iNethi and You and Your Baby: Enriching resource access on a wireless community Network

Literature review

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Abstract

Members of low-income areas do not always have access to quality internet access in order to access internet content and services. To address this, researchers have turned to wireless community networks as a solution to help communities access technology-based services. iNethi is a community network that aims to allow communities to be able to access content and services either hosted locally on the community network or by giving community members a more affordable option to access the internet. Parents of babies with developmental issues from low-income communities are often unable to access health resources and information to aid them in caring for their child. You and Your Baby is an application that allows parents of babies with developmental issues to be able to curate and access content that will aid them in caring for their baby. This paper aims to review the feasibility of placing You and Your Baby on the iNethi network, allowing users with iNethi network access to You and Your Baby.

Keywords

Human-Computer Interaction, Community Networks, mHealth

1. Introduction

Parents and caregivers in low-income communities are unable to get adequate health care resources and advice to be able to navigate their children's early childhood development and mother's maternal health. With the rise of technology, several ways to address this issue have been explored including mHealth applications.

mHealth stands for mobile health and refers to the use of mobile devices and wireless technology to educate users about health care topics and to provide other medical care related services [21].

In 2022, the Bhabhisana Baby project and a group of UCT Honours students co-designed and developed You and Your Baby. The Bhabhisana Baby Project is a Western Cape based organisation that aims to help low-income parents who have children facing developmental issues. Their aim is to address post-natal and maternal child health within the first 1000 days after a child has been born through early intervention programmes. You and Your Baby is a low bandwidth content delivery application created to provide parents with curated resources and support for the early childhood development of children.

Members of low-income communities are often unable to access affordable and reliable internet and are therefore also unable to access resources that they may need from the internet. By using a wireless community network, community members are able to access network services hosted on the network. Users also have the ability to use this network to access the internet. One such community network is iNethi.

2. Background
2.1 Post-natal maternal health

Post-birth, mothers can experience health or coping issues and require medical or social assistance. Such issues can manifest in the form

of severe anxiety and depression, which can negatively impact their and their child's wellbeing [22]. Without a support system, many mothers experience social exclusion and social isolation, which is proposed to be a major determinant of maternal depression [5]. Many mothers and caregivers do not receive support on how to navigate parenthood and guidance on how to care for a baby. Without support and guidance, mothers, especially first-time mothers, often find it difficult to know what to do to provide care for babies, how to detect if there are health issues with the baby and how to navigate motherhood. A lack of support system and adequate care can have detrimental effects on both the mother and the child.

According to the World health Organisation (WHO), factors such as socioeconomic status, education level, occupation, geographical location, religion and ethnicity play a role in the quality and use of postnatal care services by mothers [9]. Mothers with little to no education, little to no income and no access to health care services are more likely to not use or have access to adequate health care services. Therefore, mothers who are placed in this group are not able to receive the help they may need, leaving their postnatal issues unchecked.

2.2 Early childhood development

Parents and caregivers who need to access vital information pertaining to the health and development of their child, do not always have a means to access the information they need due to a lack of health resource and service access.

The early childhood period is a critical period in a person's life that shapes that individual's future and determines how their life will unfold. According to Murray *et al* [22], children of postnatally depressed mothers are at increased risk of developing depression later in life. A study by Belsky *et al* [3] has shown that children with high-quality care grow up to be better cognitively and socially developed compared to those who received lower quality care. In this study, the factors that determined the quality of childcare include caregiver qualifications, experience, knowledge and caregiver sensitivity and responsiveness.

Therefore, to ensure that a caregiver is well-equipped to care for a child, they may need to access additional resources, in order to improve their qualifications and knowledge. In countries such as South Africa, access to early childhood development health care for low-income community members is not easily accessible. The barriers faced by members in these communities include a lack of access to quality health care [12] and a lack of knowledge on how to best care for their child with developmental issues [14]. According to Maphumulo and Bhengu [12], events faced by people wanting to use health care services include long waiting times, shortage of health care tools and resources, poor sanitation of health care areas and medical negligence. Even when parents are able to reach health care clinics, these events still hinder the quality of their visits and the care they receive. According to a study conducted by Meintjies and Belkum [14], most caregivers in their participant group had inadequate knowledge in the different development areas which were fine motor and visual skills, cognitive skills, language and speech and social and emotional development. The results of this study gave a glimpse into the type of knowledge caregivers of that community lack.

3. mHealth and You and Your Baby
3.1 mHealth for low-income communities

Given South Africa's poor service delivery and inadequate health care service, members of low-income communities often find themselves without resources to deal with their and their baby's personal health. Many people in low-income areas do not have the means to go to a health care provider as frequently as they need or would like to and may not be dealing with an issue that is urgent enough to have to go to the doctor for but would still need advice for. One barrier they face is the far distances between where they live and where health care services are based [13]. This would require people to take time out of their day to travel to the health care sites, as well as lead to them needing to spend money on high transport costs.

mHealth has been proven to be a more accessible way for users to be able to access health care services, advice, and resources in a more convenient and less costly manner. Members of low income communities have found mHealth solutions to be a favourable alternative for accessing health-related information and communication resulting from limited contact with a medical health professional [1]. In a report done by Ames *et al* [1], participants stated that they experienced benefits in the form of increased access to health information which subsequently increased their awareness and knowledge to health related topics.

Although there are many benefits experienced by users of mHealth solutions, there are those who experience barriers when it comes to accessing these services, such as poor cellular network access to access the content of the applications, lack of mobile devices, lack of freedom and privacy, unaffordable costs of cellular data and language and literacy issues faced when wanting to engage with the content [1].

3.2 You and Your Baby

Studies have shown that the progression of the first 1000 days of a baby's life are crucial in terms of how the rest of the baby's life will unfold [8]. Therefore, the Bhabhisana Baby Project and the UCT honours student sought to develop an application to help members of low-income communities be able to access resources and advice on how to navigate caring for their baby, especially those that may have developmental issues. You and Your Baby provides caregivers with curated content to help and educate them on navigating taking care of and raising their baby.

4. Community networks and iNethi

4.1 Community Networks

The internet has a variety of resources that parents and caregivers could learn from to take care of and accommodate children, especially those with developmental issues who may need

a different form of care than they are aware of, but barriers such as bandwidth constraints, and lack of a compatible device are faced [1].

To access early childhood development, child, and maternal health care advice online, people would need quality internet access. Although internet usage is increasing within modern society, there are many people who do not have sufficient access to utilise its benefits, forming a digital divide between the two groups. People who form part of the latter are members of low-income communities. In South Africa, many members of low-income communities are unable to afford to buy data to access the internet due to the high costs of data. These communities also experience poor connectivity quality in their areas due to the lack of adequate infrastructure. This poor infrastructure in low income areas leads to members of these communities facing barriers relating to technical connectivity issues, and cost issues relating to digital communication access [1]. Compared to urban communities, low-income communities do not have influence over and are not in the favour of influential institutions [6]. Internet Service Providers, who have a profit driven incentive to build network infrastructure, tend to not build and provide adequate infrastructure for users to access network services due to it not being prioritised in these communities as they are not the market they intend to cater to [10]. Governments in developing countries do not have enough resources and budget to provide these communities with adequate infrastructure to ensure that they have reliable network access [6]. Therefore, these communities are often left without adequate network infrastructure which further widens the digital divide.

To combat this digital divide, many researchers have turned to community networks [10]. Community networks are decentralised and distributed network systems available to support a community by allowing them to share connectivity [4]. Community networks tend to be self-owned and managed by a community [4]. The hardware and software used in wireless community networks can differ for each one, and consist of wired and wireless links, numerous routing protocols and network

topology management systems [18]. One way through which Wireless Community Networks are implemented is through wireless mesh networks. Wireless mesh networks consist of nodes, links, content and services [4]. Nodes refer to the connection points users can connect to access the network. These nodes are responsible for receiving, sending, storing and creating data within the mesh network [2]. Links refers to how the network is connected, which in the case of wireless networks, is wireless. Content and services are what the network provides to connected users.

Community networks can provide content and services hosted on its server node to a community, give users internet access as well as allow network users to communicate [10,11,17]. Community networks require people to connect to a local network tower or node and access the local content and services on their mobile devices.

4.2 iNethi

iNethi is a co-design initiative to create a community owned wireless community network [11]. Its aim is to bridge the digital divide faced by low-income communities by allowing community members to be able to access content and services either hosted locally on a community network and by giving community members a more affordable option to access the internet. Alongside this, users can communicate and share content with each other as well over the network using the social network service hosted in the network.

By using iNethi to share content across a community, users will save on data costs as well as time costs. Generally, the digital communication platforms users use to share content are data costly, resource heavy and time-consuming as their content being sent over the internet. Using a local community network, the content can be sent faster, more efficiently and using no data, when being sent to another person also connected to the community network and using one of its services to do so.

iNethi allows community members to access local cloud and content delivery services, communication services and low-cost internet

access [15]. It also provides users with a range of other services as hosted on the network such as a social network, messaging, file-sharing and web authoring services [11]. Alongside this, community members can curate and modify the type of services that they would like to receive from the network and what they would like to interact with on the network, depending on the preferences of the individual and the community.

The iNethi community network is built with Wi-Fi mesh nodes being placed around a community. These nodes will act as access points for users in the vicinity to connect to the network. The mesh network is connected to the iNethi cloudlet server which hosts all the community content and services. The cloudlet server hosts all the services that the iNethi network provides to the community [16,19,20]. Each cloudlet server hosts different microservices within modular docker containers [7]. Cloudlet servers are also able to communicate on a global level between communities and share content from local community iNethi networks. Currently iNethi is deployed in Ocean View (South Africa), Kilifi (Kenya), CoMaCH Networks (South Africa), and Karonga (Malawi) [23].

5. Discussion

Due to lack of funds and resource access, that is health service access and adequate internet and network infrastructure access, members of low-income communities are often unable to access the internet as well as health resources and information on the internet.

While the Bhabhisana Baby project application is a low bandwidth application, users still need to have internet access to access and download content. Users still need to have data and internet access to download content they would like to engage with on the application. Users are not always able to afford data which hinders the application's aim to be an accessible mHealth option to parents with data constrains.

iNethi provides many services to its communities, it does not provide all the internet

services that members of that community may need to access. At the moment, the iNethi network does not host any mHealth services and content on its network. A possible area of research is the modification of the You and Your Baby application to be hosted on the iNethi network. This would allow community caregivers who are on the iNethi network to be able to access curated Early Childhood Development content.

6. Conclusions

People in low-income communities need a low bandwidth solution to access information and resources. iNethi is a community network allows users to do so by allowing users to access information and resources in the form of content and services, hosted in its servers, as well as by giving them lower cost internet access. iNethi provides communities with local content and services that are tailored to the needs of the community.

Caregivers in low-income communities need access to health care information and resources in order to help them with raising their baby. You and Your Baby is an application created to address this by providing content and allowing users to curate the content they would like to consume.

A potential service could that be added onto iNethi is the Bhabhisana application. This would allow parents and caregivers of low-income communities to be able to access early childhood development resources.

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