Building Empathy for Design Thinking in e-Health: A Zimbabwean Case Study

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Abstract. The challenges of healthcare delivery in Africa are well documented. Advances in technology present an opportunity to address some of these challenges in a cost-effective manner. Notwithstanding these advances, many initiatives fail to deliver the desired benefits, with a lack of citizen engagement cited as one of the reasons for this failure. Design thinking is an approach to innovation that places human needs at the centre of design by gaining empathy with those for whom the designs are initiated. This paper reports on the empathy building conducted in trying to understand the needs of mothers seeking post-natal care in a low-income neighbourhood in Zimbabwe. Through interviews, observations, journals, and using service-dominant logic theory to analyse the output, a picture emerges of the lives of the mothers and babies, and their interaction with the healthcare system. Working in teams with mobile application developers and nurses, the mothers participate in a workshop that produces points of view that define problems the teams would like addressed, using technology in a design thinking exercise.

This paper reports on the work of hospital midwives, and chronicles the lives of several mothers in the eight weeks after giving birth. It also sets out four design challenges based on the points of view derived from the design thinking workshops.

Keywords: Design thinking; e-Health; Service dominant logic; Zimbabwe

1   Introduction

The challenges of healthcare delivery are rooted in inadequate funding [1], often in the face of growing demand due to population growth [2] and, in Africa especially, the spread of disease. challenge for healthcare providers [3]. The growing availability of low-cost ICT resources makes the use of ICT in healthcare an attractive proposition [4]; despite the resources being thrown into these eHealth initiatives, however, many of them fail to deliver meaningful results, due to poor citizen engagement [5–7].

Design thinking is a tool that can be used to improve healthcare [5]. Implementation of design thinking is still novel in Africa, and its use is mainly restricted to the design industry [6], yet its usefulness extends beyond the areas that have previously been closely associated with design [7]. Cases of design thinking, in both healthcare

and ICT, are numerous within the academic literature [8]. Design thinking processes are anchored on empathy building, a process through which designers find out the needs and wants of those they design for, by engaging in their lives. The application of design thinking in low-resource environments, such as those encountered in many African countries, requires the attention of researchers, in order to encourage the future uptake of such methods in practice.

This study approaches the subject by focusing on the provision of post-natal care in a low-resource environment, by addressing the following three research questions:

Main research question (MRQ): How can design teams incorporate the needs and wants of service beneficiaries in their designs?

Sub-research question 1(SRQ1): What are the circumstances of those offering and receiving post-natal care services?

Sub-research question 2 (SRQ2): What design challenges can help designers build better systems for the provision of post-natal care?

Working with Chitungwiza Hospital, a provincial hospital in the low-income neighbourhood of Chitungwiza in Harare, Zimbabwe, the researchers sought to find ways of improving post-natal care services using ICT design thinking. The team studied the lives of new mothers and their babies in the eight weeks after giving birth, and building a rich understanding of their lives and their expectations from the healthcare system. The information collected from engagement with the mothers as well as the healthcare system, formed the basis of empathy input that was used in a design thinking exercise aimed at improving post-natal care. This study adds to the academic awareness of the process of engaging consumers of services, by means of interviews, observations, journals, and the use of storytelling as a mechanism for transmitting the information gathered.

Section 2 of this paper provides a brief survey of the literature related to the key ideas explored in this study. Section 3 describes the methodology followed in setting up the study, while Sect. 4 reports on the results, focusing on answering the two sub-research questions. Section 5 reports on observations and conclusions from the study, and proposes an answer to the main research question.

2 Literature Review

This study explores the use of design thinking methods in improving the applicability of ICT in healthcare, by gaining an improved understanding of the circumstances of those for whom designs are being made. This section reviews the literature on design thinking, and how ICT is being used in health, as well as the opportunities for research in this e-Health.

2.1 Design Thinking

Design thinking is a human-centred approach to problem solving that moves beyond the rational and analytic, but looks to utilise intuitive and pattern-recognition abilities to suggest functional products and services that appeal to their users emotionally [9]. Products and services built on assumptions about user preferences fail to fulfil the needs of those they are designed for. Proponents of design thinking argue that the perspective of end users of products and services are brought to the fore, and, when used together with rapid prototyping, more effective solutions are quickly found [9]. While arguing that users' ideas are often difficult to convert into commercial services, Magnusson et al. [10] concede that users do make a positive contribution if their role is properly managed.

Brown and Wyatt [9] describe design thinking as being "optimistic, constructive, and experiential", offering a pragmatic approach for building solutions that the end users value. Brown [11] describes a design thinking exercise as consisting of three phases: inspiration, ideation and implementation. An alternative is proposed by the Stanford D. School [12], whose design thinking process is made up of five working spaces or modes which a design team traverse in their journey to a final solution. The empathy mode allows designers to understand people, and people's needs and wants, by talking to them, listening to them, and observing their lives within the context of a design challenge. The definition mode tries to bring clarity to the area of interest within the design challenge, with the goal of coming up with a meaningful and actionable problem statement or "point of view" (POV). The idea generation mode looks for possible solutions to problems before zeroing in on the most viable, feasible and desirable solutions for prototyping, testing, and possible implementation. The activities within each of these spaces are not necessarily sequential, but may be recursive in nature, allowing design teams to revisit prior spaces to seek clarification or enhance their understanding.

Empathy lies at the heart of design thinking [15–17]. Empathy is about stepping into the lives of those for whom designs are targeted, so that the designs are relevant not only to their circumstances, but also to their lives in general [13]. Empathy entails knowing what others feel and value [14]. Gaining empathy requires that designers understand others' point of view, their beliefs, concerns and, ultimately, their needs [15]. Building empathy involves the following [15, 16, 21]:

- Observing the world in minute detail
- Noticing things that others do or not do
- Probing
- Watching
- Listening
- Collecting stories
- Caring about other people's lives

According to the Stanford D. School [12], empathy gathering helps designers uncover unmet needs, guides innovation, identifies the correct people to design for, and helps discover the emotions that guide the behaviour of those whom the designs are intended for. Liedtka [16] concludes that empathy building in design thinking helps reduce the cognitive biases that typically afflict design projects. These biases include projection bias, egocentric empathy gap, focusing illusion, hot/cold gap, say/do gap, planning fallacy, hypothesis confirmation bias, endowment effect, and availability bias. Failure to manage these biases in design may result in designers ignoring novel, value-creating, and diverse ideas. Designers may also undervalue or overvalue designs, based on their own values, if they do not take into account the perspective of those for whom they are designing.

The ideas behind design thinking resonate with the core tenets of service-dominant logic [17]. Vargo and Lusch [18] have developed, over the last twenty-five years, a set of ideas that now form the basis of service-dominant logic theory. In their 2017 [18] paper, their ideas have been reduced to a set of five axioms that define all economic exchange as being based on service. These axioms are summarised in Table 1, and used in this study as a basis for understanding the ecosystem around service offering [19]:

Table 1. The axioms of service-dominant logic [18]

$Axiom_1$	**Service** is the fundamental basis of exchange
$Axiom_2$	Value is co-created by multiple **actors**, always including the beneficiary
$Axiom_3$	All social and economic actors are resource integrators **{service network}**
$Axiom_4$	Value is always uniquely and phenomenologically determined by the **beneficiary**
$Axiom_5$	Value co-creation is coordinated through actor-generated **institutions** and institutional arrangements

This study exploits the axioms of service-dominant logic to guide the collection and analysis of empathy data.

2.2 ICT in Healthcare: e-Health

Chandrasekhar and Ghosh [4] point to three ways in which ICTs can drive service innovation in the healthcare sector, a field that has come to be known as e-Health. Firstly, ICTs can be used to inform and train healthcare workers on the latest advances in the field, providing them with access to techniques, information on drugs, as well as diseases and their cures. Secondly, dissemination of information on disaster management services to places that are difficult to access, is made easier with the use of ICT. Thirdly, the use of ICT has the capacity to improve transparency and accountability,

leading to greater availability and quality of services. Wickramasinghe et al. [20] describe a range of goals of e-Health, cautioning that e-Health is more than just the use of the Internet in medicine, a position that is in sync with that taken for this paper. e-Health drives efficiency through improved communication, while increasing quality of service. e-Health has the capacity to empower consumers and patients, while providing a platform to educate healthcare providers. e-Health redefines the geographical scope of service delivery, while also redefining the relationship between patients and service providers.

The full potential of e-Health is yet to be reached [20, 21], as both developed and developing countries stand to benefit from improvements that e-Health can bring [20]. Ricciardi et al. [22] argue that while the full potential of e-Health may not be understood, advances in ICT, increased adoption of ICT, and improvements in health policy, all driven by social changes, as well as consumer expectations, are driving e-Health forward. ICT will play a pervasive role as a stimulus for change and support for the healthcare system and individual practitioners [23]. Westbrook and Braithwaite [21] advocate a shift from simple automation of processes to innovation – a move from evolutionary changes to disruptive approaches, in order to harness the full potential of e-Health.

Mettler and Raptis [24] point out three areas as warranting attention with regard to ICT in healthcare, on which research should be focused. Personal health and independent living systems are concerned with care outside traditional medical facilities, while e-Health and clinical systems are concerned with medical processes and treatments. The third area relates to cross-sectional topics, such as the impact of ICT in healthcare on education, society, the economy and behaviour. In the area of personal health and independent living systems, Mettler and Raptis [24] advocate the investment of research effort in home care and chronic diseases, patient safety, interoperability of consumer and clinical systems, ICT for personalised inclusion, consumer health informatics, and personal guidance systems for people with impairments. In the area of e-health and clinical systems, they advocate research into patient-centred systems, clinical support systems, medical knowledge and decision support systems, bioinformatics, ICT for public health, and interoperability of medical and administrative systems. Cross-sectional topics are concerned with the social implications of human-computer interaction, standardisation and conformity, education, training and dissemination, security issues in health networks, and the value of ICT in healthcare.

3 Methodology

The main objective of this study was to explore empathy building in a design thinking exercise aimed at improving healthcare, using ICT. The researchers sought to collect empathy input whose focus was on the improvement of post-natal care in a hospital in a low-income neighbourhood. The study adopted a pragmatic, philosophical stance, and collection of data was guided by the ideas behind the theory of service-dominant logic and, in particular, the five axioms of service delivery [18].

This work was guided by the recommendations of the Committee for Research Ethics and Integrity of the Faculty of Engineering, Built Environment and Information Technology at the University of Pretoria, whose approval was sought at the start of the project. The Faculty of Health Sciences granted further ethical approval to conduct research in the healthcare sector. Local approval was granted by the Chief Executive of Chitungwiza Hospital on behalf of the Medical Research Council of Zimbabwe. All the participants in the study were requested to sign consent forms after receiving an explanation either in English, or in Shona. All interviews and journals referenced only code names, with an index to actual names only available to the main researcher, and stored in a safe in Harare.

An initial interview, conducted with the head of Chitungwiza hospital and his deputy, resulted in the decision to focus on the improvement of post-natal care. The interview aimed at gaining a broad understanding of the institutional perspective of offering care, with the objective of providing a broad scope for the design thinking work. Using a semi-structured interview format, questions were asked regarding the service that the hospital offers, and challenges faced in providing this service. The interview also looked at who the key players in service provision are and the roles they play. The two medical officers were questioned about their contact with patients after discharge, and the tools they use in the discharge of their duties as a central hospital. This meeting also served as an introduction to the hospital environment, with several follow-up meetings arranged with key personnel because of the recommendations from this meeting. The information collected formed a basis for understanding the dynamics of service provision in the hospital and the ecosystem around it.

An advertisement was placed in local newspapers for midwives to participate in a research study. Twenty midwives responded to the advertisement, of whom thirteen arrived. After explaining the nature and purpose of the research work, 10 midwives agreed to participate in the study, and they signed the consent forms. Midwives who participated in the interviews ranged in experience level from a few years to over 30 years in the case of one of the midwives. Their experience was a combination of both private and public sector experience.

The interviews with the midwives focused on their roles in providing post-natal care. The nurses were encouraged to go into detail regarding the processes they follow, with a special focus on how they manage their work and its flow. The weaknesses in service offering, and challenges faced, were investigated. The researcher questioned the midwives on their interaction with new mothers and their babies, both within the hospital and after discharge. The interviews also explored their experience with mothers as they return to the healthcare system for immunisation of their babies. The handling of information was of particular interest, and the midwives were asked to explain their experience.
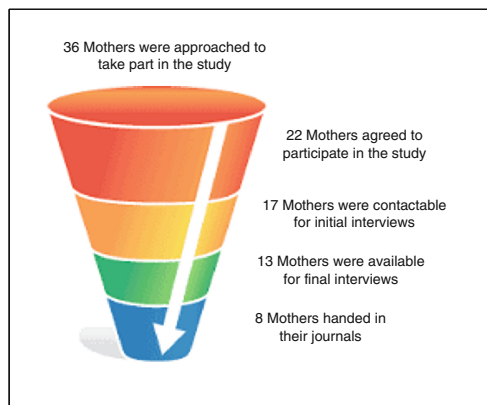
Fig. 1. Participation of mothers in the study

Twenty-two mothers who had just given birth were identified for participation in this study, as illustrated in Fig. 1, with the help of the hospital head. The cross-section of mothers included first-time mothers, as well as those who had given birth before. The group included mothers who had given birth normally, as well those who had had caesarean sections. The sample of twenty-two came out of a total population of thirty-six mothers who were presented to the researcher by the hospital, as potential participants, in groups of twelve per day over three days. At a selection session on each of the three mornings, the researcher and a midwife assistant explained the purpose of the study, and went through the informed consent considerations in both English and Shona. We explained to the mothers that our interest was in mothers who were able to maintain a journal over a six-week period, had no privacy issues at home, and had no religious concerns. On the first and second days, seven mothers apiece volunteered to continue with the study, while five mothers were released. On the final day, eight mothers came forward to bring the total to twenty-two. Figure 1, above, illustrates the outcome of the mother selection process.

Mothers were asked to write about their experiences on a day-to-day basis, detailing the common things that they went through in their lives, starting from their discharge from hospital. A week later, home follow-ups were conducted to ensure that the mothers were comfortable with the journal experience and to conduct an initial interview. At this stage, seventeen mothers were contactable, with five having become untraceable. It became apparent from talking to the other mothers that it was common practice to give false contact information to the hospital, as those with outstanding bills did not want to be found. After six weeks, a final interview was conducted, and the journals collected from the mothers. We were able to contact thirteen of the seventeen mothers who had been contacted in the first round of interviews. Of these thirteen mothers, eight had faithfully completed their journals and these were collected by the researcher (Table 2).

Table 2. Field data collection sample sizes

Purpose	Instrument		Number
Define problem area	Hospital head interview (CEO + CNO)	Interview	1
Building empathy	Midwife interviews	Interviews	10
	Initial interviews	Interviews	17
	Follow up interviews/Observations	Interviews	13
	Patient diaries/journals (returned)	Journals	8
Definition	Workshop/Focus group		24

The results of the various data collection techniques employed were analysed, and collated into a presentation that was given to a design group consisting of mobile application designers and developers, midwives, and some of the mothers. The group split into four teams at the end of the presentation, and each team was asked, using the concepts behind service-dominant logic to aid in further analysis, to come up with a point of view [POV] along the lines of the following:

"We would like to help X by providing a service Y that allow them to be a better Z"

Where X was a beneficiary of their choice, Y was a service or set of services, and Z was an outcome that they felt would be desirable for X.

The results of the data collection, as well as the resulting points of view, are presented in the next section.

4 Findings

These findings focus on the two sub-research questions, helping to understand the circumstances of those offering and receiving post-natal care (SRQ1), and, in the process, helping to define design challenges for use in designing potential solutions for improving post-natal care (SRQ2).

Midwives' Perspective: Content analysis was used to analyse interviews conducted with midwives on their role, their interaction with mothers, how they handled information, and the challenges they faced. Midwives reported that their role was to look after the mother and baby soon after birth, as well as provide education to mothers. Their interaction was intensive before the mothers' discharge; then followed a programme, recommended by the World Health Organisation, of a three-day, ten-day, and six-week visit for baby monitoring and immunisation (Table 3).

Table 3. The role of the midwife in post-natal care (Sample Analysis output) psychological support (Midwife responses)

Midwife 02	We also check on the mental health of the mother to see how they are coping after birth
Midwife 02	We are concerned about psychosis after birth
Midwife 07	So I might get a first time mother; or a mother who wanted a girl and she gets a boy, someone may want four babies, but they have method failure or the husband may not be so supportive
Midwife 07	There are psychological issues associated with the father as well and these need to be taken into account. The father may have wanted a boy and got a girl
Midwife 07	There are lots of issues to consider. As a midwife, I try and bring them together (as a family)
Midwife 08	In private hospitals, the hospital may allow the father to be present during birth, so I allow the three of them to bond
Midwife 08	So I place emphasis on the psychological aspects, congratulating them on the baby, and you will see from the facial expressions if there are any hidden concerns. So someone may start sobbing, or crying, or smiling, and I take it from there
Midwife 10	In the post-natal wards, you also have to access the mental contents of the mother. Some can develop people psychosis, and then you should monitor if they are not in that condition

Their information system was largely manual, based on registers and cards that the mothers carried. Major challenges in delivering health centred on the shortage of resources, the inability to follow-up on mothers who had given birth, and a subsequent lack of contact. Poor coordination of the healthcare delivery system was also given as a major challenge for the nurses (Table 4).

Table 4. Summary findings from the midwives

Role of the midwife	• Baby care • Mothers' physiological support • Mothers' psychological support • Education
Interaction	• Intensive while in hospital • Three-day visit • Ten-day visit (also referred to a 7-day visit after the 3-day visit) • Six-week visit • Follow-up visits managed by clinics except in exceptional cases
Information system	• Manual system built around register and patient cards
Challenges	• Lack of resources • Inability to follow up • Availability of information • Lack of coordination in healthcare

Mother's Perspective: The interviews with the mothers focused on the health support network around them, the challenges they faced, and their suggestions for improvement. Mothers felt that hospitals were difficult to access, and they relied heavily on friends and relatives. The church, local pharmacies, books, and the Internet were also seen as valuable sources of information. While mothers agreed with the midwives' version of the frequency of interaction, they regarded hospitals as the last port of call, and only to be visited in critical circumstances outside the pre-agreed immunisation visits. Resources were a major constraint, affecting their ability to access the hospital, drugs and even food. The quality of service from the hospital was also of major concern (Table 5).

Table 5. Summary findings from the mothers' perspective

Sources of information	• Hospitals and clinics difficult to access • Friends, neighbours and relatives a major source of information • Churches are influential • Pharmacies play an important role • Books • The Internet
Healthcare system interaction	• In hospital services • Three-day check-up • Seven-day check-up • Six-week check-up • Generally mothers do not engage the healthcare system unless critical
Challenges faced	• Difficulties in accessing healthcare • Finances/Lack of resources – For transport to get to the hospital – For drugs – For food • Family influence • Quality of services
Suggestions for improvement	• Healthcare system should understand their circumstances • More effort should go into educating mothers • Home follow-ups are necessary • Healthcare should be easier to access • Timeous service delivery • Available remote service (by phone/Internet) • Better scheduling of visits • Services should be more affordable

Mothers' Stories: The most compelling evidence that came out of the interaction with the mothers came out of the journals, which the mothers completed on a daily basis. The information from the journals was triangulated, and complemented with the researchers' own notes from visits undertaken to the mothers in their homes in the presence of a registered nurse/midwife. The journals were analysed, and three representative stories extracted. The first one tells the story of a mother who lives a humble but happy life with her husband and children. The second tells the story of a woman living a more challenging life, but is very representative of the lives of many of the women we met. The final story is the story of an outlier whose experience led to a tragic ending.

Table 6. Anna's story: a happy mother

Anna is the mother of four children. She gives birth to her fourth child at Chitungwiza hospital on the 11th of May 2017. Anna is happy with her child, and the nurses treat her with respect. Despite having two other boys, her husband is disappointed that she gave birth to a girl, but he is happy and supportive all the same. He comes to see her in hospital and takes her home when she is discharged the day after giving birth.

Anna lives in a cottage at the back of a large house that she and her husband are building. The husband has a steady job, and she runs a profitable mushroom growing business at home. Anna lives with her husband and children and at the start of the project has no household help. Her cousin comes to visit and gives her hints and tips on looking after the child, even though she has had three other children. Anna's mother-in-law is less pleased with her child and refuses to hold the child, claiming that she has been called a witch in the past. This causes Anna much pain, and she is often left in tears after speaking to her mother-in-law. Despite this, Anna spends a week in the rural areas with her mother-in-law, to allow her to bond with the newborn while the husband returns to town to look after the other children. Anna's mother-in-law notices that Anna writes a journal and tries, unsuccessfully, to locate it so that she can see what Anna writes in it. Anna uses public transport to return from the week in Mutoko, as her husband is busy at work.

Back home, Anna's days are filled with cooking, cleaning, looking after her children, along with tending to her mushroom crop. Having given birth normally, she recovers quickly despite heavy bleeding the days following her delivery. Anna keeps a copy of the book "Where There Is No Doctor: A Village Health Care Handbook", [25] by her bedside to help guide her in looking after her children. She keeps no formal records of her interaction with the hospital, other than the health card given to her by the hospital. Other than having had to return to the hospital where her youngest baby was born to collect a birth record, she has no further contact with them. Anna is lucky to live close to a clinic, which she visits for the regular check-ups as advised at the hospital.

Anna is generally happy with the health system, her only complaints being that the linen at the hospital was inadequate and not in the cleanest state, and that the clinic keeps no records of the care they give; relying only on evidence produced by the mother when she visits.

Anna's story (Table 6) stands out as an exception, rather than the norm.

Vimbai's story (Table 7) mirrors the stories of many other women whose diaries we saw. Trina's story, presented in Table 8, represents a powerful outlier, which had a strong impact on the design teams that participated in the first workshop.

Table 7. Vimbai's story: a struggling mother

Vimbai gives birth on the 9th of May 2017 to her only child. She is discharged from hospital on the morning of the 10th, but is unable to settle the bill, so she is only able to leave the hospital after 5pm. Having been discharged in the morning, she does not get food from the hospital, so she is tired and hungry when she finally makes her way home. Frustrated, with a baby in her hands, she boards the wrong public taxi to take her home and is dropped off a long way from the correct route. She then walks to get the correct taxi home, arriving to welcoming neighbours and friends. Her husband cooks a meal of sadza and fish for her, and she goes to bed happy.

Home is a routine of housework and looking after the baby. The baby hardly sleeps at night, which keeps her and her husband up most nights, and leaves her very tired during the day. Her husband is a faithful provider but occasionally scolds her for sloppiness, which makes her unhappy. She has a small circle of friends who come to visit, and she receives presents for her baby, which pleases her. She regularly goes to church for prayers, and when she is unable to go to church she watches church services on TV. Her mother lives close by, and she occasionally takes the baby to visit her. She also takes time to visit friends that live in the neighbourhood.

Food is occasionally in short supply in Vimbai's home. Her diet consists of sadza[a], mainly with fresh or dried fish, and occasionally chicken and beef when they can afford it. When there is little money in the house, Vimbai cooks sadza with vegetables or beans. Her breakfast is generally rice and tea. Occasionally her husband or a friend brings her some fruit. On many days, she goes to sleep hungry, and she thinks her hunger leads to headaches and the tiredness she frequently feels.

During the early days after giving birth, Vimbai suffered from severe back pain and pain in her stomach. She is frequently tired and suffers from headaches, and she attributes this to her poor diet. She takes no medication for her pain, and the only medication in the house is the methylated spirit that she uses on her baby's umbilical cord, which falls off after three days. She occasionally feels lonely, and when her husband leaves her to visit his mother in the rural areas one weekend, she is left in tears. Despite not being in the best of health and on no medication, she soldiers on to look after her baby, and finds time to visit her mother who is also unwell. Although the baby is supposed to go back to the hospital for a check-up after ten days, Vimbai does not return to the hospital, as she has no funds to do so.

Two weeks after giving birth, she begins to feel better, and finds time to attend church services with her baby, carrying her on her back on the way there and back. She resumes her business of making and selling ice-lollies. She is unhappy with her husband one morning when he, fumbling in the dark while preparing to leave for work, kicks a bucket containing syrup she was preparing to freeze to make ice-lollies. Not only does she have extra cleaning up to do, but also the loss of raw material is a setback for her business. Her husband does not apologise for the mistake, and this leaves her feeling depressed.

Month end is particularly stressful, as rent is due and there is no money in the house. The landlord threatens to evict the family, and when she packs up to go to visit her sister, she is stopped by the landlord, who promises to have the family's belongings in the street when they return. The stress takes its toll on Vimbai, and her headache and back pain becomes unbearable, yet she cannot afford to visit the hospital. She asks a neighbour to look after her child so that she can get a few hours of much needed sleep.

A month after the birth of her baby, Vimbai goes to the hospital to collect her daughter's birth record. This visit is with much trepidation, as the thought of the outstanding bill is on Vimbai's mind. She is much relieved when it turns out there is no mention of money and, in fact, no payment is required for the birth record itself. A few days later, she wakes up early and takes the long walk (she has no money for bus fare) to the local administrator's office to collect a formal birth certificate. She is informed that the birth certificate will be ready by the end of that day, and with nothing to do, she walks back home to eat lunch before she goes back to collect the birth certificate. She returns to collect the birth certificate and she finds that it has errors on it, so she is asked to come back the next day to collect the corrected certificate.

Forty-four days after her baby is born, Vimbai wakes up early to walk to the clinic to have her baby attended to as part of the six-week check advised by the hospital. She arrives at 7am but by mid-morning she has not been attended to, so she walks back home to find something to eat. She walks back to the clinic and is finally attended to after lunch, and then she walks back home. The baby cries all the way home because of the immunisation injection she received.

[a]*Sadza is a staple food in many countries in Southern Africa. It is a thick porridge made with maize meal. It is also know as pap (South Africa), nsima (Zambia/Malawi), ugali (Tanzania/Kenya).*

Table 8. Trina's story: a tragic story

Trina gives birth to a baby boy on the 7th of May 2017. A mother of two other children, the birth is a caesarean birth. She is discharged on the 10th of May at 10:00am, but having no money to settle the final bill, she calls her husband to inform him of the $192 bill that has to be paid before dis charge. She negotiates to pay the $50 that she has on her and the hospital confiscates her National Identification Card, and allows her to leave. Four hours later the husband comes to find her and the child restless and tired. The outstanding bill is paid, but as she leaves, she is told that a BCG injection must be given to the child, although a nurse expresses reservations about the injection, as the child's temperature is high at 37.8 °Celsius. At home, she notices her child's temperature continues to be very high, but thinks it will eventually normalise.

She struggles to feed the child, as she is not producing enough milk. Her child is continually groaning and has hiccups. A visiting aunt on the 12th expresses concern at the child's groaning. She asks to examine the baby's stool, which she says is not normal. A suggestion is made to purchase Gripe water[a]* for the child since the child is not sucking. The child continues to groan for a few more days until the aunt insists on taking mother and child to the local clinic on the 14th. At the clinic, they wait for thirty minutes for a nurse to attend to them. When she does arrive, she sends them to the hospital, as the case appears beyond her. They wait in a queue at the hospital until a relative, who is also staff at the hospital, comes and attends to them. Mother and child are admitted, and the child is placed in a nursery.

The hospital asks for payment for blood testing and medication, but she is unable to pay. Eventually the medication is bought, and the child is placed on a drip. According to the doctor who attends to her, the child is dehydrated. The drip is discontinued after the first day, but when the doctor returns the next day, he is angry with the nurses for having discontinued the drip, noting the child is severely dehydrated. The baby's head has started to sink in from the top, commonly kn own in Shona as "kudona nhova", a sunken fontanelle, and a known sign of dehydration, and the parents are asked to buy another drip, which is procured. Meanwhile, the child's condition continues to decline.

On the 23rd of May 2017, a week after admission into hospital, the child dies. The father chooses that the baby be cremated, and the mother returns home. The mother is in pain from the complications of the caesarean birth, as the wound on her stomach stubbornly refuses to heal. She consults friends and relatives, and all are surprised that she was only given one set of tablets, each one thinking that there should be more. She continues to treat her wound with methylated spirit, and taking the medication provided from hospital. After a few more days, she decides to go to the pharmacy and she is offered a painkiller, the first time she has received a painkiller since the birth of her child.

Trina's relationship with her husband becomes strained as the days after the child's death become weeks. The husband and his relatives visit traditional healers to establish the cause of the child's death, and they are told that the mother sacrificed the child. This causes tremendous tension in the household. Despite not having fully recovered, Trina decides to go back to work to take her mind away from her predicament.

Trina meets with the interviewer during her lunch break from work. What was meant to be a routine interview, turns into a counselling session as the young mother bares her soul for over an hour, frequently sobbing, and breaking down at some points. Between the interviewer and the accompanying midwife, we try to console, and provide words of encouragement. At the end, she stands up, wipes her tears, and thanks us. It is the first time I have told my story to a nyone, she says as she departs.

[a] *Gripe water is a non-prescription product sold in many countries around the world to relieve colic and other gastrointestinal ailments and discomforts of infants.*

Defining a Point of View [POV]: A point of view serves as a design challenge, and helps focus the efforts of a design team. In this exercise, the feedback from interviews, as well as the stories, were presented to a design group consisting of mobile application designers and developers, midwives, and some of the mothers who were split into four

teams. Further analysis of the findings was modelled around the five constructs of service-dominant logic [18, 19]:

- services on offer or those required
- actors involved in the delivery of these services
- network that influences how they consume service
- institutions and institutional arrangements that impact delivery of these services
- beneficiaries of the services

A complete analysis of this service ecosystem became the backbone of the empathy input, analysis of which was used to identify a suitable point of view to address in the rest of the design thinking exercise. The POV derived by the four design teams are summarised in Table 9, below:

Table 9. Points of view [19]

Team 1: A-team	Team 2: Med-Innov
We would like to provide Chipo with information on nutrition for both herself and baby so that she feels responsible, happy, and caring as a responsible mother, and raises her healthy self-esteem	We would like to provide Anna with information on the importance of breast-feeding, so that she feels she is a responsible mother. Healthy baby = happy mother
Team 3: Tech-Health	Team 4: Technovators
We would like to provide Janet with information on post-natal care so that she feels wanted, cared for, valued, and bonds with her baby	We would like to provide Trish with health education, to make her feel proud of being a responsible good mother and a good wife

5 Discussion and Conclusions

The aim of this study was to explore how design teams could incorporate the needs and wants of those for whom systems are being designed. In getting to this understanding, the study sought to understand the circumstances of those providing services, and those receiving services. This input was analysed, and presented to a design group that included some of the participants in the service process, as well as designers. This empathy input was then used by the design group, divided into four teams to come up with four points of view, which were then later used to guide the development of systems for use in improving post-natal care.

Three types of instruments were used to gain an understanding of the circumstances of the potential consumers of systems. The interview with the hospital head and his assistant allowed the researchers to focus on the area of post-natal care; it also gave the researcher an understanding of the key players, and some of the constraints related to offering service. Interviews with the midwives gave an insight into the services they offer and the constraints they face. Interviews were also used to understand the

circumstances faced by mothers as they seek service from the healthcare system, their challenges, and to seek ideas for improvements. Observations of mothers in their homes provided useful information that proved invaluable in triangulating the mothers' own stories, as told in the journals. The journals themselves gave a depth of information, which would otherwise not have been unearthed by the semi-structured interviews that had been used before.

The stories about the mothers, narrated by the researcher to a design group consisting of mobile application designers and developers, midwives and mothers, served as a powerful means of communicating information that had been gleaned from the mothers' journals. The stories were of such a moving nature that the bulk of the room was left in tears, with mothers empathising with one another, and midwives appearing shocked at the reality that their patients face after discharge. The weight placed upon the occupants of that room appeared to give added impetus to wanting to find a solution to how service could be improved. This study reinforces literature on storytelling that positions it as an illustrative, symbolic tool for sharing concepts in a way that creates emotional bonds with the audience [7].

The analysis of the interviews with mothers and nurses, together with the stories told, lend themselves to understanding the circumstances of those offering and receiving care (MRQ1). The points of view [POVs] that resulted from the design workshops served as design challenges (MRQ2) that the design teams employed as a starting point in the design of mobile-based applications – an exercise that was outside the scope of this paper.

This study was built on trying to understand how design teams can incorporate the needs and wants of service beneficiaries in their designs (MRQ). Three practical answers to this question arise from this study:

- Seeking a deep understanding of the circumstances of those for whom systems are being designed
- Framing design challenges, or points of view, around the stakeholders and their circumstances
- Engaging the systems' stakeholders in the design process.

While this study has built a useful understanding of the circumstances surrounding the lives of those seeking and offering post-natal services, its real contribution lies in the experience of using the various instruments in building empathy for use in design thinking work.

This work will be of interest to practitioners of design thinking – not only in healthcare, but in any industry that may require service innovation.

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