring most. These are categorized and summarised under the following headings:

7.6.6 Summary: Question Eleven

I. Challenges Identified with Care Services: Health Intermediaries' Perspective

Health intermediaries indicated some of the challenges they experience on the personal level when interacting with women in healthcare settings. Some of the challenges identified are described as follows:

- Patients' attitudes towards health intermediaries when educating patients: some mothers are under the misconception that they do not need help and shun the information being delivered.
- Fear of birth before course: most women are afraid of the delivery process even before it occurs, due to preconceived ideas.
- Lack of support in hospitals during pregnancy: women do not always receive the needed support in the various hospitals when seeking medical attention and during the delivery processes.
- There is a challenge of over dependence of clients on their "medical practitioners" without considering other professionals. Mothers could consider other reliable sources in the healthcare system to receive the needed support.
- Greater need for update in obstetricians: healthcare professionals need to upgrade their skills to meet current demands in the profession.
- Time and availability of the women: due to added responsibilities and home duties mothers are unable to avail themselves for routine maternity check-ups.
- Delays in booking for routine maternal care: some women do not book themselves on time or do not want to book at the clinics for routine check-

ups. Also, women do not want to go to the clinic to book on their own due to some psychological factors such as fear and so on. Others are less educated and do not have adequate information about pregnancy and maternity procedures. These women become ignorant about pregnancy care and they often go late for their health visits at clinics, which may lead to medical complications.

- Some doctors and hospitals instil great fear into women and do not inform them of different options for child bearing or provide adequate information on pregnancy care. The situation places these women in a dilemma, giving them the wrong perception about birthing choices.
- Women are often misinformed and therefore tend to trust the wrong information. This may often lead them to take wrong steps to care for themselves.
- Giving no BIAS when hospitals have a high Caesar rates: all women must be given the needed attention to save their lives and that of their children regardless of the demands on caesarean session.
- Discussing fertility desires and their possibilities with doctors: women and their spouses should be made aware of all the fertility possibilities and be allowed to make suitable choices to meet their desires.

II. Information Communication Challenges: Health Intermediaries' Perspective

Additional factors that confront health intermediaries when communicating with women are the following:

- Cultural traditions/barriers/differences, which counteract medical care; lack of interest in health information; fears of medical power/ professionals; lack of time/ personal time to seek medical care; lack of education; language barriers; lack of understanding; and lack of awareness of maternity care and the benefits thereof to women.
- Lack of sufficient time to communicate with a large number of women within a limited space for maternal care.
- The provision of/giving the right information at the right time: providing equitable access to health information to many women at once could be challenging. This is because of the absence of relevant technical support that could make it attainable.
- Lots of information that is not easily accessible: important information is required by women to make informed decisions. Yet, they are not easily accessible to patients due to the limited amount of relevant health information.
- Also there is evidence of insufficient information objects/ materials (e.g. pamphlets), which could be used to educate women about breastfeeding

and taking care of themselves after pregnancy. More health information communication objects would be required to argument patient information.

III. Socio-Cultural Issues

Other factors expressed by health intermediaries are related to socio-cultural factors. Some of the common themes are indicated as follows:

- It is challenging to change the current attitude of women regarding their health and their views ingrained by society. These perceptions are not usually based on health education and their informed views on maternal health. Instead, it is based on cultural and societal norms within their context. This phenomenon has been persistent because: Women are largely influenced by their societies and they often have to conform to the norms and practices. Some women have very little information on pregnancy, which poses a risk to their health. Most of these women do not communicate with their doctors after pregnancy. Also, there is a lack of maternal and child education in some communities. Others have the fear of listening to their doctors or obstetricians as their suggestions might go beyond patients' cultural norms and values.

- *Toolkits and resources*: the availability of the right materials to demonstrate a particular situation is often a challenge as some of the required devices to supplement information are expensive.

- *Establishing trust and confidence in health intermediaries:* women do not always believe their care service providers. This is because they listen and have confidence in the health information they receive from other people and believe it. Also, women do not often listen to health instructions when they interact with health intermediaries. Instead they stick to their own preconceived ideas of what people tell them from elsewhere who might not be professionals. Some of the respondents stated: "women simply do not listen to advice from us as health workers"; "They do not always believe when you explain things to them. They rather believe old people sayings". "They do not listen to you or believe you as a healthcare worker all the time". Also, "they do not concentrate when you share information concerning their personal health. "They follow their own mind"– as expressed by some of the health intermediaries. "Sometimes they are stubborn and do not want to learn anything from health workers, especially when they know some of them are not mothers themselves".

- *Some women are not interested in the information provided by health intermediaries***:** "they are sometimes ignorant about their health and risks associated with some of the actions they take when pregnant". "They have no knowledge about pregnancy and eat unhealthy food, which is not good for their babies". In a few words, women need to be encouraged to get more interested in the health information so that they can be better informed about maternal care.

- *Personal fears and psychological challenges*: some of the women are scared. "They have fears and do not trust health officers". They do not want to book at their local clinics for treatment due to these psychological barriers and personal fears of the unknown in maternal health.

- *Privacy and confidentiality:* women want confidentiality and privacy during maternal care services. Clients who are introverts do not ask or express their needs. Sometimes, language becomes a problem in such situations. There is a lack of interest when talking about their health and preventive measures for younger women who might be pregnant.
- *Language barriers:* diverse languages such as the many South Afrikan languages and other foreign languages (non-South African) can inhibit information communication.
- *Financial support:* high costs of medical care have always been a challenge for most women. They may have to be waived or presented at a minimal fee with support from government.

In brief, there is a need to let the women understand why prenatal care is important, why pregnancy could increase risks if they already have an illness and they must be more careful about their health.

- **Question 12 (Q12): What other communication tools/ devices would you consider using to communicate healthcare information to women before, during and after pregnancy?**

In this inquiry, the objective was to identify what other communication platforms health intermediaries will prefer in communicating information to women during the relevant stages in their health. The response that was obtained regarding the possible communication platforms they will prefer was analysed by comparing it with the biodata of health intermediaries. The results obtained in this analysis are presented in the subsequent Figures (7.24–7.28).

- **Question twelve (Q12A): Pairing data set with occupation**

The responses provided by the health intermediaries were paired with the communication tools/ devices available, with the current occupation (Figure 7.24).

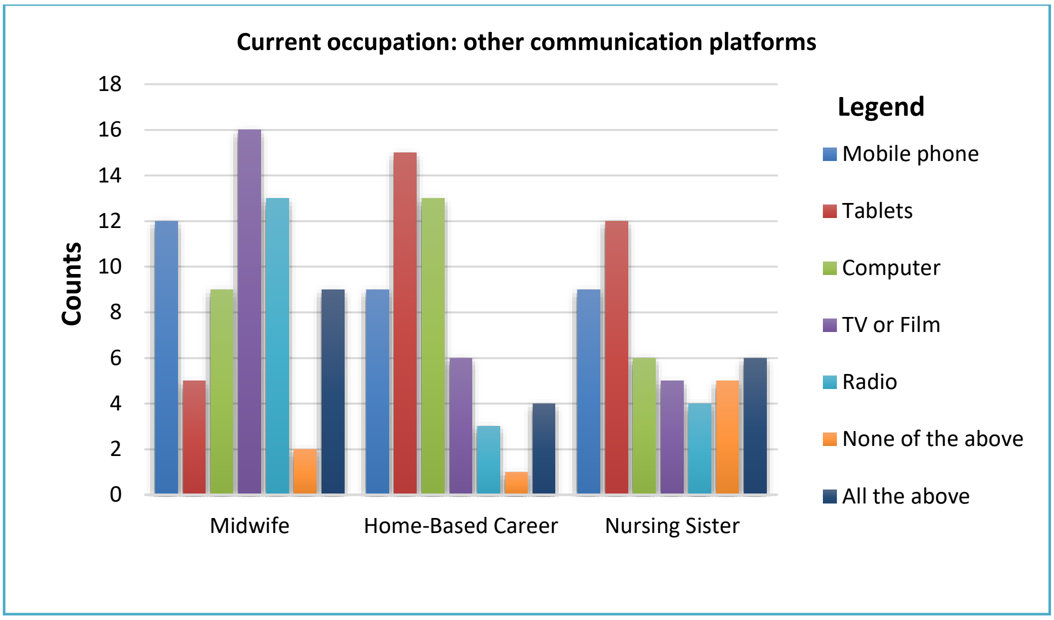


Figure 7.24: Current occupation – other communication platforms

Midwife

In response to this question, the following feedback was obtained from midwives. Mobile phones - 12 (46.2%); Tablets - 5 (19.2%); Computer (desktop/ laptop) - 9 (34.6%); Television or Film - 16 (61.5%); Radio - 13 (50.0%); none of the above - 2 (7.7%); All the above category was - 9 (34.6%). In this analysis Radio and Mobile phones scored the highest, which implies that it is the most preferred tool for communication.

Home-Based Carer (HBC)

In this category, HBCs provided the following responses; Mobile phones - 9 (30.0%); Tablets - 15 (50.0%); Computer (desktop or laptop) - 13 (43.3%); Television or film - 6 (20.0%); Radio 3 (10.0%); none of the above - 1 (3.3%); All the above category was - 4 (13.3%).

Nursing sister

In this category, nursing sisters indicated their interest as follows: Mobile phones - 9 (30.0%); Tablets - 12 (40.0%); Computer (desktop or laptop) - 6 (20.0%); Television or film - 5 (16.7%); Radio - 4 (13.3%); none of the above - 5 (16.7%); All the above was - 6 (20.0%).

- **Question twelve (Q12B): Pairing data set with sector of employment**

Moving forward, an additional analysis was conducted to compare the data set obtained with the sector of employment. The essence was to determine which sector would prefer a particular tool to the other. So that when there is a need to deploy a particular tool as an alternative to facilitate information communication, research or other government agencies will be informed on which one to choose. However, based on the feedback obtained from the user surveys, the following results were obtained from the respondents (Figure 7.25).

- **Question twelve (Q12B): Pairing data set with sector of employment**

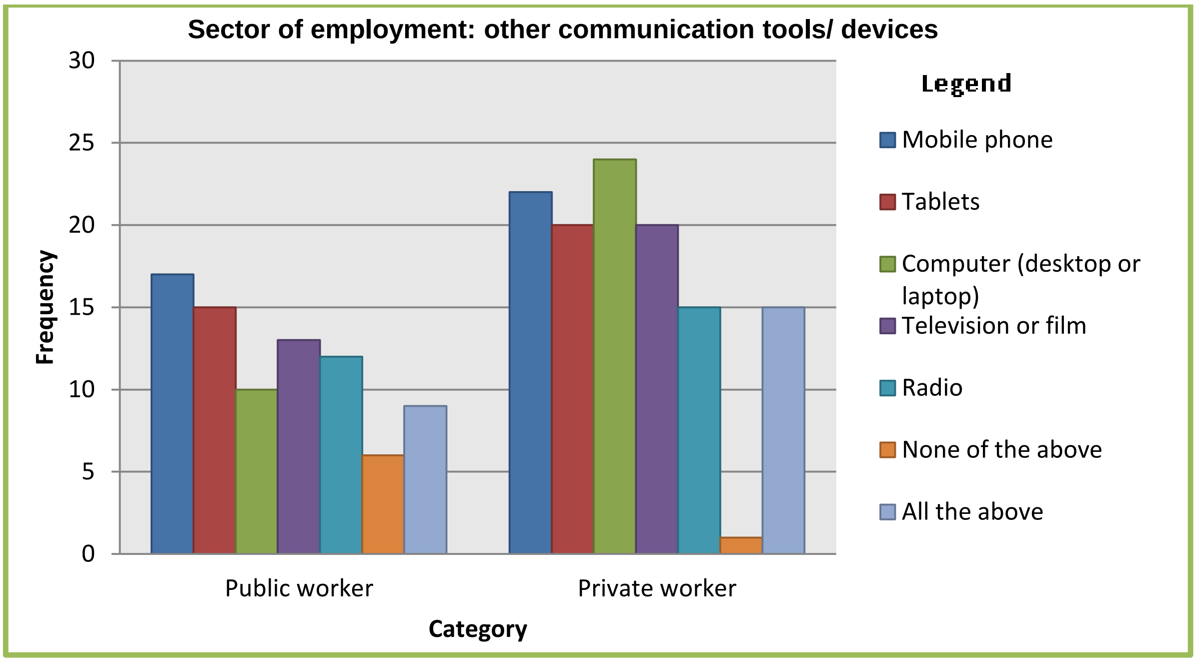


Figure 7.25: Sector of employment – other communication tools/ devices

Public worker

In this statistical analysis, the results revealed the following responses: Mobile phones - 17 (37.8%); Tablets - 15 (33.3%); Computer (desktop or laptop) - 10 (22.2%); Television or film - 13 (28.9%); Radio - 12 (26.7%); none of the above - 6 (13.3%); All the above category was - 9 (20.0%).

Private worker

In this category, private health workers indicated their responses as follows: Mobile phones - 22 (39.3%); Tablets - 20 (35.7%); Computer (desktop or laptop) - 24 (42.9%); Television or film - 20 (35.7%); Radio - 15 (26.8%); none of the above - 1 (13.3%); All the above category was -15 (26.8%).

- **Question twelve (Q12C): Pairing information communication tools/devices with employment status**

The available information communication tools/ devices were further analysed with their employment status in general. Similarly, in this category, the purpose was to identify any similarities or contrasting results from the analysis (Figure 7.26).

Question twelve (Q12C): Pairing communication tools/ devices with employment status

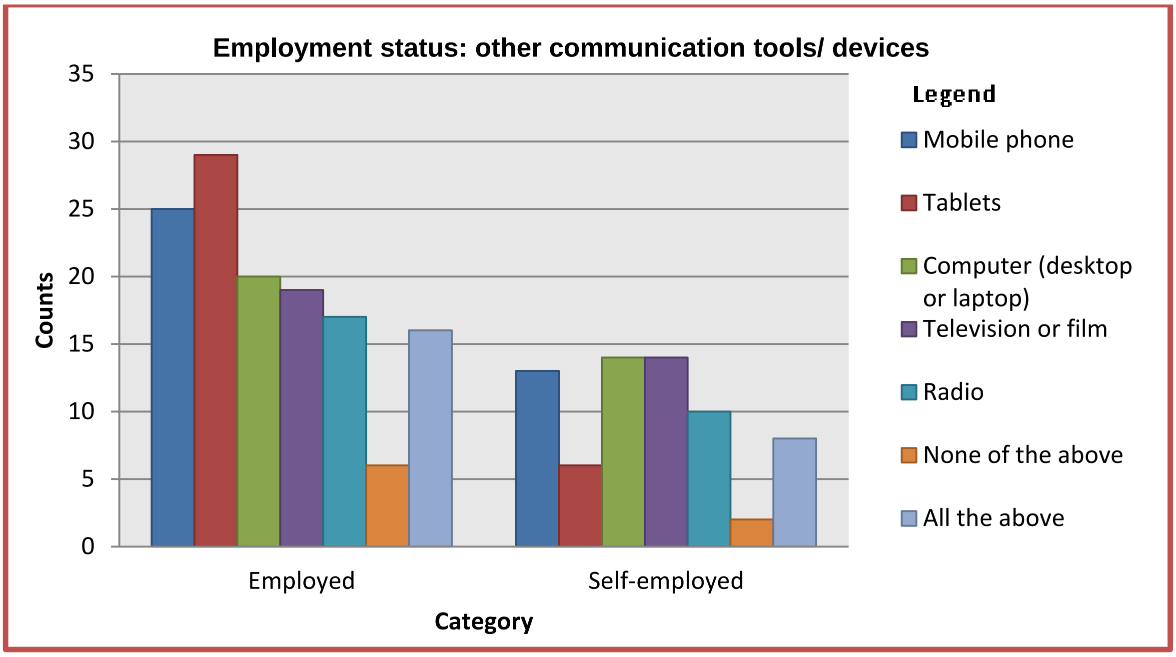


Figure 7.26: Employment status – other communication tools/ devices

Employed

Health intermediaries in this category provided the following responses: Mobile phones - 25 (34.2%); Tablets - 29 (39.7%); Computer (desktop or laptop) - 20 (27.4%); Television or film - 19 (26.0%); Radio - 17 (23.3%); none of the above - 6 (8.2%); All the above category recorded 16 (21.9%).

Self-Employed

Health intermediaries who are self-employed indicated these responses: Mobile phones - 13 (46.4%); Tablets - 6 (21.4%); Computer (desktop or laptop) - 14 (50.0%); Television or film - 14 (50.0%); Radio - 10 (35.7%); none of the above - 2 (7.1%); All the above was - 8 (28.6%).

- **Question Twelve (Q12D): Pairing data set with years of experience**

The information obtained regarding the most preferred choice of platform was again analysed by comparing it with the number of years of experience of the health intermediaries. The results obtained per the statistical analysis are presented below (Figure 7.27).

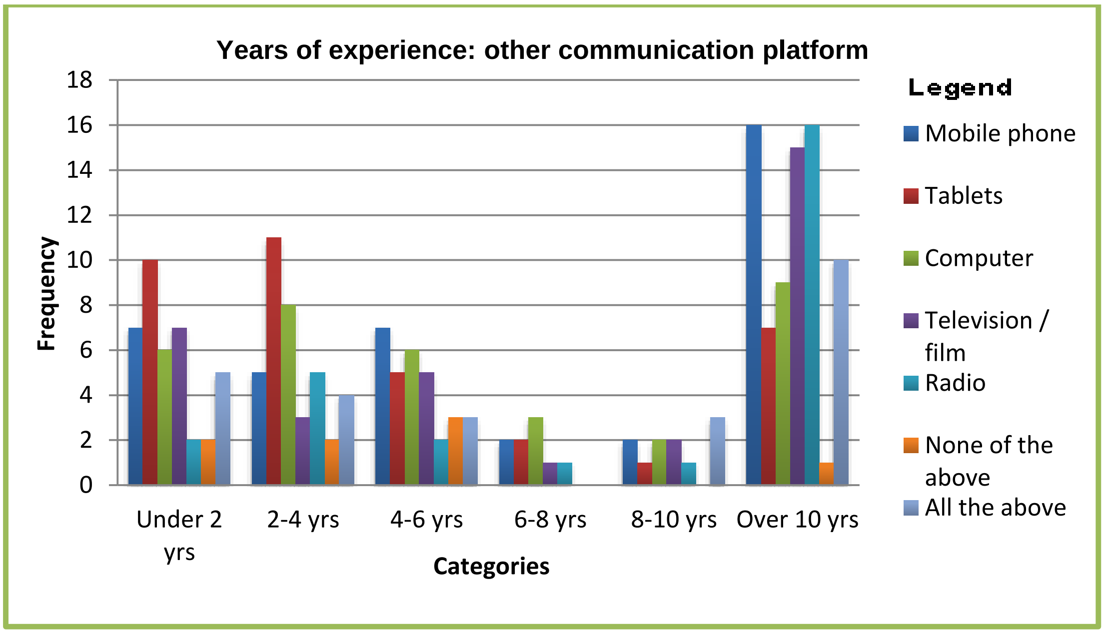


Figure 7.27: Years of experience – other communication tools/devices

Under 2 years

Respondents with Under 2 years of experience indicated their preference for other forms of information communication tools/ devices and these are presented as follows: Mobile phones - 7 (28.0%); Tablets - 10 (40.0%); Computer (desktop or laptop) - 6 (24.0%); Television or film - 7 (28.0%); Radio - 2 (8.0%); none of the above - 2 (8.0%); All the above was - 5 (20.0%).

2 to 4 years

Respondents with 2 to 4 years of experience expressed their preference for the information communication tools/ devices in this category and these are as follows: Mobile phones - 5 (20.0%); Tablets - 11 (44.0%); Computer (desktop or laptop) - 8 (32.0%); Television or film - 3 (12.0%); Radio - 5 (20.0%); none of the above - 2 (8.0%); All the above was - 4 (16.0%).

4 to 6 years

The statistics indicated that health intermediaries with 4 to 6 years provided the following responses: Mobile phones - 7 (46.7%); Tablets - 5 (33.3%); Computer (desktop or laptop) - 6 (40.0%); Television or film - 5 (33.3%); Radio - 2 (13.3%); none of the above - 3 (20.0%); All the above was - 3 (20.0%).

6 to 8 years

In the category of 6 to 8 years, the following responses were obtained: These are - Mobile phones - 2 (66.7%); Tablets - 2 (66.7%); Computer (desktop or laptop) - 3 (100.0%); Television or film - 1 (33.3%); Radio - 1 (13.3%); none of the above and all the above category recorded a null set since no feedback was obtained.

8 to 10 years

Respondents with 8 to 10 years of experience also shared the following responses: Mobile phones - 2 (40.0%); Tablets - 1 (20.0%); Computer (desktop or laptop) - 2 (40.0%); Television or film - 2 (40.0%); Radio - 1 (20.0%); in the none of the above category, a null set was recorded since no feedback was obtained. In the case of All of the above category, the feedback obtained was - 3 (60.0%).

Over 10 years

Health intermediaries with over 10 years of experience indicated their preference as: Mobile phones - 16 (53.3%); Tablets - 7 (23.3%); Computer (desktop or laptop) - 9 (30.0%); Television or film - 15 (50.0%); Radio - 16 (53.3%); none of the above - 1 (3.3%) and all the above category - 10 (33%).

- **Question twelve (Q12D): Pairing data set with unit of work for health intermediaries**

In this category, the analysis was undertaken by comparing the information communication tools/ devices with the unit of employment of health intermediaries and the findings are graphically presented below (Figure 7.28).

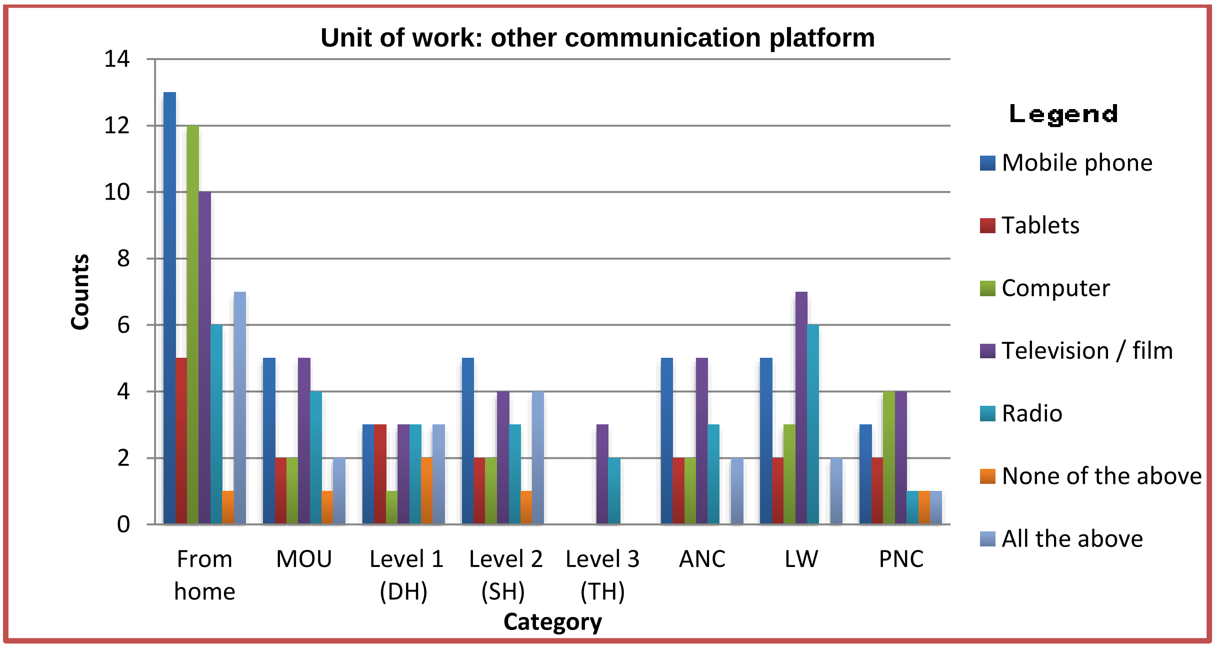


Figure 7.28: Unit of work – other communication platform

From home

The results obtained from this category of health intermediaries working from home are as follows: Mobile phones - 13 (33.3%); Tablets - 5 (27.8%); Computer (desktop or laptop) - 12 (46.2%); Television or film - 10 (24.4%); Radio - 6 (21.4%); none of the above - 1(16.7 %) and All the above - 7 (33.3%).

Unit: Midwifery Obstetric Unit

The results obtained in this category are the following: Mobile phones - 5 (12.8%); Tablets - 2 (11.1%); Computer (desktop or laptop) - 2 (7.7%); Television or film - 5 (12.2%); Radio - 4 (14.3%); none of the above - 1(16.7 %) and All the above - 2 (9.5%).

Unit: Level 1 (District Hospital [DH])

Respondents from **Level 1 (DH)** provided the following responses: Mobile phones - 3 (7.7%); Tablets - 3 (16.7%); Computer (desktop or laptop) - 1 (3.8%); Television or film - 3 (7.3%); Radio - 3 (10.7%); none of the above - 2 (33.3%) and All the above - 3 (14.3%).

Unit: Level 3 (Tertiary Hospital [TH])

Respondents from **Level 3 (TH)** indicated the following responses: Television or film - 3 (7.5%) and Radio - 2 (7.1%). However, in the category of Mobile phones; Tablets; Computer (desktop or laptop); none of the above; and All the above, recorded a null set because no response was obtained in this category.

Unit: Antenatal Clinic (ANC)

In the ANC unit, the following responses were obtained; Mobile phones - 5 (12.8%); Tablets - 2 (11.1%); Computer (desktop or laptop) - 2 (7.7%); Television or film - 5 (12.2%); Radio - 3 (10.7%); none of the above - recorded a null set; and All the above - 2 (9.5%).

Unit: Labour Ward (LW)

Respondents who work from the Unit – LW provided the following responses: Mobile phones - 5 (12.8%); Tablets - 2 (11.1%); Computer (desktop or laptop) - 3 (11.5%); Television or film - 7 (17.1%); Radio - 6 (21.4%); none of the above -recorded a null set; and All the above - 2 (9.5%).

Unit: Postnatal Clinic (PNC)

Respondents working from the PNC Unit shared the following feedback: Mobile phones - 3 (7.7%); Tablets - 2 (11.1%); Computer (desktop or laptop) - 4 (15.4%); Television or film - 4 (9.8%); Radio - 1 (3.6%); none of the above - 1 (16.7%); and All the above - 1 (4.8%).

7.6.7 Summary: Question Twelve

The results obtained from this evaluation indicated that health intermediaries would prefer to use information communication tools/ devices in their professional practise for health education activities. They indicated that tools/ devices such as cell phones, tablets, computers, television or film could serve as alternative tools to communicate with women (patients). The findings obtained, implies that health intermediaries will be able to integrate these ICT tools to facilitate health information communication with women.

- **Question thirteen (Q13): Where do you obtain your health information objects/ materials?**

In this analysis, the probing was to find out where health intermediaries obtain health information objects/ material. Again, the data set was analysed by paring the various information sources with the demographics and experience of health intermediaries. However, the unit of employment was not selected as a category as part of the analysis to this question. *This decision was made* because; the variables in the employment category did not provide significant differences in this particular analysis. However, responses obtained from health intermediaries are presented subsequently (Figure 7.29).

- **Question thirteen (Q13A): Pairing data set with occupation**

The various sources where health intermediaries obtain information were paired with their specialised areas of practice. The aim was to identify the main sources of obtaining information by the various health intermediaries. The results have been presented below (Figure 7.29).

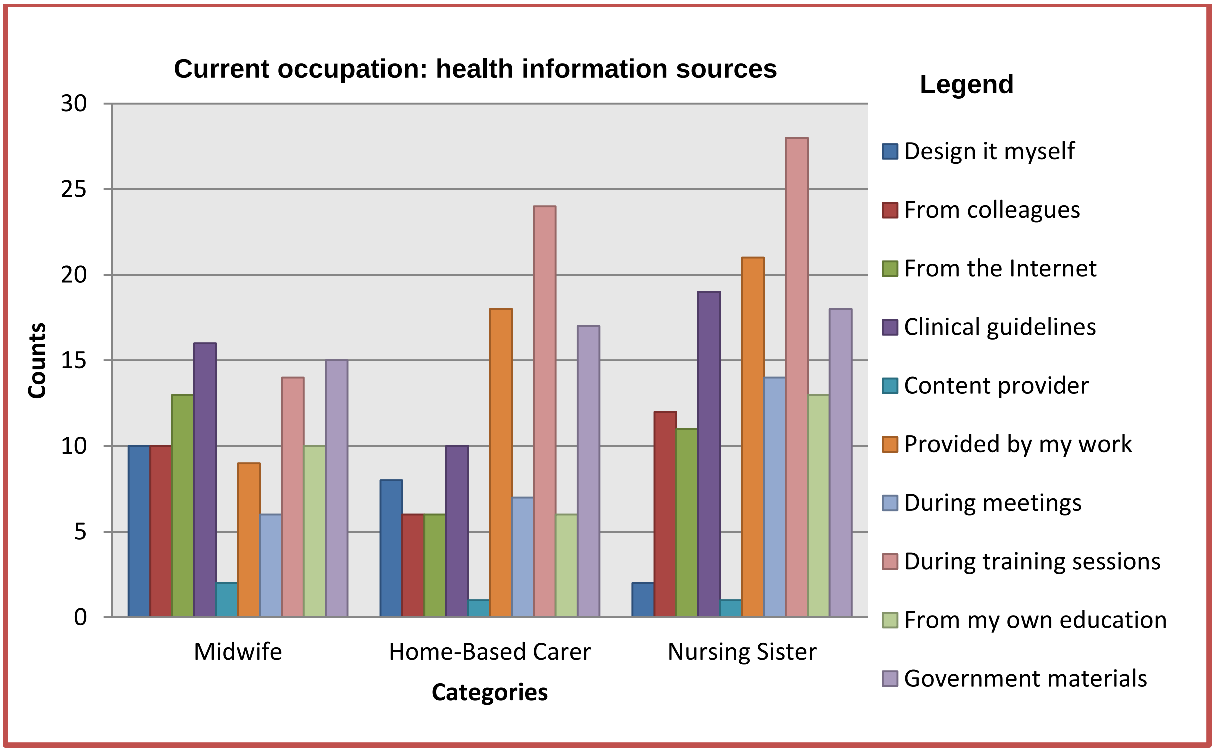


Figure 7.29: Current occupation – health information sources

Midwives

Midwives who responded expressed their feedback as follows: Design it myself - 10 (40%); From colleagues - 10 (40.0%); From the internet- 13 (52.0%); Clinical guidelines - 16 (64.0 %) Content provider - 2 (8.0%); Provided by my work - 9 (36.0 %); During meetings - 6 (24.0%); During training sessions -14 (56.0%); From respondent's education - 10 (40.0%); Government materials - 15 (60.0%).

Home-Based Carer (HBC)

HBCs provided the following responses: Design it myself - 8 (25.0%); From colleagues - 6 (18.8%); From the internet - 6 (18.8%); Clinical guidelines- 10 (31.3%) Content provider 1 (3.1%); Provided by my work - 18 (56.3%); During meetings - 7 (21.9%); During training sessions - 24 (75.0%); From respondent's education - 6 (18.8%); Government materials - 17 (53.1%).

Nursing Sister

Nursing sisters provided the following responses: Design it myself - 2 (6.5%); From colleagues - 12 (37.5%); From the internet - 11 (34.4%); Clinical guidelines - 19 (59.4%); Content provider 1(3.1%); Provided by my work - 21 (65.6%); During meetings - 14 (43.8%); During training sessions - 28 (87.5%); From respondent's education - 13 (40.6%); Government materials - 18 (56.3%).

- **Question thirteen (Q13B): Pairing data set with sector of employment**

There were two major categories in the sector of employment, which were public and private health intermediaries. Thus, the sector of employment was paired with the available sources where health intermediaries indicated they possibly obtained health information (Figure 7.30).

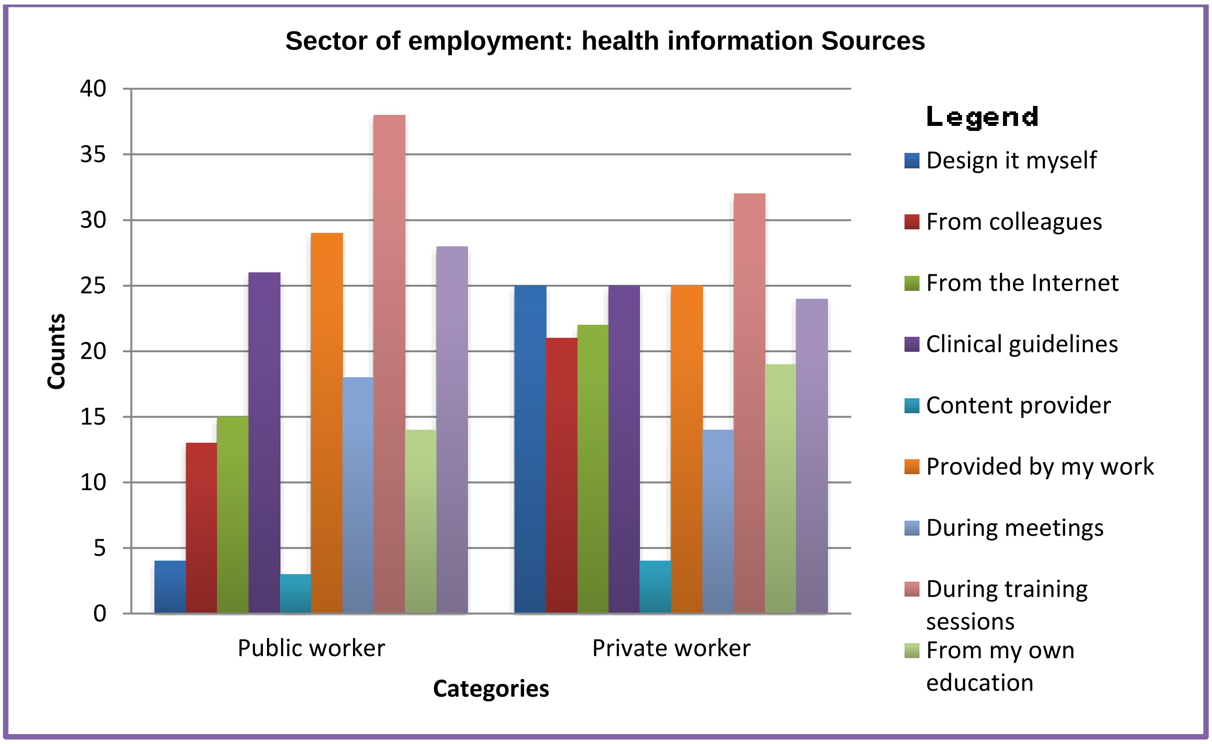


Figure 7.30: Sector of employment – health information Sources

Public worker

In this analysis, public workers provided these responses: Design it myself - 4 (8.5%); from colleagues - 13 (27.7%); From the Internet - 15 (31.9%); Clinical guidelines - 26 (55.3%) Content provider - 3 (6.4%); Provided by my work - 29 (61.7%); During meetings - 18 (38.3%); During training sessions - 38 (80.9%); From respondent's education - 14 (29.8%); Government materials - 28 (59.6%).

Private worker

In this category, the public workers indicated the following; Design it myself - 25 (44.6%); From colleagues - 21 (37.5%); From the Internet - 22 (39.3%); Clinical guidelines - 25 (44.6%) Content provider - 4 (7.1%); Provided by my work - 25 (44.6%); During meetings - 14 (25.0%); During training sessions - 32 (57.1%); from respondent's education - 19 (33.9%); Government materials - 24 (42.9%).

- **Question thirteen (Q13C): Paring data set with Employment status**

The analysis in this category undertaken by comparing the possible sources where health intermediaries obtain information with their employment status. The results from this analysis are indicated below (Figure 7.31).

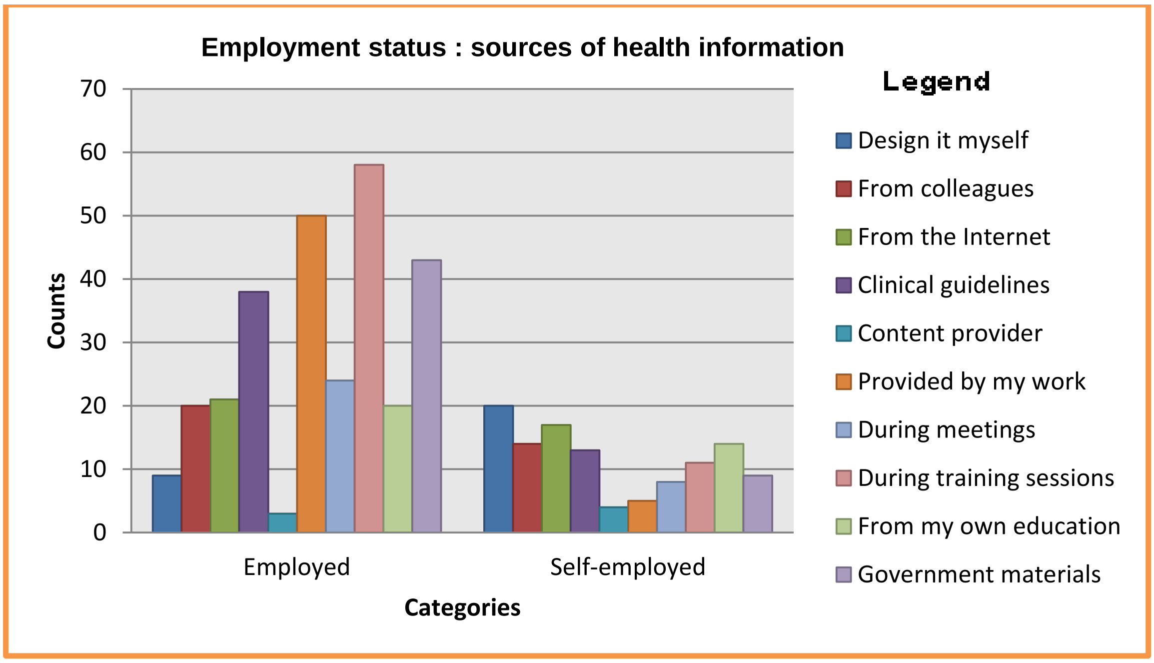


Figure 7.31: Employment status – sources of health information

Employed

In this category, health intermediaries provided the following responses: Design it myself - 9 (12.2%); From colleagues - 20 (27.0%); From the internet - 21 (28.4%); Clinical guidelines - 38 (51.4%) Content provider - 3 (4.1%); Provided by my work - 50 (67.6%); During meetings - 24 (32.4%); During training sessions - 58 (78.4%); From respondent's education - 20 (27.0%); Government materials - 43 (58.1%).

Self-employed

Health intermediaries that are self-employed provided the following responses: Design it myself - 20 (69.0%); From colleagues - 14 (48.3%); From the Internet - 17 (58.6%); Clinical guidelines - 13 (44.8%); Content provider - 4 (13.8%); provided by my work - 5 (17.2%); During meetings - 8 (27.6%); During training sessions - 11 (37.9%); From respondent's education - 14 (48.3%); Government materials - 9 (31.0%).

- **Question thirteen (Q13D): Paring data set with years of experience**

Further investigation was conducted to pair information with the years of experience of the health intermediaries. Similar to the former analysis, the objective was to find out if the sources of obtaining information based on their experiences over the years will provide some significant differences in the feedback obtained (Figure 7.32).

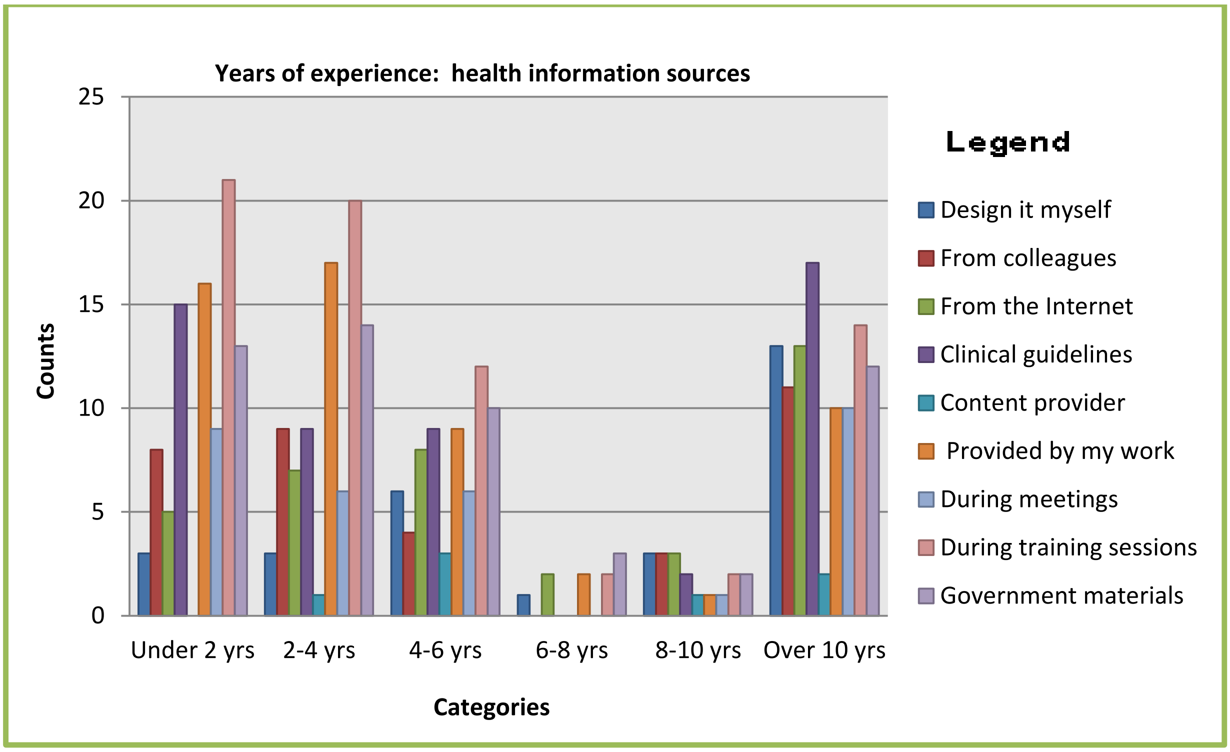


Figure 7.32: Years of experience – sources of obtaining health information

Under 2 years

In this category, health intermediaries with under 2years of experience indicated these responses: Design it myself - 3 (10.7%); From colleagues - 8 (28.6%); From the internet - 5 (17.9%); and Clinical guidelines - 15 (53.6%). In the case of Content provider, a null set was recorded. Provided by my work - 16 (57.1%); During meetings - 9 (32.1%); During training sessions - 21 (75.0%); From respondent's education - 5 (17.9%); Government materials - 13 (46.4%).

2 to 4 years

In this category, health intermediaries with 2 to 4years of experience indicated these responses: Design it myself - 3 (11.5%); From colleagues - 9 (34.6%); From the internet - 7 (26.9%); Clinical guidelines - 9 (34.6%); Content provider: 1 (3.8%); Provided by my work - 17 (65.4%); During meetings - 6 (23.1%); During training sessions - 20 (76.9%); From respondent's education - 6 (23.1%); Government materials - 14 (53.8%).

4 to 6 years

Health intermediaries with 4 to 6 years provided the following responses: Design it myself - 6 (37.5%); From colleagues - 4 (25.0%); From the Internet - 8 (50.0%); Clinical guidelines - 9 (56.3%); Content provider - 3 (18.8%); Provided by my work - 9 (56.3%); During meetings - 6 (37.5%); During training sessions - 12 (75.0%); From respondent's education - 11 (68.8%); Government materials - 10 (62.5%).

6 to 8 years

Health intermediaries with 6 to 8 years of experience provided the following responses: Design it myself - 1 (33.3%); From the internet - 2 (66.7%); Provided by my work - 2 (56.3%); During training sessions - 2 (66.7%); From respondent's education - 1 (33.3%); Government materials - 3 (100.0%); From colleagues, Clinical guidelines, Content provider. No feedback was obtained from the "During Meetings" category, which resulted in a null set.

Over 8 to10 years

In this category, health intermediaries with 8 to 10years of experience indicated these responses: Design it myself - 3 (60.0%); From colleagues - 3 (60.0%); From the Internet - 3 (60.0%); Clinical guidelines - 2 (40.0%) Content provider: 1 (20.0%); Provided by my work - 1 (20.0%); During meetings - 1 (20.0%); During training sessions - 2 (40.0%); Government materials - 2 (40.0%); From respondent's education, a null set was obtained since no feedback was recorded.

Over 10 years

Health intermediaries with over 10 years of experience provided the following responses: Design it myself - 13 (46.4%); From colleagues - 11 (39.3%); From the internet - 13 (46.4%); Clinical guidelines - 17 (60.7%); Content provider - 2 (7.1%); Provided by my work - 10 (35.7%); During meetings - 10 (35.7%); During training sessions - 14 (50.0%); From respondent's education - 11(39.3%) and Government material - 12 (42.9%).

- **Summary of open sections of Question Thirteen (Q13): Where do you obtain your healthcare information objects/ material (Other)**

Other sources and organisations where health intermediaries obtain information for patient education are indicated as follows: "Hypno-birthing institute; relevant websites and online resources of clinics with gold standards; from companies like J & J; health educational courses, from available books on health education; seminars and conferences; ICEA and HBCE"; whereas others stated, they compile their own materials for patient education.

7.6.8 Summary: Question Thirteen

Since there are many sources of information acquisition by health intermediaries, it was relevant to identify the possible sources where they obtain information. Insights derived from the analysis showed that health intermediaries obtain health information objects/ materials during their training sessions. In addition, it was noted that health workers obtain their health education materials from their workplaces, which are sometimes provided by the government. In addition, sources such as the clinical guidelines, internet sources were relevant sources where health intermediaries obtained information for patient education.

- **Question fourteen 14 (Q14): Do you have input in the healthcare information object/ material you provide women before, during and after pregnancy?**

The purpose of this question was to inquire from respondents if they contribute to the design of health information objects/ materials for patient education. Therefore, the possible ways they contribute were paired with the various sources from which they obtain health information for educational purposes (Figure 7.33).

- **Question fourteen (Q14A): Paring question 13 to 14 with sources of information /contributions**

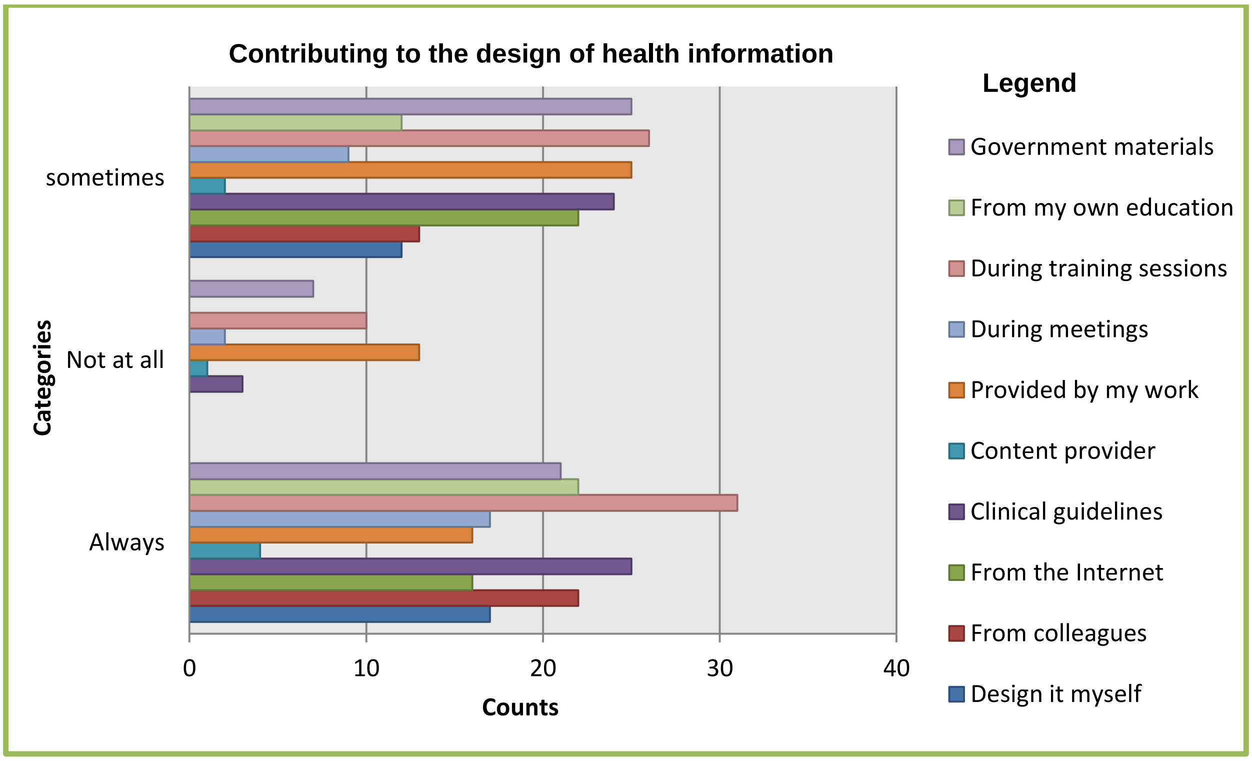


Figure 7.33: Contributing to the design/ sources of obtaining health information

Always

In the case of "**Always**" category, the following responses were obtained: I Design it myself - 17 (37.8%); From colleagues - 22 (48.9%); From the internet - 16 (35.6%); Clinical guidelines - 25 (55.6%); Content provider - 4 (8.9%); Provided by my work - 16 (35.6%); During meetings - 17 (37.8%); During training sessions - 31 (68.9%); From respondent's education - 22 (48.9%); Government materials - 21 (46.7%).

Not at all

In response to the category of **"Not at all ",** health intermediaries provided the following responses: Clinical guidelines - 3 (18.8%); Content provider - 1 (6.3%);

Provided by my work - 13 (81.3%); During meetings - 2 (12.5%); During training sessions - 10 (62.5%); Government materials - 7 (43.8%); Designed by respondent; From colleagues; From the internet; and From my own education; obtained no feedback which resulted in a null set for these categories.

Sometimes

In the category of **"sometimes",** the analysis provided these results: Design it myself - 12 (29.3%); From colleagues - 13 (31.7%); From the internet - 22 (53.7%); Clinical guidelines - 24 (58.5%); Content provider - 2 (4.9%); Provided by work - 25 (61.0%); During meetings - 9 (22.0%); During training sessions - 26 (63.4%); From respondent's education - 12 (29.3%); Government materials - 25 (61.0%).

7.6.9 Summary: Question Fourteen

Insights derived from this inquiry showed that health intermediaries are able to contribute to the design of health education materials. Some of the instances in which they are "Always" offered the opportunity to contribute to the training material is "During meetings" and during other training sessions. In addition, respondents expressed that they sometimes contribute to the design of the health information at their workplaces and from other sources. In summary the findings showed that health intermediaries obtain information from diverse sources to provide patients with relevant health education. However, inviting the contributions of healthcare workers in the design of health information will go a long way to improve patient education and maternal health literacy.

- **Question fifteen (Q15C): In communicating health information to women before, during and after pregnancy which of the day-to-day communication do you find the most difficult?**

Health intermediaries provided feedback to this question detailing some aspects they find challenging when interacting with patients. The findings obtained from this question was analysed based on the feedback obtained from respondents. The insights have been graphically presented on the next page (Figure 7.34).

- **Question fifteen (Q15A): Most difficult health information to communicate**

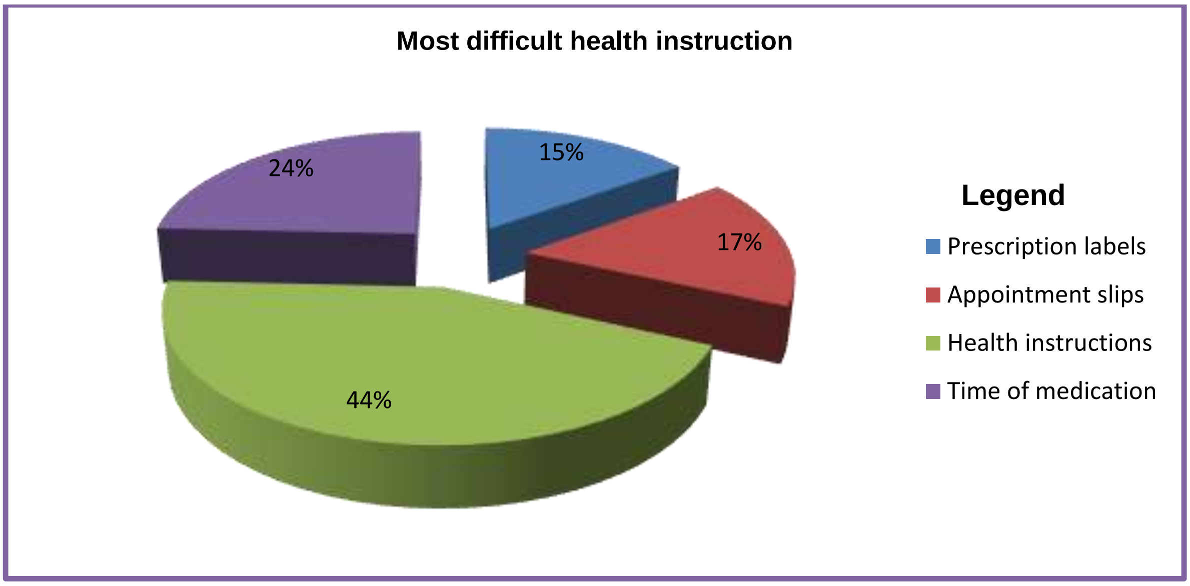


Figure 7.34: Most difficult health instruction to communicate

Health intermediaries provided responses to this question detailing the specific areas of health information they find difficult to communicate with women in their daily healthcare practice. The responses obtained from this question are as follows: Prescription labels - 10 (15.2); Appointment slips - 11 (16.7); Health instructions - 29 (43.9); and Time of medication - 16 (24.2). In this analysis, health instructions were identified as the most difficult type of information to communicate to patients. As such, there is a need to explore design possibilities that would make it easier for health intermediaries to interact with their patients and communicate health instructions towards promoting a health literate society.

7.6.10 Summary: Question Fifteen

Open sections of Q15: The findings obtained showed that **Time of medication** and **Health instructions** were one of the most difficult health information to communicate to women. Therefore, there is a need for design and development considerations to address these challenges between health intermediaries and women. Further, health intermediaries provided additional responses, which make information communication challenging in their daily care services. Some of these responses is as follows: some women have preconceived ideas during clinical birth education classes. This makes it difficult to share any other additional information with them. Also, in their professional practice, it is difficult to communicate current research, when other medical practitioners are not using this research with patients.

In addition, it is challenging to communicate issues on nutrition/ diet to women as some of them are already used to certain eating patterns. In addition, there is a lack of interest in HIV/ TB related topics and patients often shy away from discussing such topics. Again, it is sometimes challenging for women to interact with health intermediaries on personal issues such as smoking habits, history and so on. In a word, health intermediaries indicated that, there is a need to give more personal care to women in the healthcare settings and provide a conducive environment for information communication. This would encourage women to be more open and be more interested in obtaining relevant information to care for themselves and their children. In addition, health intermediaries expressed that; they often need to attend to deliveries and high-risk patients in the wards due to high demands. However, there is a shortage of midwives in most of their healthcare units and an increase in these healthcare professionals is much desired. Employing more midwives that are skilled would improve maternal healthcare services and minimise maternal morbidity and mortality in their communities.

- **Question sixteen (Q16): Where would you use visual communication tools to supplement or replace verbal communication?**

The responses obtained from the health intermediaries to this inquiry were categorised into two themes: **"the where"** (places/ locations) and the **"when"** (periods/ situational context). The responses obtained are summarised as follows:

- **The "where"** - which refers to the places where health intermediaries would like to use information communication tools for patient education. Health intermediaries indicated they would like to use these tools (pictures and posters) in areas where appropriate such as: lounges and other waiting areas at the hospitals; at the clinics where mothers have appointments; at the antenatal care, labour and delivery wards where patients are admitted; at community outreaches such as health education and promotion activities. Also, they would like to use these tools in their fields of practice; at health education classes to enhance learning experiences; at health conferences, talks or seminars; during health training sessions; at the home of patients and during discussions on HIV/AIDS. Additionally, these tools are used at several locations in the hospitals, during one-on-one consultation with health professionals, public transportation settings, at festivals for health education, at schools and on mobile devices as everybody uses cell phones these days.
- **"The when"** - which refers to the context or the situation in which these tools might be used by health intermediaries. Some of the common themes emerging from the responses obtained from health intermediaries are described subsequently. Health intermediaries expressed that, information communication tools would be used when patients do not understand health information; when making presentations on women's health; during health education activities and information sessions for pregnant mothers at antenatal classes; during routine check-ups for mothers and at presentations introducing hypno-birthing. At labour wards to show different birth positions and pain reliefs. At postpartum periods to enhance information dissemination eg. how to breastfeed and other baby first aid procedures. Also, the tools can be used when prescribing medications and giving health instructions to mothers. It can be used when explaining practical procedures of birth; childbirth and to describe the female anatomy. The tools can be used during antenatal education to describe breastfeeding, nutrition and preparations for having babies. Additionally, the communication tools would be used when there are language barriers during health education. Other situations in which

communication tools would be used include, the process of labour stages to educate women on birth, movement and exercises.

In brief, the information communication tools would be required in all areas of women's health when educating and informing mothers. "It would be relevant to show some pictures for better explanation when interacting with mothers. "*If we could show people visual information, they would understand better*" – expressed by some health intermediaries.

- **Question seventeen (Q17): Likelihood to attend a free visual communication workshop to prepare healthcare information.**

The question was not part of the major question but it is necessary to find out if health intermediaries were interested in participating in service design workshops to contribute to the design of health information services (Figure 7.35).

- **Question seventeen (Q17): Participants interest to attend design workshop**

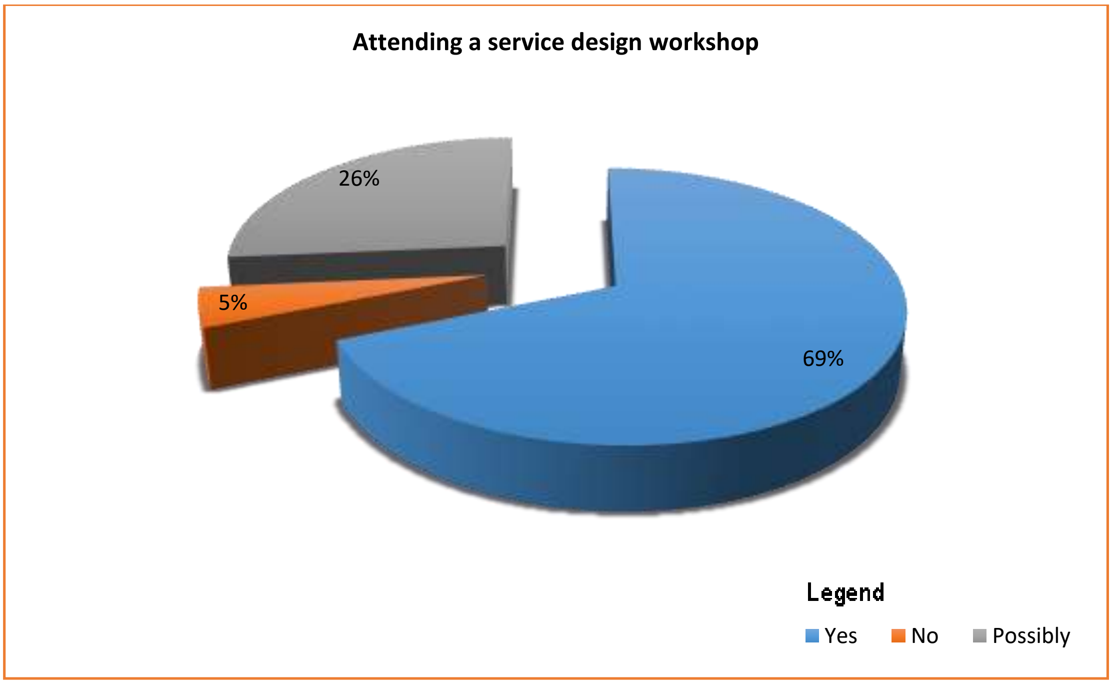


Figure 7.35: Attending a service design workshop

- **Participating in service design workshops**

  The response obtained from this inquiry is presented as follows: there were 73 (69%) respondents who indicated **"Yes"** they will like to attend the workshop. Whereas 28 (26%) respondents indicated that they will **"Possibly"** attend and 5 (5%) respondents stated **"No"** to this particular question. The feedback obtained showed that most of the health intermediaries were willing to participate in the design workshops so that they could contribute to the design of health information service design. Their responses helped to anticipate the number of participants who might be attending, so that adequate preparations could be made towards these workshop activities.

7.7 SENSEMAKING – INSIGHTS DERIVED FROM HEALTH INTERMEDIARIES

The purpose of the inquiry was to gain insights about how health information services is undertaken by health intermediaries in South Africa. Since the study focuses on maternal health education, it was necessary to ascertain, how health intermediaries disseminate health information for patient education. Through the questioning, some of the information needs and the challenges that persist in the professional practice of health intermediaries were identified. Sensemaking is explored as an analytical lens to make sense of the data obtained. The sensemaking analysis (**Level One)** was explored to gain insights about the context of health intermediaries and their work activities in the Western Cape Province of South Africa. A summary of the key findings that emerged from this investigation as elucidated in the earlier part of this section are the following:

- **Mode of communication:** most health intermediaries sampled in the study indicated that they use both verbal and written modes of communication, which are usually facilitated by ICT tools such as mobile phones and tablets.
- **Communication barriers identified:** It was identified that language was a major barrier in communication. They expressed that the many different native languages spoken in South Africa sometimes inhibits information communication. Additional factors that affected communication included the low level of education and other socio-cultural factors. Although there were other factors, those mentioned here were quite recurring in most of their responses obtained from the health intermediaries.
- **Areas in women's health where communication tools can be applied:** health intermediaries indicated that ANC, PNC and PCC as the most critical areas they will like to use communication tools to supplement or replace verbal instruction. Others indicated that they would suggest that these tools are used in all the other periods in women's health (PNC, ANC, INC, NNP, and PNC) but with critical consideration to ANC, PNC and PCC in women's health.
- **Providing health information to women (the how):** health intermediaries expressed that they provide information to women in a face-to-face situation. This information is made available, using print media, such as pamphlets and handouts and electronic media such as Films and DVDs. Additional platforms that are used by health intermediaries to facilitate information communication are the use of social media such as Facebook and WhatsApp for communication.
- **Improving existing health information communication practices:** the responses provided by health intermediaries here were mainly based on their personal aspirations in their professional practice. They shared that they would like to be more educated in order to inform women better on their health. In addition, they suggested that the provision of adequate materials for health education will go a long way to improve health information communication with women.

- **Challenges experienced when disseminating health information:** the study revealed many challenges that confront health intermediaries. These were mainly personal issues as identified from the health intermediaries' perspective as well as other communication related challenges and Socio-cultural issues. Some of these challenges include the personal attitudes of women, lack of support during pregnancy, issues of mistrust and confidentiality, fear of pregnancy, and lack of education are some of the challenges health intermediaries identified affect the communication of health information.

- **Information Communication Tools/ devices:** the most preferred ICT tools for information communication as expressed by health intermediaries are: cell phones, tablets, computers and television/ Films.

- **Acquisition of health information and sources:** the investigation showed that health intermediaries obtain health information materials during their training sessions, educational programmes and so on. The government and other content providers from external sources usually provide these materials. Also, the internet serves as a valuable tool to obtain information for patient education by health intermediaries.

- **Making a contribution to the design of health information**: some of the health intermediaries indicated that, they are offered the opportunity to "Always" make contributions to the design of health information "During meetings". Others expressed that they "Sometimes" make contributions when it's from external content providers.

- **The most challenging healthcare information to communicate:** health intermediaries expressed among other challenges that the communication of "*health instructions and time of medication*" are the most difficult concepts to send across to patients in their daily practice.

- **Situational context to use visual-based / multimedia information objects:** Some of the situations and places where health intermediaries would like to use visual-based/ multimedia information objects are described as follows: information objects can be used at the communities for health education activities and the various clinics and hospitals. They stated they would use the information communication objects/ tools in situations where patients do not understand health information being provided.

- **Health intermediaries interest to participate in service design activities:** although this was not a major question in the research, it was relevant to this study to ascertain whether or not health intermediaries would be interested in participating in a service design workshop. The feedback here showed that majority of the health intermediaries would like to participate in such workshop whereas a few indicated that would possibly like to participate. In a word health intermediaries participated in the design sessions which provided valuable outcomes for this study which have been detailed in the previous **Chapter (Six)** of this thesis.

7. 8 ANALYSING DATA – USER SURVEYS (SET B) TO MOTHERS

7.8.1 Brief Description of the User Surveys

In this section, data obtained from user surveys (Set B) administered to participating mothers in the research context is presented (Appendix 7: [click to view sample – [7] **surveys - women**]).

The user surveys administered to the participants in this category were aimed at obtaining basic information from mothers regarding their information needs and sources. These user surveys were administered to these participating women in both research contexts – in South Africa and Ghana. These were given to participants in order to get a sense of who they were prior to co-design activities. At this stage of the data collection process, I personally administered the user surveys to the women and assisted them with the "filling-in" of the responses in both research contexts. Some portions in the user surveys needed explanation and I translated those sections to make the questions clearer to the participating women. In some instances in the Grabouw context, where I did not understand the native languages, translation was done with the assistance of a native South African. Through this process, it became easier for participants to provide the relevant responses for the questions being posed.

Additionally, the sample size in this case was not so large as compared to the feedback obtained from the health intermediaries who participated in the study. As such the data obtained in both cases were combined and analysed using SPSS statistical analysis software. The information obtained from both contexts were categorised according to the biodata of respondents and the categorisation of the information obtained. The description of the statistics is made based on the collective analysis of the responses obtained from participants in both research contexts. The feedback obtained from respondents, provided valuable insights into the background of the women in their various contexts. The corresponding results obtained from the statistical analysis are presented subsequently in this section. A summary of the analysis is briefly described under the subsequent headings. These covered their biodata; access to healthcare, literacy, use of technology and their information needs and sources.

7.9 PRESENTATION AND DISCUSSION OF RESULTS

The data obtained from this set of user surveys are categorised based on thematic areas and presented in this section (Appendix 7: [click to view sample – [7]**surveys - women**]). Generally, it provides an insight into the information needs and sources of women in various research contexts.

- **Question one (Q1): Employment status?**

The statistical analysis showed that, women who were employed in this category are 6 (75.0%); and those that were unemployed are 2 (2.5%). Although the majority of them were working (employed), they were mostly low-income earners within their various contexts (Table 7.1).

Table 7.1: Employment

Employment status					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Employed	6	75.0	75.0	75.0
	Unemployed	2	25.0	25.0	100.0
	Total	8	100.0	100.0	

- **Question two (Q2): How old are you?**

The results from the statistical analysis showed the following ages of the participating women; those that were 18-34 years were 2 (25.0%); those who were between 35-49 years were 5 (62.5%); there was only 1 (12.5%) woman who was older than 49 years. The feedback obtained in this category shows that majority of the women participating were not teenagers and were all mature women (Table 7.2).

Table 7.2: Ages

Ages					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	18-34 years	2	25.0	25.0	25.0
	35-49 years	5	62.5	62.5	87.5
	Older than 49 years	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

- **Question three (Q3): What is your marital status?**

The responses obtained showed that, participating women that were single was 1 (12.5%); the married women were 6 (75.0%); and those living with a life partner was 1 (12.5%). This shows that on average, majority of the women were married (Table 7.3).

Table 7.3: Marital status

Marital status					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Single	1	12.5	12.5	12.5
	Married	6	75.0	75.0	87.5
	Living with life partner	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

- **Question four (Q4): What is your highest qualification?**

The feedback obtained in terms of the educational levels of participants showed that, those that have been to High School or less were 7 (87.5%), and 1(12.5%) of the women had no formal education. The inference that can be made from this analysis is that most of the women have had some form of formal basic education (Table 7.4).

Table 7.4: Highest qualification

Highest qualification					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	High school or less	7	87.5	87.5	87.5
	None	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

- **Question five (Q5): Do you belong to a medical aid?**

The respondents who indicated they have medical aid were 7 (87.5%). However, 1 (12.5%) woman had no medical aid. The suppositions that can be made from this analysis is that the majority of the women from both research contexts, belong to a medical aid and could easily access basic healthcare in their various communities (Table 7.5).

Table 7.5: Medical aid

Medical aid					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Yes	7	87.5	87.5	87.5
	No	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

- **Question six (Q6): Which healthcare services do you use (public/ private)?**

The respondents that access healthcare in public hospitals were 7 (87.5%) whereas 1 (12.5%) woman indicated she uses private healthcare services. This shows that the participating women in this case mainly use healthcare services offered from public hospitals (Table 7.6).

Table 7.6: Healthcare services

Healthcare services					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Public	7	87.5	87.5	87.5
	Private	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

- **Question seven (Q7): How often do you visit a health facility?**

In response to this question, the participants provided the following responses: “Sometimes” 1 (12.5%); “Every month” 1(12.5%), “Never been” 1(12.5%), and “one – two” times a month 1(12.5%). Whereas the participants who indicated that “once a month” and “it depends on the situation” was 4 (50.0 %). On the average, majority of the women visit the clinic once every month, which largely depends on the situation in which they find themselves in their various communities (Table 7.7).

Table 7.7: Regular visits to hospital

Regular visits to a health facility					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Sometimes	1	12.5	12.5	12.5
	Every month	1	12.5	12.5	25.0
	Never been	1	12.5	12.5	37.5
	1-2 times a month	1	12.5	12.5	50.0
	Once a month and it depends on situation	4	50.0	50.0	100.0
	Total	8	100.0	50.0	

- **Question eight (Q8): Can you afford antenatal care?**

The feedback indicated 1 (12.5%) woman could rarely afford antenatal care in her context. On the other hand, 5 (62.5%) women indicated they could sometimes afford antenatal care. Whereas 2 (25.0%) women indicated they were unable to afford antenatal care. The supposition from these responses shows that majority of the women could rarely afford antenatal care in their various communities (Table 7.8).

Table 7.8: Affording antenatal care

Affording antenatal care					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Yes	1	12.5	12.5	12.5
	Sometimes	5	62.5	62.5	75.0
	No	2	25.0	25.0	100.0
	Total	8	100.0	100.0	

- **Question nine (Q9): What is your pregnancy status?**

In response to this question, the majority of the women who indicated they were not pregnant were 6 (75.0%). However, the rest of the women stated they are pregnant were 2(25.0%). This implies that most of the participating women were not pregnant as of the time of the research except for a few who were expectant mothers (Table 7.9).

Table 7.9: Pregnancy status

Your pregnancy status					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Not pregnant now	6	75.0	75.0	75.0
	Pregnant	2	25.0	25.0	100.0
	Total	8	100.0	100.0	

- **Question ten (Q10): If you are pregnant, how far are you?**

The respondents who were 3-6 months pregnant were 2 (25.0%), and those that were not pregnant were 6 (75.0%). The feedback obtained shows that most of the respondents were not expectant at the time of the study (Table 7.10).

Table 7.10: Duration of pregnancy

Duration of pregnancy					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	3-6 months	2	25.0	25.0	25.0
	N/A	6	75.0	75.0	100.0
	Total	8	100.0	100.0	

- **Question eleven (Q11A): Is this your first pregnancy?**

The responses obtained regarding the pregnancy status showed that, all the 8 (100%) women have been pregnant more than once. Also, the results from the analysis indicated that it was not their first pregnancy. This implies that they have more than one child since most of them were not pregnant at the time of the research but they all already had children (Table 7.11).

Table 7.11: **First pregnancy**

First pregnancy					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	No	8	100.0	100.0	100.0

- **Question eleven (Q11 B): How many children do you have?**

The feedback obtained from participants showed that, women with 2 or more children were 7 (87.5%); whereas the other woman had 1(12.5%) child. This implies that all women have 2 or more children and have experienced more than one pregnancy (Table 7.12).

Table 7.12: Number of children

Number of children					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	1 child	1	12.5	12.5	12.5
	2 or more children	7	87.5	87.5	100.0
	Total	8	100.0	100.0	

- **Question twelve (Q12): Which languages can you read?**

The feedback obtained from women in the various categories in response to this inquiry in the various research contexts is indicated as follows. Women from Ghana indicated their readable languages: English, Hausa, Mossi, Dagomba, Kusasi and Frafra was 1 (12.5%) woman. The other women in the same context indicated their readable languages: English, Ga and Twi was 1 (12.5%) woman; English and Twi were 3 (37.5%) women; and English and Fante was 1 (12.5%) woman. On the other hand, women in South Africa who indicated their readable languages: English and Afrikaans were 2 (25.0%) women. The responses obtained per the various categories (Figure 7.36) shows that some of the respondents could read most of their native languages in addition to some amount of English (see related paper Debrah *et al.*, 2017).

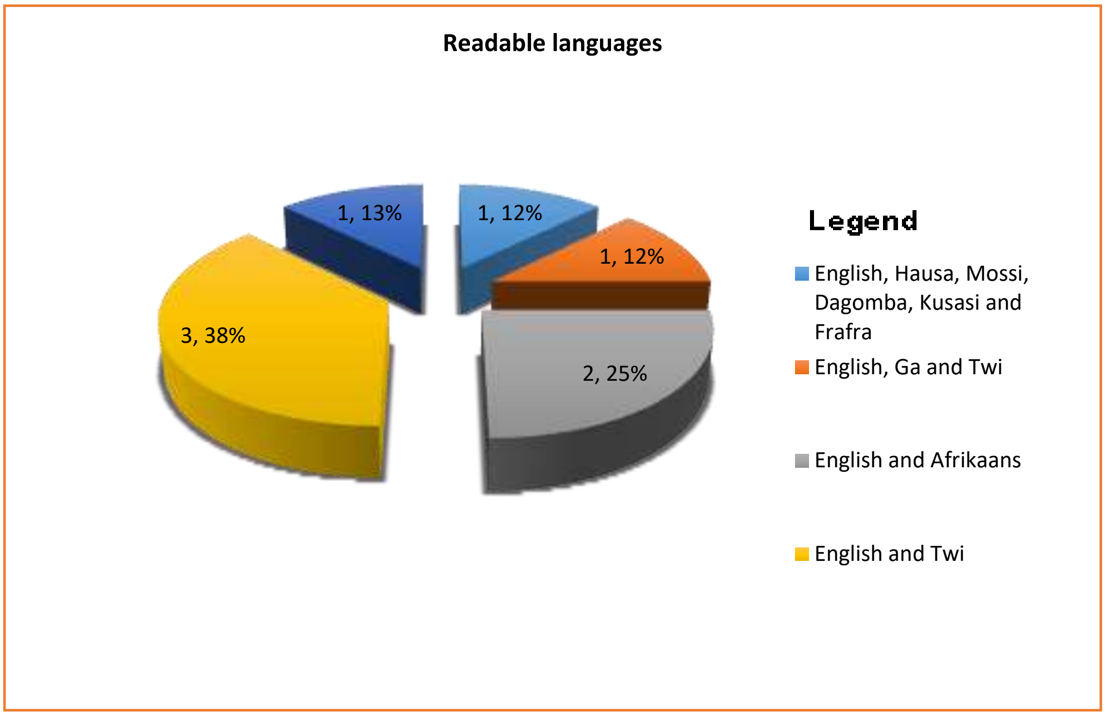


Figure 7.36: Readable languages

- **Question thirteen (Q13): Which type of cell phone do you have?**

The results from the statistical analysis showed that there were 5 (62.5%) women who indicated they use android phones; those that indicated they do not use android phones were 3 (37.5%) women. The result shows that majority of the women have android mobile phones and would be able to use it to access health information in their various contexts (Figure 7.37).

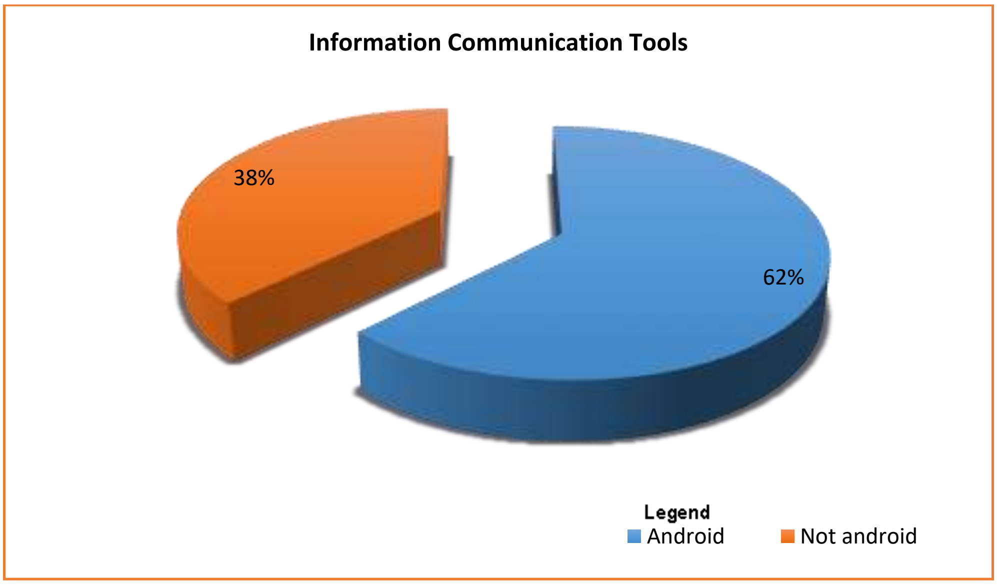


Figure 7.37: Types of cell phones/ devices owned

- **Question fourteen (Q14): Where do you obtain health information?**

Participating women, indicated the various sources were they obtain health information as follows: women who obtain health information at the hospital were 3 (37.5%); those who obtain information from the clinic were 2 (25.0%); there was 1(12.5%) woman who indicated she obtains health information from her grandmother; again, there was 1(12.5%) woman who stated she obtains health information from the hospital and her mother; Also, 1(12.5%) women, stated she obtains health information from the hospital and older members of the family. On the average majority of women obtain health information from the hospital and older members of their families within their various communities (Figure 7.38).

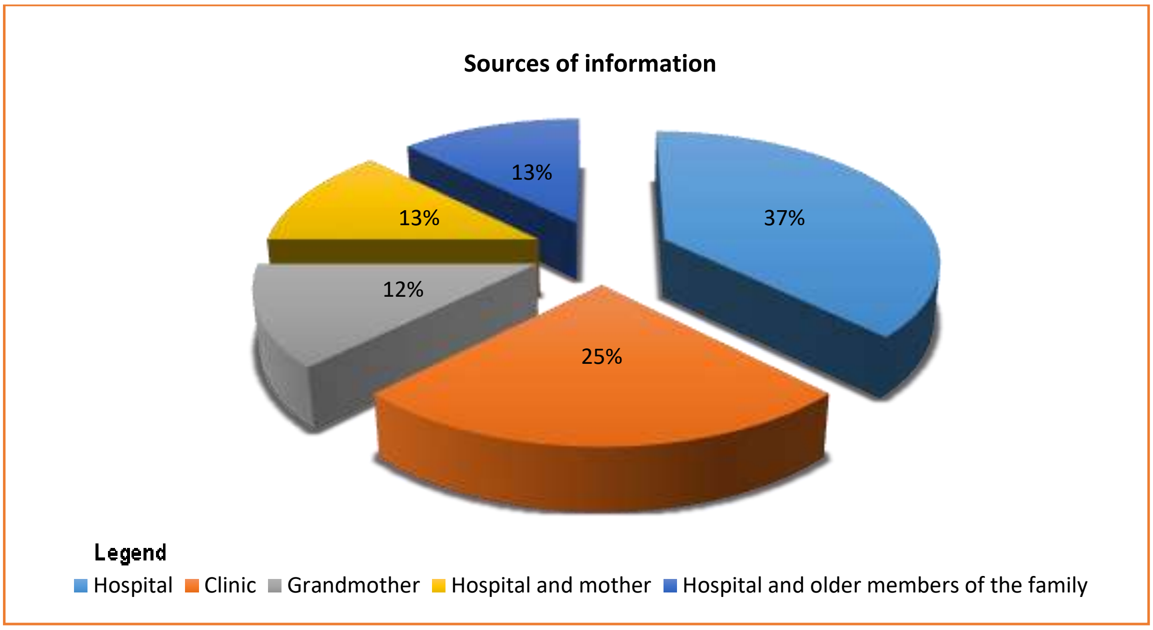


Figure 7.38: Sources of health information

- **Question fifteen (Q15): Is the health information sufficient?**

The responses obtained showed that, there was 1 (12.5%) woman who indicated that, the health information is sufficient; also, 1 (12.5%) woman indicated that the health information was somewhat sufficient; whereas the other 6 (75.0%) women said the health information they obtain was insufficient. The feedback obtained from the women shows that, there is a need for more health information services to be extended to women in their various contexts (Figure 7.39).

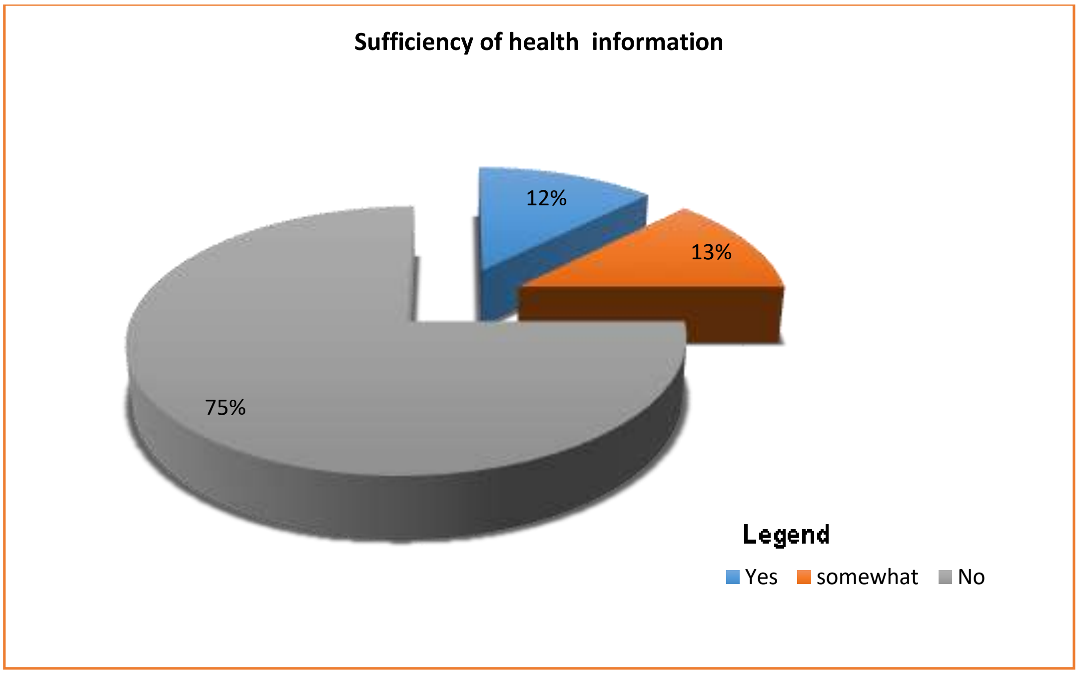


Figure 7.39: Sufficiency of health information

7.10 SENSEMAKING – INSIGHTS DERIVED FROM MOTHERS/ WOMEN

The user surveys (Set B) given to women in this case were for the purposes of gaining insights about the information needs of women in the various research contexts. Sensemaking framework, served as analytical lenses to make meaning out the data obtained from the perspective of mothers. The sensemaking (Level one) analysis was mainly based on the information obtained through user surveys given to participants in various research contexts. The responses obtained from the participants broadly covered areas such as their biodata, pregnancy status, number of children, medical aids, accessing healthcare services, information communication tools, and information sources.

Some of the insights derived showed that, most of the women were all mature women and married. These women were low - income earners and have some basic form of formal education. Most of the women have two or more children and they usually go for antenatal care once every month. Their frequent attendance to antenatal clinics largely depends on the situation in which they find themselves in their communities. Also, they indicated that antenatal care services are not easily affordable in their various communities. Since most of them are on medical aid, they normally use public healthcare services in their communities.

Further, the women indicated that they could read their native languages and some amount of English. Also, it was evident that most of the women own android mobile phones, which they use for information communication. Also, the women indicated, they obtain health information from hospitals or their relatives in the various communities. Yet, the health information provided from these sources are sometimes insufficient to address all their information and educational needs. In sum, insights derived shows that further research is required to provide health information services to women in underserved communities, to address their information and educational needs.

7.11 SUMMARY

The findings obtained from the data analysis provided insights into the some of the challenges that confront health intermediaries in their day-to-day activities. Some of these are related to the types of information communication tools they use and other factors that affect patient education. I will like to put forward a few of these challenges, which include: issues with privacy and confidentiality; the design of "health instruction and time of medication"; and how to create interest for women to access health information towards promoting health literacy. Additional insights derived showed that women in underserved contexts of this study would require health information and educational services customized to their needs. There is a need to provide information to women in readable languages so that women can comprehend health messages and make informed decisions for themselves and their children. Other challenges identified with attending antenatal care due to high cost implications could be addressed on the government level. Designers could explore other innovative ways to support home-based care services so that more women could be assisted in their homes. Health information could be in the form of multimedia messaging provided through mobile devices to make health information more accessible to women. Further research needs to be conducted to explore how to design relevant health instructions for patient education with low-functional literacy. Also, it will be beneficial to tackle some of the most difficult health information communication challenges identified in order to improve the health and wellbeing of mothers in futures studies.

7.12 IMPLICATIONS FOR FUTURE STUDIES

As a designer-researcher, my reflections on this chapter elicited many questions, which requires further research. Some of the unanswered questions were not captured in this research since it was not the focus in this particular study. Hence it will be beneficial to consider some of these questions below to provide equity in the dissemination and access to health information in underserved communities in Afrika. Some of these questions that needs to be considered for further research are: -

- *How might maternal health information be communicated efficiently to mothers with special needs (such as the physically challenged, the blind, autistic mothers and other vulnerable populations)?*

- *What are the health information needs and sources of women with special needs?*

- *How might health information be designed for or with women that have special needs towards providing equity for accessing maternal healthcare services?*

- *What are the design considerations for developing health information services to women with special needs?*

In sum, service design thinking provides a wide range of methods that could be explored to find solutions, which could address some of the challenges identified in women's health. Service designers could explore the wide range of designerly tools available to explore service solutions for mothers with special needs in underserved. This would ensure equity in the dissemination of maternal health information services to **EACH/ALL** women living in underserved contexts in Afrika.

Designers and future researchers would need to consider the socio-cultural dynamics of mother's when designing these innovative solutions in Afrikan communities. In the process of designing these solutions, emphasis should be laid on the contextualised design processes, which would be relevant to women with low literacy in underserved communities. In summary, it is anticipated that transdisciplinary designers and researchers would study the outcomes of this investigation and design socially responsive maternal healthcare services in Afrikan sub-regions.

CHAPTER EIGHT

SUMMARIES AND DISCUSSION

"Design must reflect the practical and aesthetic in business but above all... good design must primarily serve people" - Thomas J. Watson

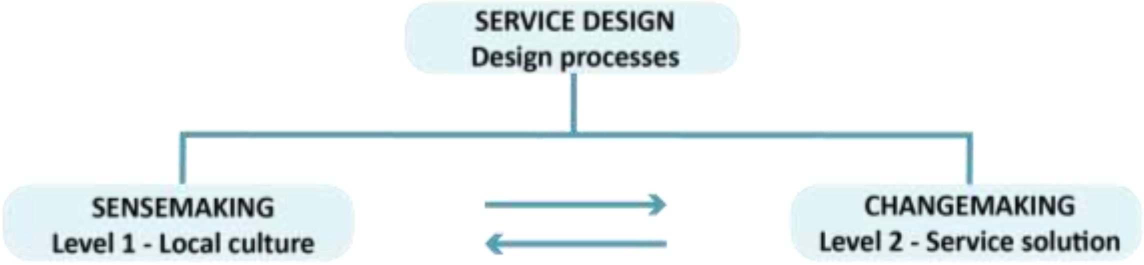


Figure 8.1: Sensemaking and service design as analytical lenses

8.1 INTRODUCTION

In this chapter, a summary of the findings and discussion obtained from preceding chapters of this study is presented (Figure 8.1). **Service design** and **sensemaking** theories served as analytical lenses and set the direction for this research. The summary of discussion in this section, is based on outcomes of service design activities and service user surveys in **Phase I** and **Phase II** of this study. Reflecting on sensemaking as a service design activity, the discussion is presented in the subsequent headings that follow.

8.2 SENSEMAKING: REFLECTING ON SERVICE DESIGN TOOLS AND PROCESSES

Service design tools and processes served as a viable means for participants to collaboratively express their thoughts during co-design activities. The designerly tools and processes served as boundary objects, which generated discussions in co-design activities in the various design milieus. The outcomes obtained from the designerly activities helped in making sense of the research context as a participatory joint activity. The insights derived from sensemaking (gaining insights) informed the changemaking (new value propositions) processes (Pastor, 2012:3-5). The changemaking process resulted in the design and development of a prototype Multimodal Cryptographer. The Multimodal Cryptographer was designed at the second phase of the Double Diamond Design process, which resulted in a hard-coded prototype of the healthcare system. The processes involved in the design of the Multimodal Cryptographer (InfoShare) has been elaborated upon in **Chapters Five and Six** of this study. The hard-coded prototype of the Multimodal Cryptographer (InfoShare) is a healthcare system, which could facilitate interaction between health intermediaries and their patients. The prototyped solution is envisioned to improve health information sharing and exchange during health education activities in underserved contexts. Additionally, an emerging sensemaking and service design framework is proposed as analytical lenses to inform future design and innovation projects in healthcare (Figure 8.2). The proposed sensemaking and design framework is explored as lenses to discuss the outcomes of this study. I now move on to present the discussion through the lenses of sensemaking and service design as a participatory joint activity.

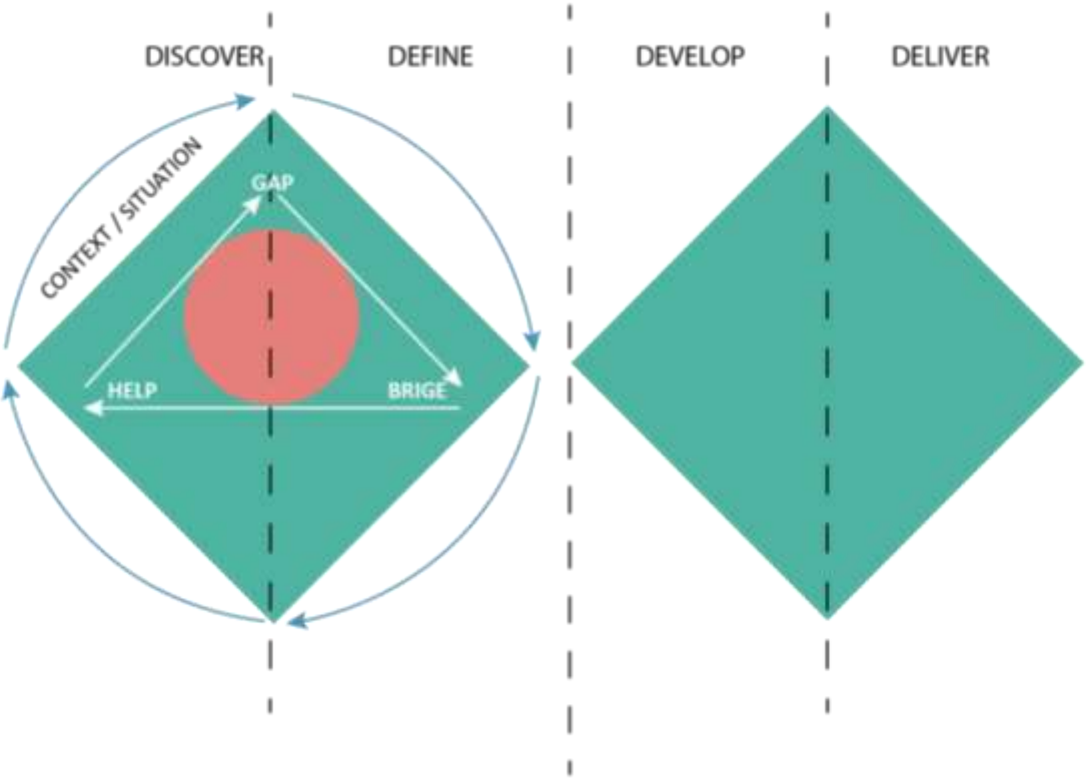


Figure 8.2: Sensemaking and service design framework
(A hybrid framework for sensemaking, adopted from Double Diamond Design process)
(Source: Pastor, 2012:3-5; Davies & Wilson, 2013:6; Clatworthy, 2013:6)

8.3 DISCUSSION

The study was conducted in two major **Phases (I & II)** within the various research contexts, which has been elaborated upon in the previous **Chapters Six (6) and (7).** In **Phase I** of this study, data were mainly obtained through service design activities such as co-design using designerly processes and tools. Whereas data obtained in **Phase II** was mainly through the use of opinionnaires (user surveys). The feedback obtained from both cases in **Phase I and II** yielded interesting outcomes in both visual and textual data. The insights derived have been summarised and discussed through the lenses of sensemaking and service design based on two levels as a participatory joint activity. **Level one** is based on understanding context whereas **Level two** is the proposed service solution. The findings obtained in the sensemaking process in **level one,** provided **insights** about the research context. These insights led to the discovery of **new value propositions** to bring about changemaking in the provision of care services in underserved contexts (Figure 8.3).

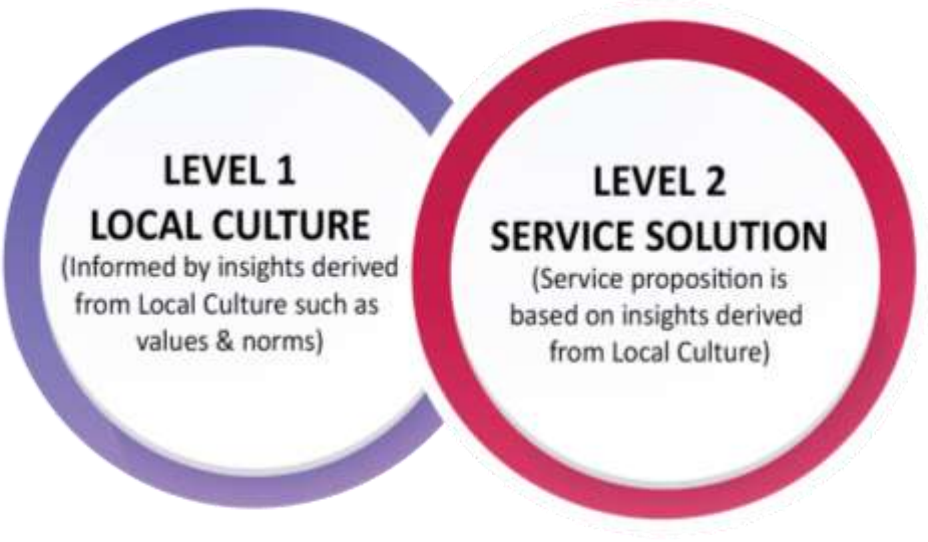


Figure 8.3: Service design as a sensemaking activity
(Source: Authors' own construct modelled after Cipolla & Reynoso, 2017:6)

8.4 PHASE I: SENSEMAKING OF DESIGNERLY ACTIVITIES

In **Phase I,** the study was mainly characterised by service design activities using designerly methods and tools. In designing healthcare services eco-centric design strategies was explored in this study. In these processes, bottom-up approaches were explored and community members become their own drivers of change. The designer-researcher acted as a facilitator during service design activities to explore innovative solutions to healthcare in the various design milieus. Co-design activities served as one of the main processes to engage with the participants to gain insights from their perspective in **Level one** of the sensemaking process (Figures 8.2 & 8.3). These service design activities provided more insight about the context of caregivers in Grabouw.

8.4.1 Designerly Activities: Insights Derived

The outcomes obtained from the service design activities showed that caregivers required more *health information objects* to aid in health education activities in the Grabouw area. Also, caregivers capture data using *paper-based technologies* while attending to patients. The recorded data/ information is later, submitted to their administrator who transfers this information on to the computer for onward forwarding to relevant authorities for verification and evaluation. Caregivers indicated that the transfer of patient data would be easier if they could obtain a system that could help them *digitise* and *record patient data*. Also, it was observed that caregivers have access to mobile technologies, which can be used to facilitate health information sharing and exchange to patients in far to reach areas in underserved communities. Additionally, most patients in the selected communities have low educational levels. This makes it sometimes difficult for caregivers to communicate information to their patients. Caregivers indicated that, designing relevant/ attractive messages with no language barriers could help retain patient's interest when educating and informing patients in underserved contexts (see Chapter 6 for detailed insights). Additional thematic areas that emerged through the sensemaking process in **Phase I** of this study have been graphically presented as Figure 8.4. These thematic areas would require future design intervention and innovation to improve healthcare services in the underserved contexts of the study.

Figure 8.4: Some insights derived in the design milieus
(Service design and sensemaking activities – opportunity for service innovations)

8.5 PHASE II SENSEMAKING: SERVICE USER SURVEYS

Healthcare services in a particular environment involve communication with different groups of people in the healthcare system. Improving the quality of care for people who engage with such services requires that solutions are designed from their perspectives. As discussed in earlier sections of this study, the concept of service design aims at improving services. One of the tools used in service design activities is the service user surveys, which helps in soliciting the opinions of people whom the services would benefit.

8.5.1 Sensemaking: Care Service-Provider Perspective

As part of this study, service user surveys (opinionnaires) were administered to health intermediaries to gain insights about their work practices. The purpose was to ascertain alternative ways that health intermediaries could support mothers to make informed decisions for themselves before, during and after pregnancy. Health intermediaries who participated in this study were from both public and private healthcare settings. Their working experience was ranging from under 2 years to over 10years of providing maternal healthcare services to women (see Chapter 7 for detailed outcomes). The feedback obtained from health intermediaries provided insights about the challenges they experience in their work practices. Some of these insights are summarised into themes and discussed in the subsequent lines that follows.

- **Relevant Information and communication objects**

  In making sense of the information obtained, it was observed that visual-based information objects such as posters were one of the commonest tools used by health intermediaries for patient education in underserved contexts. Health intermediaries acknowledged that *relevant* information in the form of visual-based media would facilitate interaction with patients. However, they would require technology-enabled solutions that could facilitate interaction and send information to many women in remote areas.

- **Major areas requiring maternal health information objects**

  Maternal health information is required before, during and after pregnancy. Some of the stages where information is required include: Pre-Conception Care (PCC), Antenatal Care (ANC), Intra Natal Period (INP), Post Natal Period (PNP) and Neo Natal (NP). The responses obtained from health intermediaries showed that ANC and PCC periods recorded the highest scores, which was followed by PNP, and NP with INP recording the least. These responses showed that women require information critically before, during and after delivery. However, it is critical to provide most of the information during PCC and ANC periods. Relevant information provided at these stages would minimise pregnancy complications, which may lead to maternal morbidity and mortality in underserved contexts.

- **ICT tools for patient education**

  The outcomes obtained from the perspective of health intermediaries showed that, there are many health information objects available for patient education. However, these information objects are usually from paper-based sources, such as posters, pamphlets and dummies for demonstrations. These information objects are usually provided from government sources or obtained from the healthcare centres where they work. The findings showed that ICT tools such as mobile phones, tablets, television and radio are the most preferred tools for patient education. Some of the most experienced health intermediaries indicated that mobile technologies would be a good tool to facilitate patient education in underserved communities.

- **Patient education and communication barriers**

  Health intermediaries indicated that they are sometimes confronted with challenges, which makes it difficult to communicate with women in underserved communities. Some of the barriers to communication they identified amongst many include: *Language* – these are the variations in the native languages of the patients; the prevalence of *low literacy levels* of patients (lack of education) was another major factor which undermined information sharing and exchange with patients; and the high influence of *social cultural norms, beliefs and practices* negatively impacted on communication. Other factors, which inhibit communication include: *lack of time, mood* and *interest of patients* in the information being communicated. Thus, the integration of relevant health information objects with no language and cultural barriers could facilitate interaction and patient education in underserved contexts (Figure 8.5).

In a few words, future health information service innovation should include: technology-enabled information objects, which comprises of multimedia messages with no language barriers to facilitate interaction between intermediaries and patients. Relevant health information enabled by technology is to be disseminated to women before, during and after pregnancy. Some of the ICT tools to facilitate interaction include: mobile phones and tablets with fewer or no boundaries to minimise vulnerable attacks of health intermediaries during healthcare service delivery in their communities (Figure 8.5).

Figure 8.5: Considerations for health information service innovation

8.6 SENSEMAKING: PATIENT-USER PERSPECTIVE

The outcomes obtained from the user surveys administered to participants (patients) showed that most women can access public healthcare services in underserved communities. The participating women indicated they all have medical aids, which enables them to visit health facilities for care on a regular basis but sometimes at a high cost. Furthermore, all participating women can speak more than one of their local languages and a bit of English. The women indicated they obtain health information from sources such as their family members, hospitals and various clinics in their communities. They indicated that health information obtained from these sources is not sufficient to satisfy all their information needs. As such, they would require more relevant information to enable them make informed decisions for themselves and their children. In addition, it was observed that most of them have access to mobile devices, which are android phones for communication. These tools could be explored in future studies to facilitate equitable access to health information to mothers in underserved communities.

8.7 SENSEMAKING: INFORMATION NEEDS AND SOURCES

In this section, the sensemaking concepts are drawn from the classical model and metaphor on sensemaking of (Dervin, 1992:69 cited in Kari, 1998:4-6) (see details description in Chapter Four). The sensemaking process is adopted as one of the analytical lenses to gain insights about the information needs and sources of health intermediaries and mothers in underserved contexts. The concepts are explored to situate the information needs and sources of participants within the context of this study. The sensemaking concepts, such as **Situation, Gap, Bridge** and **Help/ Uses** of information in **space** and **time** by health information seekers were explored to analyse the information needs and sources of intermediaries and mothers (see Figure 8.6). The sensemaking framework as depicted in Figure 8.6 is adapted to service design process to make sense of the information needs and sources of participants at the forefront of the design process. The sensemaking concepts in the prototypical process are described as follows:

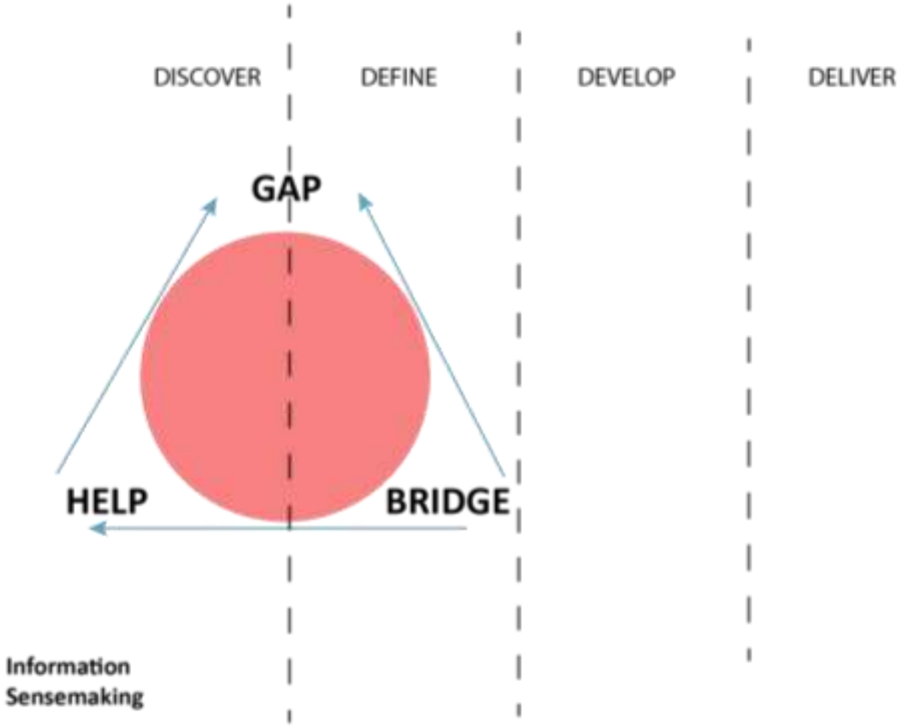


Figure 8.6: The process of sensemaking, gap–bridge–help in situation (Source: Adapted from Dervin, 1992:69, cited in Kari, 1998:4-6; Davies & Wilson, 2013:7)

8.8 SITUATING SENSEMAKING IN THE STUDY

8.8.1 The Prototypical Service Design Process and Sensemaking

Service design activities: sensemaking is explored as an adjustable lens to make sense of designerly activities in the various phases of the Double Diamond Design process. At each phase, the designer-researcher makes sense of context and the complexity within the problem space diminishes towards the *Develop and Deliver* stages of the design process. The **Gap** reduces while **sensemaking** increases through an iterative design process. In this sense, information derived from ***Local Culture*** *(Discover and Deliver) stages* would inform service solution *(new value propositions)* (Davies & Wilson, 2013:6-7; Cipolla & Reynoso, 2017:5-6). These propositions are made at the Develop and Deliver phases to meet the information needs of health information seekers in underserved contexts (Figure 8.7). However, sensemaking occurs as part of the iterative design processes and re-iteration continues according to the desired research goals The sensemaking concepts in relation to this study is described subsequently in lines that follows.

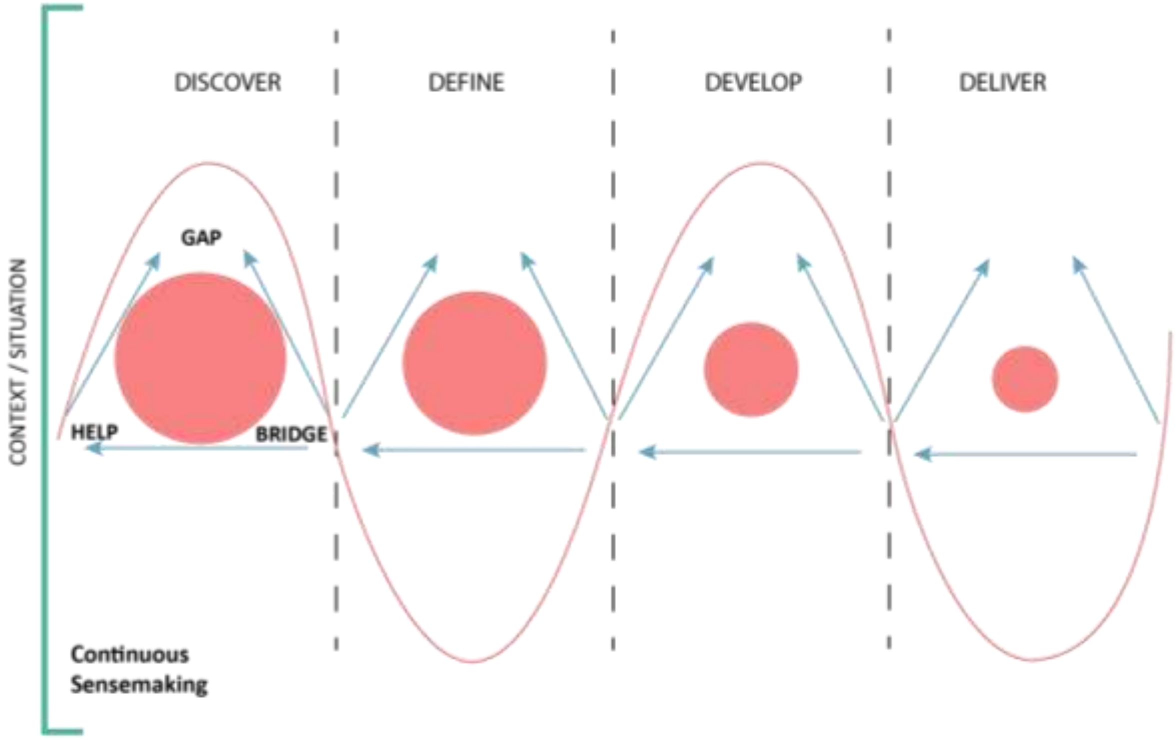


Figure 8.7: Situating sensemaking process in service design activities (Source: Adapted from Dervin, 1992:69, cited in Kari, 1998:4-6; Davies & Wilson, 2013:7)

- **Situation/ Context:** the research environment plays a critical role in the designing of services. The service context which is the world of the service is to be studied in order to design relevant services that could respond to user needs (Edman *et al.*, 2013: 18-19; Yu & Sangiorgi, 2014:119). As such, the social cultural context of the health information seekers needs to be factored into the design of future Multimodal Cryptographer. The Multimodal Cryptographer may comprise of health information objects/ products, services or systems designed for effective information sharing and exchange between health intermediaries and patients (mothers). The Multimodal Cryptographer is to be activated within a Product-Service System (PSS) (Beuren *et al.,* 2013: 222-223; Vezzoli *et al.*, 2018:49) to improve health education and information service delivery in underserved contexts. Therefore, issues such as the social cultural beliefs and users' value systems (local culture) are to inform future design process for proposed service solution which is desirable, useful and useable (Mager, 2006:5; Mager, 2008:355; Cipolla & Reynoso, 2017:6-8).

- **Gaps:** information seeking begins with the **– gaps –** in knowledge. Women seek health information from many sources to **– bridge –** the knowledge **– gaps –** using both manual and ICT information sources (Dervin,1998:39-40; Kari, 1998:5-6; Liu, 2013:1-2; Wilson, 2000:49-50). However, not all women have equitable access to health information particularly in underserved contexts which is due to the low educational levels (United Nations [UN] Report, 2012:25-29; Adanri, 2017:44-45; United Nations [UN] Report, 2018:7-8). Thus, there is a need to **– bridge –** the information **– gaps –** so that women could obtain relevant information towards improving their health and wellbeing in underserved communities. Future healthcare service propositions are to be designed with a foresight of making information easily accessible to women in underserved contexts. Through the use of available technologies, health information can reach many women in underserved communities (Crul & Diop, 2014:3-4; Sondaal *et al.,* 2016:1-2; Miah *et al.,* 2017:4-8). This could help reduce maternal morbidity and mortality and accelerate Afrika's progress towards meeting global health targets such as the UN SDGs by 2030.

- **Bridge**: the findings showed that respondents obtain information from different sources to satisfy their health information needs. Health intermediaries obtain information from sources such as content providers and healthcare sectors, which are provided by the government. On the other hand, patients (mothers) obtain health information from health intermediaries in hospitals and clinics. Furthermore, they obtain information from their family members to satisfy an information need. This information searching process enables the information seeker (mothers) to bridge the information **gap** and obtain **help/ uses** within **space** and **time** in a particular context (Dervin, 1998:39).

- **Help/uses:** the analysis obtained from this study shows that, health information seekers tend to search for information from different sources (Wilson, 2000:49). Through this process, they may find information from people or other relevant sources. The outcomes of the information seeking process of individuals are termed **help/ uses**, which are at the **bridge** stage to close the information **gap** (Kari,1998:6; Agarwal, 2012:9). One of the possible ***help/uses*** in this research case is the proposed **Multimodal – Cryptographer** to serve as a **bridge** to facilitate health information sharing and exchange in underserved contexts. The knowledge gained from these sources largely depends on the knower (information seeker). In brief, designerly ways of inquiry are suggested to identify the information needs of persons (knowers), in order to fill in the information **gaps** to satisfy their health information needs in the future.

8.9 EMERGING SERVICE DESIGN AND SENSEMAKING FRAMEWORK

The study was conducted exploring designerly strategies and tools in the various service contexts. Sensemaking and the Double Diamond processes served as adjustable lenses for the investigation and guided the analysis to inform new value propositions. As a result, an emerging design framework, which is a fusion of service design and sensemaking theories, is suggested to guide future research. The process of sensemaking as part of the design processes in this case starts with the ***current situation*** *in the service context.* Next, the investigation continues with several **iterative co-design processes** through the **Double Diamond Design** phases. The proposed **technology-enabled service** is then designed as the outcome of these processes. Throughout these design process there is a continuous moments of sensemaking – which is represented by the ***spiral*** in the diagram (Figure 8.8). The additional actors involved in the sensemaking processes and the various levels of the framework are described as follows:

- **Intermediaries' sensemaking:** this level of the sensemaking process, represents intermediaries making sense of their *current situation* and identifying their various information needs and sources. The current situation of the intermediaries is then transformed into an *improved situation* with the proposition of technology-enabled information.

- **Developers' sensemaking:** activities at this level involve developers making sense of intermediaries' sensemaking (*of information needs and sources)* to co-design the proposed technology-enabled service.

- **Researchers' sensemaking:** this level involves the sensemaking activities from the researchers perspective in this study. In this case, the sensemaking of the intermediaries and developers were identified. Accordingly, design actions and insights obtained at the various levels (see Figure 8.8) formed the foundation of the emerging framework, which is a fusion of the sensemaking and service design theories. Other researchers conducting similar investigation could explore the proposed framework as a baseline structure to inform health information service innovation in Afrika and other similar settings.

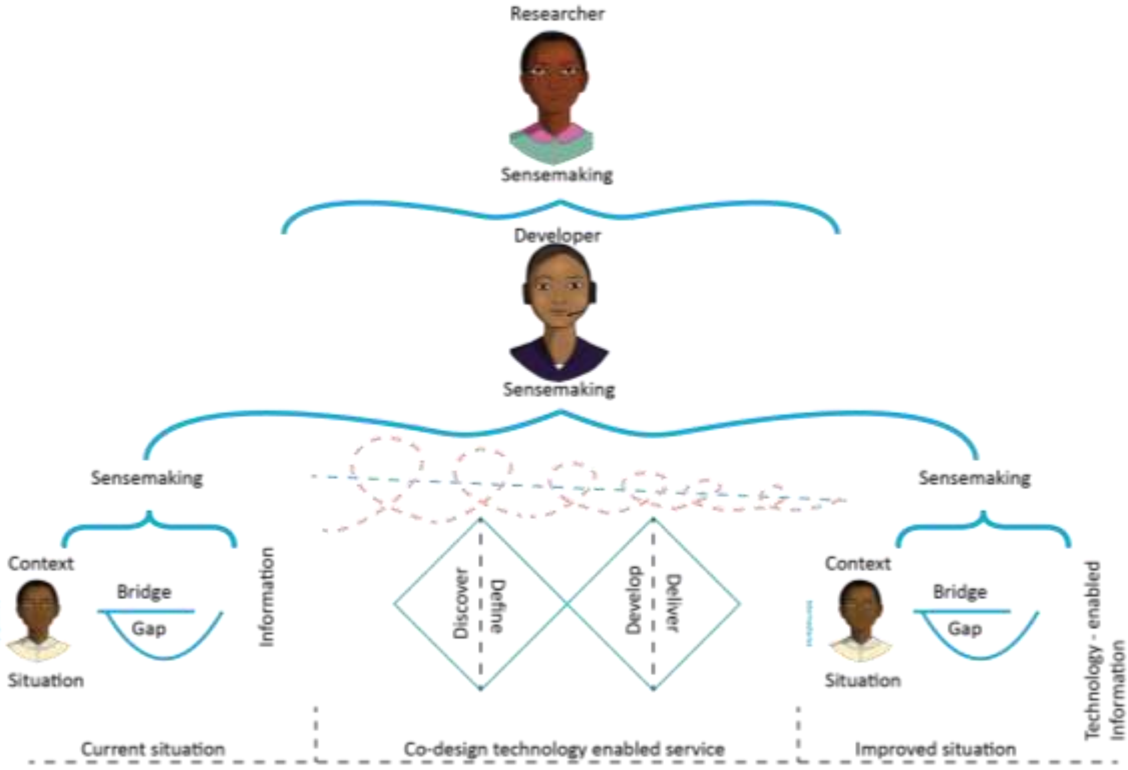


Figure 8. 8: Emerging service design and sensemaking framework
(The framework depicts the moments of sensemaking in the service design activities)

8.10 SUMMARY

Healthcare services are provided in many countries to improve the health and well-being of members living in a particular community. There have been global concerns to improve maternal health across the world. Although, many countries in developed regions have made remarkable progress in maternal health, the case is not the same in underserved contexts in sub-Saharan Afrika. Challenges still exist in various aspects of healthcare service delivery such as providing equitable access to care and availability of experienced health professionals in remote areas in Afrika. There is still a prevalence of high adolescence birth rates, lack of family planning and limited coverage of free antenatal care in underserved communities. These challenges increases maternal morbidity and mortality in underserved contexts in Afrikan sub-regions (United Nations Economic Commission for Africa [UNECA], 2015:XV-XVI; World Health Organisation [WHO], 2015:2-3). Although these challenges may be prevailing in underserved contexts in Afrika, they can be perceived from the designers' point of view as opportunities for innovation.

Consequently, both the public and private healthcare sectors in Afrika are making efforts to improve patient care in order to meet health-related UN SDGs by 2020. Thus, *this study has been conducted to explore ways of designing health information services, which could facilitate information sharing and exchange between health intermediaries and patients in underserved contexts*. Technological interventions such as mHealth and other ICT initiatives have the potential in bridging the information gap to extend healthcare services to women in underserved communities. These could be achieved through affective health education and promotion activities facilitated through technology to reduce maternal morbidity and mortality in underserved communities (Leveille, 2016:13-15; Ariani *et al.,* 2017:16-18).

Health education is one of the major ways of promoting healthy lifestyles in communities. One of the ultimate goal of health education is to communicate meaningful messages to people towards improving their health behaviour (Adanri, 2017:44-46; Smith-Greenaway, 2015:124-126). Providing health information to low-literate populations requires that, health messages be simplified so that it becomes easier for patients to comprehend. Health information could be more meaningful to people, when relevant information is designed from the perspective of information users without boundaries (Friis *et al.*, 2016:6-7). Hence, the need to explore healthcare service design strategies, which are more inclusive to meet user needs. In designing usable and useful health information services, the socio-cultural dynamics of information seekers are to be considered as part of the design processes (Mager & Sung, 2011:1-2; USAID, 2019:26). The inclusiveness of users in the design processes would in turn, improve the information quality and make messages easily understandable by patients (women) (Van Niekerk & Bonnici, 2014:3-8). This would ultimately help low-literate mothers to make informed decisions for themselves and their children. A well-informed society on healthcare would promote a health literate society, which could accelerate sub-Saharan Afrika's progress towards meeting the health-related UN SDGs by 2020 (Speer, 2017:15-16; United Nations [UN] Report, 2018:7).

Further, the outcomes obtained through these designerly processes, unearthed the complexities surrounding health information services in various research contexts. Additionally, it provided insights about the research context, which could inform future design and development process of multimodal health information services. In summary, the emerging sensemaking and service design framework could be explored as a lens to inform future design and development processes of health information services in underserved communities. Also, while conducting this investigation, some of the research questions, which were addressed, are as follows:

3. **What are the characteristics of technology–enabled health education and information services that could facilitate the ability of health intermediaries and pregnant women to make sense of health information relevant to their needs in underserved contexts?**

    a) *What are the alternative ways of assisting health intermediaries in disseminating information to support pregnant women in making informed decisions during prenatal, antenatal, neonatal and postnatal periods?*

    b) *How does the circumstance of health intermediaries and patients in underserved contexts affect the dissemination of relevant health information services?*

4. **How could technology-enabled health (education) information services be designed using visual media to facilitate interaction between intermediaries and pregnant women in underserved contexts?**

   a) *How can health information communication services be designed to meet the education and information needs of patients (women) with low literacy levels?*

   b) *What are the available service design research processes and tools that could be explored to design health information services in underserved contexts?*

In conclusion, the findings obtained from this inquiry have been analysed and discussions have been made which identifies opportunities for service design and innovation. Further research is suggested into the second Phase (Diamond 2) of the Double Diamond Design process in the underserved context of this study (see Figure 8.8). A future experiment is required to design and develop practical solutions to the many complex problems identified in the various service contexts. Some of the strategies, which could be explored for future sustainable healthcare service innovations, have been detailed in the next **Chapter (9)** of this study.

CHAPTER NINE

CONCLUSION AND RECOMMENDATIONS

"To design is to communicate clearly by whatever means you can control or master" – Milton Glaser

Figure 9.1: The main concepts discussed in chapter Nine

9.1 INTRODUCTION

Service design aims at improving services from the perspective of potential users. Service design research as an emerging field can be applied to a wide range of services, starting from simple services and including complex services such as healthcare. Healthcare service is one of the notable areas where opportunities exist for business. Some of these opportunities include *nutrition, caring for the aged,* and *exercise*. These are all potential areas in healthcare where opportunities exist for investments that could benefit service users in underserved communities. However, healthcare services are multi-layered and present their own challenges at every level and point of care. Designing efficient healthcare services that could meet the needs of people in any given society requires careful analyses of the user needs. Consequently, adequate information would be required from the potential service users in order to design sustainable services in a particular context. On the other hand, it is evident that health information is required on all the various levels of care for patient education. Thus, health information is critical to promote a health literate society.

Furthermore, this study was aimed at accelerating South Africa's progress towards meeting global health goals such as UN SDGs Goal 3 – **"ensure healthy lives and promote well-being for all ages"** (Pisano *et al.,* 2015:15-16). In order to achieve this goal, service design research was explored to gain insights into contexts and to explore the possibilities of improving health information services in an underserved context in Afrika. The main research context is in Grabouw, situated within the Western Cape Province of South Africa. Further studies were conducted in Ghana, West Afrika, for replication purposes. Participants in this study were mainly health intermediaries and mothers living within the selected Afrikan communities. A number of service design activities were organised with these participants and this provided valuable insights from the various research contexts. The outcomes obtained from this inquiry are presented in **Chapters 2** through to **Chapters 8** of this study. Some results from this study include *the exploration of new design tools and processes; proposal of a prototype multimodal cryptographer (InfoShare)* – a healthcare system for health information sharing and exchange; and an emerging sensemaking and service design framework for future work in sustainable health information service innovations within underserved communities.

Furthermore, **Chapter 9** covers the conclusions and recommendations of this study. These are based on the data obtained from fieldwork and data analyses. Additionally, the contributions of this study and suggestions for further research are indicated in this section. Also, suggestions for futuristic design innovation in healthcare services within Afrikan settings are proposed. This chapter culminates with the limitations and a summary of this research (Figure 9.1). I now move on to expound on the main concepts stated in this chapter.

9.2 CONCLUSIONS

Conclusions drawn from this investigation have been aligned to the main research questions of this study. Discussion was made using sensemaking as analytical lenses that are placed within service design activities. The sense making approach made it possible to gain an understanding of the data obtained in order to make propositions that would make sense to future service users. I now turn to the conclusions of this investigation, which are as follows:

1. **What are the characteristics of technology–enabled health education and information services that could facilitate the ability of health intermediaries and pregnant women to make sense of health information relevant to their needs in underserved contexts?**

Conclusions drawn from this enquiry are that technology-enabled health education and information services require information objects with multimodal functionality to facilitate interaction. The health information service is to be operational using relevant information objects with multimodal functions, which could facilitate interaction. More visual-based information objects are preferable as it potentially makes it easier for mothers with low literacy to comprehend health information in underserved communities. A few attributes of this healthcare system have been identified which have been broadly categorised into thematic areas such as ***Genre, Format, Medium, Form and Mode***. These attributes are to serve as a foundation and inform future design principles for designing and developing health information services in underserved communities in Afrika.

a) **What are the alternative ways of assisting health intermediaries in disseminating information to support pregnant women in making informed decisions during prenatal, antenatal, neonatal and postnatal periods?**

Conclusions from this inquiry are that technologies could serve as viable tools to facilitate health information communication between health intermediaries and their patients (women) in underserved communities in Afrika. Health intermediaries who were closely studied in this research case could actually use ICT tools to educate and inform patients about their health. Likewise, some patients could use mobile devices for communication and for other purposes. These tools could be used as part of their continuing professional development so that they could improve their health informatics skills for their professional practice.

In addition, this study showed that opportunities exist for technology to be integrated into healthcare services in underserved communities. Some of these areas include: wearable technologies for patients (mothers) so that health intermediaries could monitor their patients' progress from remote areas. Also, with the new digital age, the proposed technology-enabled solution (InfoShare) could be used to support the training of health intermediaries in the future. The proposed healthcare system could be upgraded with training materials in the form of multimedia messages. This could facilitate interaction and easy comprehension of messages to persons in underserved contexts.

Also, technology-enabled solutions could be further developed to record patient data and could also be used for other purposes in healthcare service delivery. For instance, caregivers within the Grabouw community could be emancipated in their professional practice through the use of technology. Technology-enabled solutions could accelerate the daily activities of caregivers towards meeting global-health targets (UN SDGs). Thus, the integration of technologies in health information services could facilitate the dissemination of health information to patients (mothers) in underserved communities.

b) How does the circumstance of health intermediaries and patients in underserved contexts affect the dissemination of relevant health information services?

Conclusions from this inquiry were mainly derived from insights gathered in service contexts. The supposition was that health intermediaries required additional information objects and other relevant materials to facilitate interaction during health education activities in their communities. Also, more visual-based materials would be required as part of the training activities for caregivers while they prepare for health campaigns in their communities.

Other factors undermining the dissemination of relevant information revolve around barriers such as, *low educational levels, differences in many native languages, lack of interest, time and the mood of patients*. All these prominent factors affect information quality when informing and educating patients (women) in underserved communities. Hence, contextualised health information objects would be required to facilitate interaction between health intermediaries and their patients.

Nonetheless, health intermediaries indicated some of the challenges confronting them in their work activities. Some of these issues included, *lack of transportation, unavailability of warm and protective clothing, insufficient healthcare toolkits, unsatisfactory salaries and a lack of incentives to serve as motivation.* An industry that offers a market related salary and observes basic conditions of employment would be required to address these challenges and needs of health intermediaries in underserved communities.

2. **How could technology-enabled health (education) information services be designed using visual media to facilitate interaction between intermediaries and pregnant women in underserved contexts?**

Technology-enabled health information services are to be co-designed with potential beneficiaries of the proposed health information service. The designing processes are to be participatory in a shared space such that users of these services can collaboratively offer suggestions to improve emerging health information services. Health education and information services are to be tailored towards the specific needs of intermediaries and pregnant women in a particular environment. The identification of specific requirements such as the *demographics* and *psychographics* of information recipients is critical towards providing relevant health information services in underserved contexts. Additionally, gaining insights about the socio-cultural values and systems provides a direction for designing services that could respond to specific information needs of intermediaries and pregnant women in underserved communities.

a) **How can health information communication services be designed to meet the education and information needs of patients (women) with low literacy levels?**

Conclusions are that information designed for low-literate populations should be *context specific*. Visual-based information is suggested with minimal text-based information so that it is easier to comprehend health information. In order to communicate effectively, health information would need to be designed without *language barriers*. Health information services could be designed collaboratively with community members who might have indigenous knowledge on certain topics through a community-based approach.

Also, community leaders and family members in underserved communities could be equipped with health information to support women to improve their health behaviour. Additionally, health information could be provided to low-literate populations through other visual methods such as **photo voice, digital storytelling and drama/play**. All of these processes could potentially enable women with low literacy to obtain information about their health. This could ultimately lead to a health literate society.

b) **What are the available service design research processes and tools that could be explored to design health information services in underserved contexts?**

Service design methods were explored in this research to obtain data from the participants. Design thinking activities such as co-design was proven to be a useful method to gain insights from participants. These were characterised by visual methods such as illustrations, role-play, design probes and toolkits that minimised the presence of the designer-researcher in the co-design activities. Again, service design methods made it possible to immerse oneself into the community and to step into the shoes of participants and empathise with them in various research contexts. Design empathy was achieved through service design methods employed for this investigation. The service design activities facilitated the identification of information needs and sources of caregivers. As a result, health information objects were co-created and prototyped to facilitate interaction between health intermediaries and their patients.

Conclusions are that service design activities could be further explored towards improving healthcare services in various research contexts. Inclusive design strategies would serve as viable means to improve healthcare services in the selected underserved communities. Reflecting on design ethics, *enkrantic* norms are to be factored into the design as well as the development of sustainable solutions (Coates, 2011:321-322; Young, 2013:90). Thus, designers are encouraged to act and design based on moral reasons which aligns with global design ethos. This implies that ethical values in designing solutions should move beyond *local* and *global* to *glocalised views* when working in underserved communities (Debrah, De la Harpe & M'Rithaa, 2015:70-71; Sserunjogi *et al.,* 2016:408). This means that solutions could be designed with Afrikan philosophies without compromising global standards. Futuristic design innovations in healthcare should be socially responsive and sustainable in Afrikan communities.

9.3 RECOMMENDATIONS

Reflecting on this research, a number of recommendations were identified based on fieldwork conducted in two different Afrikan regions. These recommendations mainly revolved around policy formulation in design education and in healthcare services. Also, the designer's role in developing services in Afrika is also to be considered. These recommendations are detailed subsequently:

- ### Healthcare policy formulation

Ensuring equity and access to health information: health information is required on every aspect of care so that people can make informed choices about their health. The UN SDG 3 aims at **ensuring healthy lives and promote wellbeing for all ages**. These goals could be achieved when there are no disparities in the provision of healthcare services in underserved communities. Some of the suggestions for improving healthcare services include, the provision of infrastructure and relevant amenities required to improve healthcare services in underserved communities.

Health information should be readily available in all regions particularly to low-literate women in underserved communities. Also, health intermediaries who provide healthcare services to women in remote areas should be equipped with the relevant resources to enable them to provide better services for everyone. Additionally, it is recommended that the appropriate government agency for labour should explore ways of improving working conditions of health intermediaries in underserved communities.

Health information materials should be readily available for health intermediaries to use during health education activities in underserved communities. The design of personalised health information objects could be integrated as part of the continuing professional development of health intermediaries. This could enable them to design basic health information with little or no assistance from expert designers and thus facilitate health education activities in their communities.

• Health information services

Providing relevant information: information systems available for health information communication are either obtained through manual sources such as Print Media (P-Media) or Electronic Media (E-Media). Relevant health information could be made available in these media for health information seekers and providers. However, consideration should be given to women with special needs during the design of health information services. A combination of a more visual-based system with lesser text-based information is suggested. This visual-based information could be combined with face-to-face interaction to ensure better understanding.

Mobile technologies could be employed to facilitate health information dissemination to remote areas in Afrikan sub-regions. Due to challenges with connectivity in some remote areas, both online and off-line messaging platforms could be combined. This could facilitate the dissemination of health information to many people at once. Health information systems and materials should be designed with prospective information receivers in mind.

A more participatory approach to health education campaigns such as photo-voice is recommended to sustain the interest of health information receivers. A holistic approach to designing healthcare services, which would include stakeholders in underserved communities, is suggested. These could be attained through the use of bottom-up approaches to include community stakeholders in the design process towards attaining sustainable results.

• Design policy for healthcare service

Design policy in healthcare: service design provides opportunities to design *with* people by exploring bottom-up approaches. Hence, there is a need to integrate the use of eco-centric design strategies into the design of healthcare services in underserved communities in Afrika. Policymakers in healthcare are encouraged to integrate design thinking as a means to improve healthcare services in developing contexts. For instance, in the year 2014, Cape Town emerged as the World Design Capital (WDC) (click to view: **WDC|projects**]). The WDC was characterised by many community-based projects and activities where designers proposed innovative ideas and discussed pressing challenges within communities. A policy document was formulated as part of the WDC, which could serve as a guide to design innovation in healthcare services in South Africa (click to view design policy document: [**WDC|policy**]). This intervention could be emulated by other health organisations in other parts of Afrika when formulating health policies to improve the general well-being of persons.

• Design education and socially conscious design

Social design: design could be used as a tool for social, cultural and economic development in underserved communities in Afrika. Higher education institutions in Afrika could explore the use of service design thinking strategies to promote community development. Design education in Afrika could be re-designed to accommodate real life projects so that learners could participate as part of service learning for assessment. The formal design education system could be adjusted to go beyond designing innovative solutions for **"only users"** to designing sustainable service product systems for **ALL.**

Social design strategies should be explored to create an enabling environment to co-create sustainable solutions with potential beneficiaries of designed solutions. Designers could be more involved in socially conscious projects where they immerse themselves into communities and allow social actors to be the enablers of ideas to solve wicked and complex societal problems (Cross, 1982:223-224). They could explore service design as a tool to transform society through transdisciplinary community engagements while exploring Afrikan philosophies such as Ubuntu. In these social and transdisciplinary spaces, designers could serve as change agents in society and design sustainable solutions that could improve the health and wellbeing for **EACH** and **ALL.**

• Strategic design in underserved communities

Collaborative services: underserved communities in South Africa are faced with a myriad of challenges, as in the case of Grabouw. Service design research methods provide tools that could be explored to address other health-related problems such as HIV/Aids. This is prevalent in underserved communities in South Africa. However, this research case serves as an example of how service design research could be explored to strategically extend healthcare services to people in underserved contexts. Insights derived in **Phase I** and **Phase II** of this study provide avenues for future design interventions. These opportunities and challenges identified are suggested as avenues for future design innovation and require a design challenge from prospective partners. Thus, the need for innovative design solutions that focus on health and wellness is great. These solutions have the potential to emancipate community stakeholders to become animators of change in underserved contexts.

• Futures design studies and innovation

This investigation was conducted following the Double Diamond design process. Insights obtained through Diamond 1 would require further research to inform future design and development processes in Diamond 2. Some of the insights derived revolved around other pressing social issues such as crime and violence, the HIV and AIDS scourge, substance abuse, teenage pregnancies, uncontrolled migration, lack of jobs, growing ageing population, poor hygiene and inadequate health facilities. Consequently, all these areas present opportunities for future research that could be explored through service design research. I now move on to elaborate on recommendations for some of these identified challenges.

• Design Challenge: speculative futures scenarios

The challenges with healthcare services in Grabouw present opportunities for designers to explore design strategies for sustainable solutions. Further research is required to unearth complexities around communication practices and other areas of care in Grabouw.

Futures studies could explore:

“**The Journey of the Home-Based Community Health Worker (HBCHW)**”. The health intermediaries’ journey could be explored through the following communication lenses:

1. **Sharing health information with patients*:*** challenges around information needs and how information is given/ left with patients.
2. **Capturing health Information*:*** challenges around capturing and updating of (patient) information.
3. **Sharing health Information with stakeholders*:*** challenges around how information is shared successfully with other medical workers, Institutions, etc.
    - **Health education and training:** challenges around information needs for training and health promotion in the community. A Sample of potential design briefs for future design challenges is captured as Appendices 9-13 (click to view samples – [[9] **design briefs and tools**; [10]**posters - visual prompts;** [11]**storyboard**; [12] **customer journey map;** [13]**service blueprint**]).
4. **Health literacy:** challenges around how patients comprehend health information etc.
5. **Working conditions:** challenges around working conditions that could make the work of health intermediaries easier. For example, design interventions could focus on designing innovative solutions that revolve around suitable clothes, the provision of transportation systems, providing training programmes, developing systems to improve salaries and enhancing the self-esteem of caregivers.

In summary, when designing solutions in the field of healthcare, the proposed systems or artefacts should go beyond “pretty things”. Designed solutions should be meaningful and practicable within the context where it will be used and placed. For example, in providing solutions to some of these existing problems in the real world, frugal innovation strategies could be explored. In essence, frugal innovation strategy aims at tapping into existing ideas and making it practicable by removing the complexities that surround objects and systems. A collaborative approach through service design strategies could improve healthcare services in underserved communities.

9.4 RESEARCH CONTRIBUTIONS

This study was conducted with much rigour within a transdisciplinary research domain, adhering to design ethos and research guidelines within an Afrikan context. Service design provided a common ground for divergent, yet interrelated disciplines, to work together in an abstract space to explore solutions to complex problems. Several propositions were identified because of transcending disciplinary boundaries to find sustainable solutions for health information services. Conducting this research through service design methodologies provided multi-layered contributions. These contributions are described in four main categories: **knowledge, theoretical, methodological** and **practical** contributions which are described subsequently.

9.4.1 Knowledge Contribution

Research activities are conducted to search for knowledge or to add to existing knowledge. This investigation revealed major areas in healthcare where information is required by health intermediaries to improve healthcare services. The identification of the various information needs and sources reveals areas where health information objects are most needed. This study contributes to knowledge in many transdisciplinary fields such as ***Art and Design; Communication Studies; Health and Clinical Sciences; Computer and Information Sciences; and Social Sciences.*** Additionally, outcomes obtained from this study provide opportunities for further research towards improving healthcare services in underserved contexts. Also, factors inhibiting effective interaction between health intermediaries and women were identified and suggestions for improvement have been made. These findings contribute to knowledge and present other researchers with futuristic design innovation opportunities. The emerging service design and sensemaking framework as part of this study, could provide a foundation to set out the direction for further research in underserved communities.

9.4.2 Theoretical Contribution

Sensemaking theories were explored as analytical lenses for this research. As a result, an emerging theoretical framework for making sense out of complex data from service design activities is proposed. The emerging sensemaking framework is a combination of the Double Diamond design process and sensemaking theory. This framework could serve as a tool for analysing design-related research activities in further research.

9.4.3 Methodological Contribution

Interpretive philosophies were explored in this research case and knowledge was mainly co-constructed with participants through service design processes. However, additional design probes and toolkits were designed that served as boundary objects to generate discussions during service design activities. A process model of designing these toolkits and probes has been developed to guide future researchers when working in similar settings. In addition, an emerging design framework from the larger research project, called the ISD4D life cycle, is proposed. This could serve as a methodological approach for future researchers when designing health information services in underserved communities in Afrika.

9.4.4 Practical Contribution

This study was highly exploratory and has yielded multiple practical contributions. Working with community stakeholders was a practical way of collaborating with potential users to design services that would be beneficial to them. Also, the development of design probes and toolkits for information needs inquiry serve as practical contributions for future work. Additionally, the proposed **service blueprints, storyboards** and **design briefs** could be practically used in future research activities as prompters to generate discussion (Appendices 9, 10 & 11: [click to view samples –

[9]**design briefs and tools**; [10]**posters - visual prompts**; [11]**storyboard**]). Also, the proposed kujali designerly method cards could guide future facilitators during co-design activities in similar settings in Afrikan communities (Appendix 19: click to view - **designerly method cards**]). Another practical contribution from this study is the prototyped multimodal cryptographer *(infoShare [brand name])* – healthcare system to facilitate interaction. This technology-enabled health information object/system could serve as a translator for health education and promotion purposes in underserved contexts. Also, the emerging design principles for developing multimodal healthcare systems could serve as a practical guide for programmers and developers in future work. Additionally, a guideline book – titled "SD4D guidelines" (click to view: [**ISD4D guidelines book**]) has been compiled as part of the larger research project (INDEHELA ISD4D), to inform future research activities in underserved communities Afrika.

9.5 LIMITATIONS OF THIS STUDY

In conducting a piece of research, investigators may be confronted with challenges that could negatively impact expected outcomes. Likewise, in this research endeavour, some challenges were experienced but some of them were creatively resolved. This made it possible to achieve the stipulated research goals for this study. Yet, there were some challenges that were beyond my jurisdiction as the designer-researcher and these are described as follows:

At the time of this investigation, there was frequent social unrest at the main project sites and higher education institutions within South Africa (Fees Must Fall Protest). These protests disturbed the data collection process and the general research process causing undue delays for this investigation. For instance, there were several riots at the main project site in the Grabouw community. Due to these protests, it was not advisable to continue working in the Grabouw area because it was too risky (click to view: [**Grabouw unrest**]). Following the directives of contact persons at the Elgin Learning Foundation, all research activities were suspended until social stability was regained. These eventful protests interrupted the research pace and delayed the timely completion of this study.

After the numerous protests had subsided, I was over-enthusiastic at some stage during data collection, which resulted in excessive information. In analysing the data, I was caught in a dilemma of what information to retain and what to leave out. This situation caused me editing problems and unfortunately I have to exclude valid data due to restrictions in word count (Collins, 2010:95). However, the rest of the data will be published as journal articles in future to share research findings for the benefit of all interested parties.

Also, due to the numerous challenges and opportunities, which were discovered in the research context, it was difficult to make propositions that could address all the problems identified. This was a bit challenging due to the budget constraints for this study. Thus, further research has been suggested to investigate further into the identified areas for improvement.

I therefore accept the limitations of this research, based on some of the challenges I faced in the process of conducting fieldwork. These challenges made it difficult to delve further into the phenomenon under investigation. Albeit these persistent challenges, this investigation was conducted with much rigour to achieve the stipulated objectives of the study. The main research aim is stated as: explore ways of designing technology-enabled health information services that could facilitate interaction between health intermediaries and patients (mothers) in an underserved context.

Therefore, I would like to state that based on the situation at the time of this investigation, the findings presented in this document are valid and reliable, based on research quality. Hence, aspects, which were not covered due to the research constraints, have been suggested as further research. It is my hope that overcoming some of these shortcomings indicated here, future service design researchers would improve the research quality and enrich the experience of designers in transdisciplinary studies.

9.6 SUMMARY

This study epitomises what can be achieved through service design research to find sustainable solutions to emerging problems in underserved contexts. Designing health information services that could facilitate better interaction between health intermediaries and women (patients) in underserved contexts has been a socially responsive research endeavour. Service design methods employed in this investigation permitted the establishment of healthy relationships with participants for future research activities. Also, outcomes from this study could potentially improve maternal healthcare services when implemented in future and promote a health literate society.

Reflecting on my experiences from this study, I have gained knowledge and experience in service design research within a transdisciplinary domain. Some of the outcomes from this study, such as the prototyped multimodal healthcare system, emerging sensemaking framework, design processes and tools, could serve as a guide for future researchers in underserved contexts (click to view available resources: www.designforhealth.org). Service designers could explore Afrikan design ethos such as Ubuntu drawn from Afrikology philosophical viewpoints to design socially responsive healthcare services. Designers could explore eco-centric design strategies to solve some of the wicked and complex problems associated with healthcare services in sub-Saharan Afrika. In conclusion, future service design and innovation researchers are encouraged to ***"Live design – transform lives"*** (WDC, 2014 [click to view: **WDC|Cape Town**]) while working in underserved contexts in Afrika.

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APPENDIX(ES)

Appendix 1: Ethical clearance – CPUT, FID

- **Click to view: <u>Ethical clearance</u>**
  https://drive.google.com/file/d/1Nju8rmRyRqezLiywYTfaVn318PANJ_8-/view?usp=sharing

- **Short URL:** https://bit.ly/2MAK1e1

Appendix 2: Permission letter – Elgin

- **Click to view: <u>Permission letter</u>**
  https://drive.google.com/file/d/1kQ9AfuKx9yH-vv1X_l5B3elxSSuzWnyl/view?usp=sharing

- **Short URL:** https://bit.ly/3jgsy6B

Appendix 3: Ethical concern for research

- **Click to view: <u>Ethical concern| research</u>**
  https://drive.google.com/file/d/1l8pOWbP9XZfO7m06Ke6FzueQ3ASe-5cu/view?usp=sharing

- **Short URL:** https://bit.ly/3tsvSAu

Appendix 4: Ethical concern – student participants

- **Click to view: <u>Ethical concern|students</u>**
  https://drive.google.com/file/d/1iBsgcIFK1dsn_zJsz0eqUBH-F9HZ0nh2/view?usp=sharing

- **Short URL:** https://bit.ly/3oNhYVK

Appendix 5: Ethical concern – researcher

- **Click to view: <u>Ethical concern|researcher</u>**
  https://drive.google.com/file/d/1hG1Jd3Fz3Go_ZeSmrjO17rn2_k5evz03/view?usp=sharing

Short URL: https://bit.ly/3oNhYVK

Appendix 6: Sample of service user survey/ opinionnaire (Set A)

- **Click to view: Service user survey|healthcare workers** https://drive.google.com/file/d/1ZsuM-uLewybn2oYV2JZxPOFJco_h9Mj_/view?usp=sharing
- **Short URL:** https://bit.ly/2O4jLt3

Appendix 7: Sample service user surveys/ opinionnaires (Set B)

- **Click to view: Service user surveys|women** https://drive.google.com/file/d/1dsm_9-bidqDDOX2S6EdkCbBcYL708kRv/view?usp=sharing
- **Short URL:** https://bit.ly/2O5aYag

Appendix 8: CPD certificate – MBC

- **Click to view: CPD certificate - MBC** https://drive.google.com/file/d/1NFoZGUL2lempWa2I7erTQx0j1b8ti1Wc/view?usp=sharing
- **Short URL:** https://bit.ly/3pMm01T
- **Click to view conference**: MBC- Conference http://www.spiritualbirth.net/midwifery-and-birth-conference-2014
- **Short URL:** https://bit.ly/3cCALAT

Appendix 9: Design briefs and tools

- **Click to view: Design briefs and tools** https://drive.google.com/file/d/1yLIcHrQk8oPjErYrjlGddfywHlxYdPSI/view?usp=sharing
- **Short URL:** https://bit.ly/3pLfWac

Appendix 10: Sample posters – designerly activities

- **Click to view: Sample posters|designerly activities** https://drive.google.com/file/d/1ovmPXEAEYSSPyni9MgXuTnQ63CxGRIdN/view?usp=sharing
- **Short URL:** https://bit.ly/3pOMLmt

Appendix 11: Sample storyboard – caregiving activities

- **Click to view: <u>Storyboard|caregiving activities</u>** https://drive.google.com/file/d/1DuDPrydW7yWAvCjS-Ku3RQVc2JOdu87O/view?usp=sharing

  Short URL: https://bit.ly/39N9zNK

Appendix 12: Sample customer journey map

- **Click to view: <u>Customer journey map</u>** https://drive.google.com/file/d/1pq4v0HT05R3F_OH0UqCC_3y2E1flAGI8/view?usp=sharing
- **Short URL:** https://bit.ly/3pMEIqo

Appendix 13: Sample service blueprint

- **Click to view: <u>Service blueprint</u>** https://drive.google.com/file/d/1JUhXoZWo-vW5lb83NFrM-kqytagrT7y7/view?usp=sharing
- **Short URL:** http://bit.ly/3pLm2HC

Appendix 14: Sample mind map – caregiver sessions

- **Click to view: <u>Mind map|caregiver sessions</u>** https://drive.google.com/file/d/1PdKCUyY-o62d5MDU17NWxqwyr478aQ12/view?usp=sharing
- **Short URL:** https://bit.ly/3oSFG3e

Appendix 15: Expanded data sets

- **Click to view: <u>Expanded data sets|co-design sessions</u>** https://drive.google.com/file/d/1odY9jVyUkOomGaEIIbPsgm-m8XL8Xqzr/view?usp=sharing
- **Short URL:** https://bit.ly/39J7rXm

Appendix 16: Prototyped solution

- **Click to view slides/ interaction display: <u>Prototype|InfoShare</u>**
  https://drive.google.com/file/d/1X8ElcfcSIH4QwykxLcjgJmkGS3SSxS2O/view?usp=sharing

- **Short URL:** https://bit.ly/3rIpAAM

- **Click to view posters/ pamphlets/ codes:**
  - **Poster Sample: <u>Poster</u>**
    https://drive.google.com/file/d/1WxglagCuM00JasS_7SzxKd2mJXV4DuAr/view?usp=sharing
  - **Short URL:** https://bit.ly/3arS1WK
  - **Pamphlet sample: <u>Pamphlet</u>**
    https://drive.google.com/file/d/1ML_MPDVBBLG-MWTMYMdHpieSLxa0PFgG/view?usp=sharing
  - **Short URL:** https://bit.ly/3jglC9N
  - **Programming links/ code to infoShare: <u>Programming|Coding|Infoshare</u>**
    https://github.com/boniface/infoshareapi
  - **Short URL:** https://bit.ly/3pOi290

Appendix 17: Films/ slides and other supporting documents

- **Click to view**: **<u>Films and slides</u>**
  https://docs.google.com/document/d/19s8-RVMNXT3Jh0QC0JRqarxpHIY0fO2MJ5iKO264rbY/edit?usp=sharing

- **Short URL:** https://bit.ly/3oKrJnJ

Appendix 18: List of research output/ publications

- **Click to view: <u>Research output from the study</u>**
  https://drive.google.com/file/d/1UwzbsASr6TNMrsry6rB4pdKWguFhmeID/view?usp=sharing

- **Short URL:** http://bit.ly/3rlFATk

- **Click to view: <u>Research output|other publications</u>**
  https://drive.google.com/file/d/1SZwgKtjp19JPg1RXL-TWeelg-Mf0eofm/view?usp=sharing

- **Short URL:** http://bit.ly/3pPShVU

Appendix 19: Samples of designerly method cards

- **Click to view: Designerly method cards** https://drive.google.com/file/d/151M1vOvsXIcx0ExDpfycpWg4Ci15h62o/view?usp=sharing
- **Short URL:** http://bit.ly/2LgYWtf

Appendix 20: Design research ePortfolio

- **Click to view**: **PhD Thesis|ePortfolio** https://sites.google.com/d/0B8iF6rsGItLLeGVNSFZ3SGF0VWc/p/10zIpoTWMJjxPVu3JmNqKEnoIzwvzmqAy/edit?authuser=6
- **Short URL:** http://bit.ly/3atS98h