# MOBILE PHONE USE IN CHRONIC DISEASES EDUCATION AND AWARENESS IN RURAL KENYA

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## ABSTRACT

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This study set out to develop an integrated model that could explain the sustainable adoption of mHealth, among the rural populations.

With a penetration level of 130%, the ubiquitous mobile phone infrastructure was conducive to implementing mHealth even in the remote and rural regions of Kenya, which otherwise grapple with inequality and inequity of the healthcare system and a rising chronic diseases burden. Whereas mHealth could provide a suitable low-cost solution to disseminate targeted education to the grass-root masses in a short time, its uptake was reported to be low and short- lived. Therefore, the purpose of the study was to evaluate the factors that could explain the low levels of mHealth adoption for education on chronic diseases in the rural settings of the country.

From a theoretical perspective, a combination of four social behaviour change theories, three technology adoption models, and two health behaviour change models guided the development of the theoretical framework. Seven factors were subsequently tested: perceived susceptibility, perceived severity, perceived usefulness, perceived ease of use, social influence, age, and language literacy, all of which measured mobile phone use for health literacy. Thirteen hypotheses were formulated from these factors.

Through the random sampling method, 315 respondents were selected from Nyatoto Sub-location, of Homabay County, located in Kenya's Western fringes. Quantitative research methods were employed with the aid of a Likert-type survey questionnaire which was further translated into the local Dholuo language. This facilitated ease of understanding by the respondents and resulted in no error or missing data.

Using Structural Equation Modelling, the data was analysed to simultaneously verify the relationships among the seven observed factors and their influence on the two latent factors, intention to use and mobile phone use.

The key outcome of this study was the exposé that behavioural intention to use health-based technology was insignificant in the actual behaviour change, which was its use in this case. The concept was well represented in the concluding model, which showed that perceived ease of use of mHealth technology led to its actual use.

The age of the user, their literacy level in the language chosen for healthcare information, and the influence from the community, friends, and the family also acted as significant stimuli towards the decision on mHealth adoption by the user. Equally significant was the users' belief in the disease threat in terms of their perceived susceptibility to and severity of chronic diseases, which had a cumulative effect on their perceived usefulness of the mHealth technology. The degree of perceived usefulness directly induced the users' perception of ease of use of the mHealth technology, leading to its ultimate adoption or rejection.

This study hence, conclusively answered the question regarding the factors that engendered the low adoption of mHealth for chronic diseases in the rural settings of the country. This study has significantly contributed to mHealth adoption by developing a novel unified model through integrating the four fields of behaviour change, namely individual, social, health, and technology.

Other researchers would find this model essential to explain the adoption of health-related technology by rural populations. Policy makers, the government, and mobile technology investors should study this model to understand how their mHealth interventions would provoke a sustainable impact in rural communities.

**KEYWORDS**

Adoption, Age, Chronic Diseases, Health Literacy, Kenya, Language Literacy, mHealth, Mobile Phone SMS, Mobile Phone Use, Perceived Ease of Use, Perceived Severity, Perceived Susceptibility, Perceived Usefulness, Rural Poor, Social Influence, Technology Adoption, Behavioural Intention to Use

January 2022

## DECLARATION

I declare that **Mobile Phone Use in Chronic Diseases Education and Awareness in Rural Kenya** is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Full Name: ANURADHA KHODA Date: January 2022

Signed: 

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I dedicate this work to the research participants and all those individuals who have succumbed to chronic diseases, with the sincere hope that health literacy will be provided in good time to educate the rural Kenyan population on the prevention and management of the disease condition.

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| BI | Behavioural Intention to Use |
| CAK | Communications Authority of Kenya |
| CFA | Confirmatory Factor Analysis |
| DOI | Diffusion of Innovation Theory |
| HAPA | Health Action Process Approach |
| HBM | Health Belief Model |
| HIV/AIDS | Human immunodeficiency virus/acquired immunodeficiency syndrome |
| HPV | Human Papillomavirus |
| ICT | Information Communications Technology |
| K4H | Kiosk-for-Health |
| KNBS | Kenya National Bureau of Statistics |
| LMICs | Low-and-Middle-Income Countries |
| mHealth | Mobile Health |
| MoH | Ministry of Health |
| MVA | Missing Value Analysis |
| NCPD | National Council for Population and Development |
| NCDs | Non-communicable Diseases |
| PSUS | Perceived Susceptibility |
| PSEV | Perceived Severity |
| PU | Perceived Usefulness |
| PEOU | Perceived Ease of Use |
| PE | Performance Expectancy |
| PCA | Principal Component Analysis |
| SI | Social Influence |

| | |
|---|---|
| SCT | Social Cognitive Theory |
| SEM | Structural Equation Modelling |
| SMS | Short Message Service |
| SNT | Social Norms Theory |
| SPSS | Statistical Package for Social Sciences |
| TAM | Technology Acceptance Model |
| TPB | Theory of Planned Behaviour |
| TRA | Theory of Reasoned Action |
| UTAUT | Unified Theory of Acceptance and Use of Technology |
| USE | Mobile Phone Use |
| WHO | World Health Organization |

# CHAPTER ONE

# INTRODUCTION

## 1.1 BACKGROUND TO RESEARCH

Healthcare literacy on the risk factors and awareness on developing healthy lifestyles is a way of dealing with the surging burden of chronic diseases prevalent in low-to-middle-income countries in Sub-Saharan Africa. Education and awareness have a pivotal role in prevention, maintenance and adherence to the treatment of chronic diseases. Therefore, factors associated with acceptance of health literacy by rural communities need to be studied in Kenya.

From the onset of the third millennium, researchers have been reporting on a worldwide trend in a perpetual rise of non-communicable diseases (Boutayeb, 2010) and two decades down, the number of cases in developing countries is alarming (Ministry of Health [MoH], 2015; Shiroya et al., 2019). World statistics show chronic diseases kill approximately 40 million people worldwide, accounting for 71% of all global deaths annually. About 15 million of those deaths consist of the population ranging between 30 and 69 years of age; the age bracket that ideally comprises a family's main breadwinners.

Previously, the reported cases of chronic diseases were concentrated in developed countries. However, they have been on the rise in developing countries (Institute for Health Metrics and Evaluation, 2018), with over 77% of all premature deaths from chronic diseases occurring in developing nations (World Health Organization [WHO], 2021). What was once thought of as the “diseases of affluence” (Meetoo, 2008) are now rampant in economically disadvantaged and poor nations with low incomes. Whereas chronic disease numbers increase worldwide, they tighten their grip on the Sub-Saharan population.

Kenya has been grappling with the long-standing despondency caused by infectious diseases, and now the rise in chronic diseases adds to its burden. The country has demonstrated an increase in the cases of non-communicable diseases (NCDs) (commonly referred to as chronic diseases) (MoH, 2019) over the past decade, as shown in Table 1.1 below. Three out of the five chronic diseases under consideration of this study, namely diabetes, heart disease, and stroke, have shown a steady rise in

deaths between 2009 and 2019 by 39.5%, 36.8%, and 27.7%, respectively. The percentage change for blood pressure and cancer between 2009 and 2019 was not readily available at the time of reporting.

**Table 1.1: Top 8 Causes of Death in 2019 and Percentage Change, 2009 - 2019**

**Adapted from: Institute for Health Metrics and Evaluation (2019)**

| Disease | % Change 2009-2019 |
|---|---|
| HIV/AIDS | -41.5% |
| Lower Respiratory Infection | -4.9% |
| Diarrheal Diseases | -30.1% |
| Neonatal Disorders | -11.3% |
| Tuberculosis | -4.5% |
| Diabetes | +39.5% |
| Heart Disease | +36.8% |
| Stroke | +27.7% |

In the fiscal year 2021/2022, the Kenyan health sector was allocated a paltry 3.99% of the total budget, hovering around 3.3% in 2019-2020 and 4.00% in 2020-2021, respectively (The National Treasury and Planning, 2021). With an already small proportion of the budget available for the entire country's healthcare sector, rural areas are less likely to receive much of this allocation, leaving individuals to spend their earnings on chronic healthcare, diminishing their already constrained resources. Therefore, much attention needs to be paid to reduce this negative economic influence on the country's rural population.

Unlike infectious diseases, chronic diseases are not passed from one individual to another but are of long duration and generally progress slowly, sometimes leading to terminal illness (WHO, 2017). These diseases pose a long-lasting healthcare burden on the affected and their loved ones (Mikkelsen et al., 2019). The impact of chronic disease conditions can be felt from the prolonged and often prohibitive treatment costs, leading to the loss of the family's primary breadwinners (Mikkelsen et al., 2019). Therefore, they are argued to be driving the affected families into increased poverty at an accelerated rate, stifling their opportunities for financial and social development (Mikkelsen et al., 2019).

Some of the socio-economic, cultural, and environmental causes of chronic diseases are argued to be globalization, urbanization, and the ageing population (Meetoo, 2008). Globalization and urbanization have caused a shift away from a traditional diet

of fresh fruits and vegetables to a diet rich in complex carbohydrates and trans fats. Such a diet combined with low level of activity, increased tobacco and alcohol consumption, trends of affluence, set the scene for a rise in chronic diseases. With the local national boundaries merging into global villages, there is more availability of unhealthy food, tobacco, alcohol and other sugar and salt rich foods. This globalization phenomenon is the ready breeding ground for an increase in chronic diseases.

While age, gender and genetic susceptibility are non-modifiable factors, lifestyle risk factors are modifiable, albeit difficult and with some discipline. These triggers are lifestyle and dietary behaviours, such as excessive use of tobacco and exposure to its smoke, an unbalanced diet, lack of physical exercise, and irresponsible and extreme alcohol consumption (Shiroya et al., 2019; WHO, 2017, 2018). Educating the population and making them aware of the risk factors, as well as the signs and symptoms associated with these diseases – mainly the use of tobacco, an unbalanced diet, the harmful consumption of alcohol, and physical inactivity – can help reduce the impact of chronic diseases (Shiroya et al., 2019; WHO, 2017).

The WHO (2017) reported that interventions that focus on the early detection and timely treatment of chronic diseases were excellent economic investments and, if provided early to patients, they could reduce the need for more expensive treatment. Establishment of a United Nations 2012-2022 Decade of Action on chronic diseases proposed that at least 85% of the world's population should receive education and awareness on NCDs with the expectation of reducing the debilitating health effects and deaths caused by the NCDs (Terzic & Waldman, 2011). The statistics presented in Table 1.1 provide reason to educate the population on prevention and maintenance strategies in order to reduce the incidence of chronic diseases.

Sharing the information on healthcare may be grouped into active and passive methods, where active means prompting the end user to act in terms of hearing, reading and listening to the message, and passive where the information is available and can be accessed as and when needed (Nutbeam et al., 2018). Education and awareness of healthcare can take various forms, from having printed brochures at a health facility or a community centre, billboards with a targeted message, audio and video messages shared through television and radio, face-to-face interaction with a

healthcare provider, to the Internet, messages via the mobile phone short message service, mobile phone web applications, and the like (Nutbeam et al., 2018).

Most of the Kenyan rural communities receive healthcare information through face-to-face interaction with the healthcare providers, generally at healthcare facilities; through word-of-mouth form community healthcare workers and volunteers to groups and individuals in their community setups; through newspapers, radio and television; and through the use of printed educational materials such as brochures, posters and flyers (Ngaruiya et al., 2019). This can be attributed to the fact that over 70% of the Kenyan population resides in the country's rural areas (National Council for Population and Development [NCPD], 2018; World Bank, 2019).

This population shares a common malaise in poor infrastructure, low levels of health literacy, insufficient and inequitable access to healthcare facilities, a shortage of trained healthcare professionals, low socioeconomic status and the associated high disease burden (MoH], 2018). Poor access to healthcare providers, a preventive and curative healthcare imbalance, and increased incidences of disease cumulatively have a dire influence on people's livelihoods and economic productivity.

The aggregate ratio of healthcare workers in 2018 as per the latest data in the public sector in the country, was roughly 16.5 (MoH, 2018) per 10,000 people which was in fact lower than the 2013 ratio of 17 per 10,000 (MoH, 2013), of which medical staff represented only 5 for every 10,000 people. This proportion is way smaller than the WHO (2017) recommendation of 23 medical staff for every 10,000 people. This distribution is inequitable in all areas of the country, with the rural parts of Kenya having even fewer health personnel (Kimathi, 2017; MoH, 2018). The significant gap in healthcare providers in the rural regions causes inequitable access to healthcare personnel in the already low-resourced rural healthcare facilities (MoH, 2018).

As mobile phones provide a platform for extended outreach in cases of inequitable distribution and shortage issues relating to healthcare providers, they are gradually becoming an integral part of healthcare services worldwide and could be used in Kenya for chronic disease education and awareness (Kaunda-Khangamwa et al., 2018). Mobile phones have found ubiquitous inroads even in regions where there is an absence of essential infrastructures like electricity, water and sanitation, and roads (Otieno et al., 2014). The users have adopted alternate sources to power their phones,

using solar panels and battery packs to store power for extended periods (Otieno et al., 2014).

The ubiquitous presence of elementary-level mobile phone sets that allow the use of basic features such as making voice calls, and sending and receiving SMS, allows them to be used for education and awareness, disease prevention and maintenance in areas that have low or absent internet connectivity and the potential to be off the power grid (Opoku et al., 2017). Using mobile phone SMS for education and awareness of chronic diseases has been implemented successfully in other countries (Sarabi et al., 2016; Opoku et al., 2017; Thakkar et al., 2016). In a particular study conducted on 30 Korean women, one SMS per day was delivered for seven days. Findings of the study revealed that these women showed a significant increase in awareness of the disease, understood the benefits of screening, and were very positive about receiving a mobile phone SMS for cervical cancer education (Lee et al., 2014). Betjeman and others (2013) reported SMS as the medium used to monitor and manage patients' adherence to medicine for diabetes in Uganda and South Africa, and for tuberculosis and HIV/AIDS in Kenya. Community health workers in Malawi used SMS for patient communication (Betjeman et al., 2013).

Mobile phone SMS has been used with success for healthcare education and awareness of communicable diseases in Kenya. To counter the low number of healthcare providers in rural areas, and the high level of social stigma linked to infectious diseases, Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) and other sexually transmitted infections, healthcare education in Kenya has preferably been provided through mobile phones, which has demonstrated a positive outcome (Bhattacharyya et al., 2015). To augment the existing methods of educating the rural population, mobile phone SMS could be a useful tool to use in Kenya's rural settings for education and awareness of chronic diseases.

The Communications Authority of Kenya ([CAK], 2021) reported that mobile phone penetration in Kenya has been rising steadily, from 88.7% in 2016 to 130% by the mid of 2021. However, there was limited national fibre infrastructure and internet penetration in rural areas (Kenya Ministry of ICT, 2019). Consequently, although

mobile internet applications could be a challenge, the landscape was ready to use mobile phone SMS for healthcare education in rural settings in Kenya.

## 1.2 STATEMENT OF PROBLEM

In the wake of inadequate healthcare systems and a remarkable mobile phones penetration, a rapid increase in the use of mobile phones for healthcare in Sub-Saharan Africa has attracted significant interest among several individuals and institutions (Feroz et al., 2017, 2018; Kiberu et al., 2017; Manyati & Mutsau, 2021). One study (Feroz et al., 2017) concluded that out of the several mHealth initiatives in the Sub-Saharan Africa on mobile phone SMS reminders with postnatal women, the literature was weak and inconsistent. Much of the literature reported on mHealth pilot projects, with inadequate large-scale implementation (Feroz et al., 2018).

Several mHealth initiatives have been reported in Uganda with insufficient evidence of sustainability and inter-operability (Kiberu et al., 2017). Whereas these projects have mainly demonstrated only conceptually how the use of mobile phones for healthcare can alleviate specific healthcare system constraints, there is however, a considerable shortage of empirical evidence on its sustainability and scalability for improved health outcomes, which is needed urgently by policymakers (Kiberu et al., 2017; Manyati & Mutsau, 2021; Opoku et al., 2019; Stephani, 2019).

Many of the mHealth initiatives in Sub-Saharan Africa show donor-dependencies, are low on government involvement thus, lack sustainability notwithstanding, very few of these are targeted towards NCDs (Stephani, 2019). The insufficient data, not clearly defined strategies used for mHealth initiatives, and poor monitoring were also responsible for low uptake of large scale initiatives in the Sub-Saharan countries (Manyati & Mutsau, 2021). During the GSMA mobile health (mHealth) summit held in May 2012, the term ‘pilot-itis’ for mHealth was coined where most of the projects did not take off from the pilot stage to be scalable and sustainable (GSMA, 2012); the situation a few years later was not any different.

The empirical evidence on the use of mobile phones for healthcare education was scarce and not backed by research to support claims about its potential effects in terms of better consumer health or a reduction in the cost and increase in the efficiency of healthcare delivery services (Kitsiou et al., 2017; Mariwah et al., 2021; Seiler et al.,

2017; Stephani, 2019). The few studies focused mainly on HIV/AIDS, malaria, and maternal and child health, even though the burden of chronic diseases was multiplying at a fast pace (Stephani, 2019).

A few other studies focused on pilot projects with little or no clear strategy for long-term scaled-up projects (Amoakoh-Coleman et al., 2016; Manyati & Mutsau, 2021; Opoku et al., 2019), with many of them based on the technological perspective, focusing on technical feasibility, implementation, adoption, usage and its acceptability (Opoku et al., 2019; Opoku et al., 2017b; Stephani et al, 2016). An all-inclusive study that looked at wider perspectives, such as individual, social, health and technological factors which could influence a sustainable adoption of mobile phones for health, was lacking.

This study thus, aims to understand the factors that could influence the sustainable uptake of mobile phones for healthcare education and awareness of chronic diseases in rural Kenya.

### 1.3 RESEARCH AIM

This research aimed to study the influence of individual, social, health and technological factors on the sustainable use of mobile phones by individuals in rural Kenya for healthcare education and awareness of chronic diseases.

Against the backdrop of an upsurge in reported cases of chronic diseases in Sub-Saharan Africa, this study sought to assess factors that would influence mobile phone adoption for healthcare education by populations faced with constrained healthcare systems, in this case the rural parts of Homa Bay, in the western fringes of Kenya.

Suba sub-county in Homa Bay is a rural and remote area in the western region of Kenya, with constrained healthcare systems and limitations, such as poor road infrastructure, low levels of health literacy, insufficient and inequitable access to healthcare facilities, a shortage of trained healthcare professionals, and low socio-economic status and its associated high double-disease burden, along with scanty access to healthcare providers, inequitable healthcare financing, inadequate capacity and training programmes, and inadequate access to and inequitable use of medicines and technologies (MoH, 2018; 2019).

## 1.4 RESEARCH QUESTION

The following overarching question guided this study in order to understand a sustainable adoption of mobile phones for chronic diseases education by the rural population disadvantaged due to inadequate healthcare infrastructure:

1) What is the effect of the individual, social, health, and technological factors on a sustainable mobile phone use by individuals in rural Kenya to receive healthcare education and awareness of chronic diseases?

## 1.5 RESEARCH OBJECTIVES

Based on the research question, the following objectives were developed:

1) To assess the individual, social, health, and technological factors that could influence a sustainable mobile phone use by rural Kenyans for healthcare education and awareness of chronic diseases.
2) To develop an all-inclusive model for sustainable mobile phone use by rural Kenyans focused specifically on education and awareness of chronic diseases.

## 1.6 LIMITATIONS OF STUDY

Some of the limitations of the study included: inadequate financial resources, sparsely populated study site, poor local infrastructure, and a constrained transport system. Thus, the data collection exercise took more time than was planned for, due to the harsh travelling conditions, moving between the dispersed community centres to meet the respondents. Some respondents withheld information that they considered sensitive and confidential. In contrast, others were unwilling to participate in the study due to cultural and social barriers. As the consent form had clarified to the potential respondents that their participation was entirely voluntary. The research was for academic purposes, data was collected only from the willing study participants.

Against all the odds, the number of respondents was 130% of the calculated sample size.

## 1.7 CONTRIBUTION OF STUDY

The primary contribution of this study was the multi-theory model that resulted from a triangulation of nine of the social, health, and technological behaviour change theories and models investigated in this study.

A significant outcome of the study was that the behavioural intention to use mHealth technology is not suggestive of the ultimate behaviour of an individual. Nevertheless, the degree of perceived ease of use of a mHealth technology is what poses a direct and sizeable influence on the actual adoption or rejection of mHealth for health literacy on chronic diseases.

## 1.8 ASSUMPTIONS OF STUDY

The study made an assumption that there would be sufficient eligible and willing study participants, and this assumption was met. The research participants were supposed to have mobile phones available or accessible to them, and this condition was also accomplished. The mobile phones would need a reliable source of electricity/alternate source of power to be recharged. Some of the respondents had access to a shared, solar-power energy source for charging their mobile phones. Another supposition of the study was an adequate basic level of literacy among the research participants for receiving healthcare information. The terms adoption, uptake, and use of mobile phones were treated as interchangeable, retaining the same meaning in this study, which was to utilise the mobile phone short message service feature in order to receive healthcare information on chronic diseases.

## 1.9 ETHICAL CONSIDERATIONS

Ethical considerations and ethical behaviour are of prime importance in research (Clar et al., 2014; Rothstein et al., 2020). Ethical clearance was sought from the University of the Western Cape, and the letter of clearance is attached in Appendix I of this document. Consent to participate in the study was requested from each research participant and the consent forms were developed and attached to the questionnaires as presented in appendix II of this document. The study's importance was explained to the respondent before beginning the data collection, and the respondent had the right to withdraw from the study.

The research was conducted consistently, using accepted research methods, maintaining the highest honesty and integrity standards, and complying with all applicable research laws and procedures. The subjects of the research were treated professionally while observing all the principles of ethics. Information sources were acknowledged appropriately and adequately. Where personal bias could conflict with the research, it was clearly stated.

## 1.10 STRUCTURE OF THESIS

The thesis is divided into seven chapters.

Chapter one introduces the background to the study. The research foundation is set, highlighting the study's context, the research problem, research aim, research question and research objectives. The chapter also highlights the main contribution, the limitations and the assumptions of the study.

Chapter two reviews the literature on mHealth and its applications, mHealth readiness in the country. It analyses the global and Kenyan scene on mHealth for chronic diseases and proposes the use of mobile phone text messages for health literacy in rural settings in Kenya. It finally looks at the factors that act as the enablers and inhibitors of mHealth adoption.

Chapter three covers nine theories and models of social behaviour change, health behaviour change, and technology acceptance, respectively. These were social norms theory, social cognitive theory, diffusion of innovation theory, the theory of reasoned action, the theory of planned behaviour, the technology acceptance model, the unified theory of acceptance and use of technology, the health action process approach, and the health belief model. Having studied the building blocks of each, assessing their strengths and weaknesses, a multi-theory integrated research framework for mHealth use for education and awareness of chronic diseases in Kenya was developed.

Chapter three further navigates the step-by-step development of the theoretical framework and the study hypotheses by identifying variables from the theories and models studied in the previous sections, suggesting their hypothetical interdependence based on the existing literature, and recommending their combined influence on the adoption of mobile phones. The framework endorses the study's overall aim which was to study the influence of individual, social, health and

technological factors on the sustainable use of mobile phones by individuals in rural Kenya for healthcare education and awareness of chronic diseases. The theoretical framework comprises seven constructs: perceived susceptibility, perceived severity, perceived usefulness, perceived ease of use, social influence, language literacy, and age. All seven constructs cumulatively influence the adoption (use) of mobile phones for health literacy.

Chapter four presents the research methods and procedures employed in this study. It begins by explaining the various types of ontologies and epistemologies used by researchers, and then narrows these down to substantiate the use of objectivist ontology coupled with a post-positivist epistemology, which was selected for this study. Types of research methodologies and research methods, leading to the quantitative methods utilised in this research, are presented in this chapter. Using probabilistic, random sampling method, the sample size was calculated to be 239 respondents. Ethical considerations are covered, before discussing the planning and implementation of the data collection procedure using survey questionnaire.

Chapter five describes the data analysis and discusses the results. The chapter presents the data analysis strategy, which is divided into five stages, namely management of data using Microsoft Excel 2013 ©™; checking for missing data and outliers using the Statistical Package for Social Sciences ©™, followed by testing for data reliability and validity; presenting the demographics of the respondents; model testing using AMOS for Structural Equation Modelling; and hypotheses testing. There were thirteen study hypotheses that were tested, of which eight were retained and five were not retained. The resultant model was developed from the variables that influence mobile phone adoption by rural Kenyans to acquire health literacy on chronic diseases.

Chapter six is the final chapter of this thesis. It presents the conclusions, contributions, and recommendations of the study. The theoretical contribution is offered through the resultant integrated model, which was developed with empirical evidence based on nine adoption models and theories from the fields of social behaviour, health behaviour, and technology acceptance. The ultimate contribution of this study was in the outcome that behavioural intention does not always lead to the actual behaviour. This was contrary to the theories and models that were explored in this research where

all factors led to intention, which in turn informed behaviour. For mHealth, perceived ease of use is significant in determining the sustainable adoption of the technology.

The final model emphasises that, to be able to adopt mobile phone for health literacy in rural Kenya, it is necessary for the adopters to believe that the mobile phone technology will be easy to use. While several factors contributed to the perceived ease of use, the language used to develop the healthcare information stood as one of the crucial factors. Age of the user was found to be inversely proportionate to adoption where the younger population would adopt the mobile phone technology faster than their older counterparts.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 INTRODUCTION TO MHEALTH

This study aimed to assess the factors that would influence individuals to use mobile phones for health literacy on chronic diseases. This chapter reviews the extant literature on mHealth, its varied applications, mHealth readiness in Kenya, mHealth initiatives globally and locally for health education and awareness emanating from the need for health literacy on chronic diseases at the rural community level. It further suggests the use of mobile phone SMS for health literacy. The chapter finally assesses the factors that act as enablers and inhibitors of mHealth.

Essentially, the chapter builds a case to propose use of mHealth through the mobile phone SMS to provide health literacy on chronic diseases to the rural population, against the backdrop of limited healthcare infrastructure and the rising disease burden in the western fringes of rural Kenya.

The literature studied was a mix of peer-reviewed articles based on empirical research, evaluation reports from projects not based on empirical data, and practitioners' reports from global health and mobile technology organisations.

## 2.2 MHEALTH AND ITS APPLICATIONS

The WHO (2011) describes mHealth as the use of a mobile phone's core utility of voice and short message service (SMS), as well as more complex functionalities and applications, including general packet radio service (GPRS), third-and fourth-generation mobile telecommunications (3G and 4G systems), global positioning system (GPS) and Bluetooth technology (Cajita et al., 2018; WHO, 2011). mHealth helps in overcoming the traditional geographical barriers to reaching rural communities; it allows for an interactive mode of communication between the sender and the receiver; it utilises the existing established mobile phone infrastructure, thus reducing the costs of delivering healthcare; and it can distribute healthcare information to a large consumer population in a short time (Ngaruiya et al., 2019; Patel et al., 2017). Such abilities of mHealth were considered conducive for this study, which aimed to assess the use of mobile phones for delivering healthcare education to rural Kenyan populations living in a remote setting of the country.

The WHO acts as the key global organisation, with the primary role of ensuring that all health organisations adhere to the international standards of health within the United Nations system (WHO, 2012). The WHO defines health to be the state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 2014). Being healthy is central to human completeness, since it brings about economic progress in a healthy population that is disease-free and lives a long, productive life. The need for a healthy population impels the aim of this study which was to investigate elements that facilitated the use of mobile phones to disseminate health literacy on dietary and lifestyle behaviour change to the Kenyan rural population.

The WHO advises that public health encompasses preventing disease, prolonging life and promoting health through the combined efforts of society, organisations, public and private communities, and the individuals (WHO, 2012). There are several determinants of individual health or ill-health, which can be categorised as biology and genetics, physical environment, social and economic environment, individual characteristics and behaviour, health services, social support networks, education, employment and working conditions, culture and traditions (Palmer et al., 2019). Past studies (Abejirinde et al., 2018; Fisher et al., 2018; Khatun et al, 2016) have looked at innovative ways of improving individual health by adjusting some of these determinants and assessing their impact. In line with the above studies, this study focused on the specific lifestyle determinants that would improve the health of rural Kenyan individuals suffering from chronic diseases.

Some of the global health challenges mentioned by the WHO (2012) are increasing costs of health services; increasing treatment costs; inequitable health resources, where 10% of the population is believed to use 90% of global resources; the global disparity in terms of doctor-to-population ratio; an ageing population; and consumerism, where the use of health services is a benefit for the rich. Low-and-middle-income countries (LMICs) like Kenya face the challenges of trained health personnel shortages, especially in remote and rural areas (Abejirinde et al., 2018), a poor healthcare infrastructure (Fisher et al., 2018), and high poverty levels (Khatun et al., 2016), to name a few. This study was motivated by the innovative way of dealing with the inadequacies of a strained healthcare infrastructure by using mobile phones

for providing health literacy on chronic diseases to the rural Kenyan population, which also suffered from the above healthcare challenges.

In developing countries like Kenya, mHealth has various solutions to offer that may counter, among others, challenged healthcare systems, scarce healthcare delivery services, limited trained healthcare personnel, in-accessible road infrastructure, and a lack of information in the population that is pertinent to the prevention, treatment and management of chronic diseases (Beratarrechea et al., 2016; Watkins et al., 2018). This study proposed the use of mHealth in a selected rural part of western Kenya that faces most, if not all, of the challenges common to under-developed regions.

Labrique and others (2013) had developed a framework of twelve mHealth applications that have since been used for different purposes which include, but are not limited to, education and awareness among the population on disease conditions, such as prevention and management behaviour change strategies; remote data collection and reporting, sensors and point-of-care diagnostics; remote monitoring of patients; communication with and training of healthcare workers and volunteers; registries and disease/epidemic tracking; electronic health records; electronic decision support; provider-to-provider communication; provider work-planning & scheduling; provider training & education; human resource management; supply chain management; and financial transactions & incentives (Labrique et al., 2013; Kaunda-Khangamwa et al., 2018; Marufu & Maboe, 2017; Sun et al., 2016). This study however, focused on studying the provision of education and awareness on chronic diseases through the use of mHealth, with the aim of preventing and maintaining the disease condition.

## 2.3 MHEALTH READINESS IN KENYA

Over the past decade, Kenya has witnessed several mHealth initiatives being deployed (MoH, 2016). This may be attributed to the government recognizing and promoting the use of ICT in several sectors including health, through its Vision 2030, as a significant contributor towards the social and economic development of the country. The CAK (2021) reported that mobile phone penetration in Kenya had been rising steadily, from 88.7% in 2016 to an impressive 130.3% by the end of March 2021. Such a high rate of ownership of mobile phones in the country was evident of potential for implementing mHealth initiatives. The high geographical coverage of mobile

networks in the country meant that most electronic-based health interventions could be delivered at the grassroots level through mobile phones in terms of mHealth projects (Lee et al., 2018; Njoroge et al., 2017). Figure 2.1 below shows these comparative statistics over a period of five years.

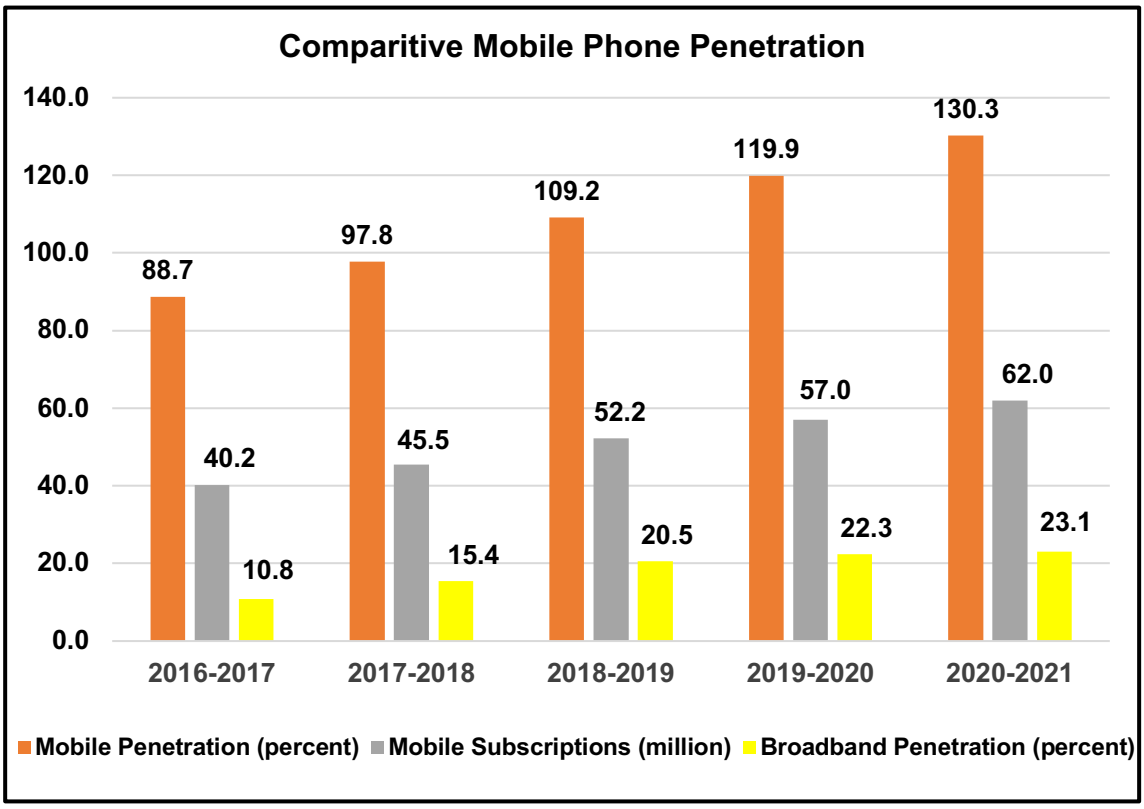


**Figure 2.1: Trends in Mobile Phone Penetration in Kenya, 2016 - 2021**
**Source: Produced from Communications Authority of Kenya data**

Several mHealth initiatives in Kenya have utilized SMS-based platforms to educate the grassroots population, with a fundamental focus on primary care in HIV/AIDS, maternal and new-born health, and malaria (Feroz et al., 2017; MoH, 2016; Njoroge et al., 2017). The reason behind the use of SMS vis-à-vis Internet-based applications could be pinned to the limited reach of broadband services, especially in the rural regions of the country, as presented in Figure 2.1 above, which shows only 10.8% of broadband penetration reported by June 2017 (CAK, 2017), rising to a mere 23.1% by March 2021 (CAK, 2021).

Most of the SMS-based mHealth initiatives have focused on primary care in terms of drug adherence and the monitoring of HIV/AIDS, maternal and new-born health, and malaria (Campbell et al., 2017; Feroz et al., 2017; MoH, 2016; Patel et al., 2017). Ngaruiya and others (2019) however, reported success in adherence to treatment of

cardiovascular disease through mobile phone SMS in the urban poor population of Nairobi, the capital city of Kenya.

There has not been specific mention of mHealth initiatives in the rural area under scrutiny, with a focus on providing health literacy on the five chronic diseases of concern in this study namely cancer, cardiovascular disease, hypertension, diabetes, and obesity. Therefore, to fill this gap in the research and to reduce the chronic disease burden in the Kenyan population, this study looked at the ecosystem that would be conducive for providing sustainable education and awareness on chronic diseases to Kenya's rural population with the use of mobile phone SMS.

## 2.4 MHEALTH FOR CHRONIC DISEASES

Before the year 2003, response by the Kenyan MoH towards chronic diseases was very low. This was due to the perception that chronic diseases did not pose any major threat to health especially in developing nations (Mwai, 2016). One of the major progressive steps towards curbing chronic diseases was the ratification of Resolution 53.17 of 2002 by the WHO that granted priority to war against chronic diseases. In the same year, 2002, various programs and strategies were set by the Kenyan government such as assisting in planning and commemorating World Disease Days for chronic diseases such as the World TB Day, World Diabetes Day as well as Cancer Awareness Day. However, there was no funding allocated that facilitated the treatment, control and prevention of the various chronic diseases (Mwai, 2016).

The desk that was set up at the Kenyan MOH actively dealt with chronic diseases cases like active discussion on tobacco control (John, 2013). This was reinforced by the ratification of the tobacco control treaty by the WHO in 2003. However, the ratification and signing of the treaty happened in Kenya in as late as June 24, 2004 (John, 2013). The treaty facilitated establishment of health projects that were found useful in spearheading the fight against chronic diseases at the Kenyan MoH. At the same time, the National Tobacco Free Initiative lobby group necessitated the control on smoking through a Kenyan Act of Parliament, subsequently, the Kenyan MoH established a chronic diseases department in the year 2007.

Unlike chronic diseases, communicable diseases are those that spread amongst people or from animals to individuals through contact with something that contains a

germ, such as airborne viruses or bacteria. Examples are HIV/AIDS, influenza, malaria, polio, tuberculosis and hepatitis (Boutayeb, 2010). NCDs also known as chronic diseases, refer to conditions that are not caused by acute infection and contact (Boutayeb, 2010). In the wake of the double disease burden faced by the country in the recent years, this study limited its scope to five of the chronic diseases, namely cancer, cardiovascular disease, hypertension, diabetes, and obesity, which were major causes of global as well as local morbidity and mortality (Feroz et al., 2018; WHO, 2011).

In 2018, the WHO stated that chronic diseases caused 71% of deaths globally, 85% of these in developing countries (WHO, 2019). By the year 2020 in Kenya, 51% of adults suffered from at least one type of chronic disease (Smit et al., 2020), and thus, the population needed to gain information on the prevention and maintenance of the disease condition. This study proposed that mHealth would provide a suitable solution to spread awareness to the masses in a short time, and at a low cost.

The common risk factors in most of these chronic diseases are excessive use of tobacco and exposure to its smoke, an unbalanced diet, a lack of exercise, and the harmful use of alcohol (Juma et al., 2017; Kluge et al., 2020; WHO, 2019). Chronic diseases are preventable through lifestyle and behavioural adjustments made by the patients through limiting tobacco use, eating a balanced and healthy diet, taking regular physical exercise and reducing the consumption of alcohol (Mikkelsen et al., 2019; WHO, 2011). Thus, as outlined in this study, it was important to assess the factors that would encourage a sustainable solution for the rural Kenyan population to receive healthcare education and awareness on the risk factors, signs and symptoms, and preventative and maintenance measures for chronic diseases.

Chronic diseases, which result in dire health consequences, often creating a need for long-standing treatment and care, are mostly attributed to interrelated factors such as high poverty, urbanisation, change of lifestyle and globalisation (Juma et al., 2017). The population under study for this research faced significant poverty levels, poor infrastructure, and an unhealthy lifestyle. It was thus, paramount to understand what would motivate the individuals of this rural region to adopt healthcare awareness through mobile phones for better health outcomes.

The inadequate healthcare systems also contributed a significant percentage to the disease burden and mortality rates amongst people who did not have ready access to diagnosis and treatment (Juma et al., 2017; Kraef et al., 2020). Since the country's healthcare system faced inequity and inequality of services, especially in the rural regions (Ilinca et al., 2019), it seemed prudent to provide health literacy to the rural population on changes in lifestyle and dietary behaviour though mobile phones.

Health literacy plays a crucial role in the prevention and self-management of chronic diseases (Khan et al., 2018; Kreps, 2017). Health literacy comprises 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 (Kuyinu et al., 2020; Magnani et al., 2018; WHO, 1998). The American Medical Association defines health literacy as "a constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the healthcare environment" (American Medical Association, 1999). According to the Institute of Medicine, health literacy may be described 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" (Institute of Medicine, 2004; Parker & Ratzan, 2019).

As explained above, the chronic diseases landscape in the country necessitated this study, which would help to understand the enablers of sustainable mHealth adoption by the population to reduce the chronic disease burden on society through health literacy. Poureslami and others (2017) reported that low health literacy is associated with poor health outcomes, higher healthcare costs, and heightened risk behaviours like smoking, excessive consumption of alcohol, high salt intake, and low physical activity, which increased the prevalence of chronic diseases. The pervasiveness of these associated behavioural aspects in the rural Kenyan population necessitated the appraisal of their levels of health literacy on chronic diseases.

## 2.5 MHEALTH FOR HEALTH LITERACY THROUGH SMS

In different regions and environments, mHealth-based health literacy has used several modes of communication, some of which have been the SMS, multimedia messaging service (MMS), interactive voice response, voice communication, audio clips, video clips, and images (Amoakoh-Coleman et al., 2016; Watkins et al., 2018). The preferred

mode of delivery would depend on the population involved and the resources of the specific mHealth initiative.

However, other factors that come into play while selecting the mode of delivery of such information are population literacy rates, mobile phone affordability, availability and accessibility, and the local language(s) preferred by the population (Jusoh, 2017). In the light of this narrative, this study aimed to understand the contextual catalysts that would encourage the study population's disposition to receiving healthcare education and awareness of chronic diseases through mobile phone SMS.

The ever-increasing trend in mobile technology interventions that use low-cost feature phones that support text message (SMS) is seen to help break the barriers of disparities originally caused by geographical area, socioeconomic levels, and education level (Patel et al., 2017). The population under study is geographically dispersed, comes from low socioeconomic backgrounds and has varying education levels therefore, mobile phone SMS would prove beneficial to these individuals relative to other modes of providing health literacy, such as face-to-face communication from health personnel.

Mobile phone SMS has been the preferred method to provide healthcare education by many mHealth initiatives in the LMICs owing to their popularity among the recipients, and the benefits of its cost-effectiveness, scalability, convenience and broad reach at the community level (Patel et al., 2017; Varleta et al., 2017). In Kenya, mobile phone SMS provides the bridge between limited healthcare, physical and organizational infrastructures and high geographic reach of the mobile phone in rural areas (MoH, 2017). With limited access to broadband data services, the sparsely populated rural study population would benefit from the use of SMS rather than internet-based solution for providing education and awareness on chronic diseases.

The SMS feature is potentially a powerful tool, as it is widely available to a large population, easy to use, and the SMS may be sent and received instantaneously (Sarabi et al., 2016). The use of SMS for healthcare purposes in LMICs relegates the strained healthcare system's challenges, such as a limited healthcare workforce, limited financial resources and high disease burden, coupled with the rising population (Sarabi et al., 2016). With the backdrop of limited healthcare infrastructure and the low number of healthcare workers in the area, the community could also leverage their

own experience with feature phones when receiving education on chronic diseases through mobile phone SMS.

SMS has been found apt to understand the change in health behaviour as it allows for timely, personalised and targeted healthcare communication to reinforce such change (Rico et al., 2017). The rural Kenyan population would find it advantageous to receive education and awareness of chronic diseases through SMS if the information was customised and contextual to their healthcare needs.

An SMS has the advantage of being asynchronous, as it is stored when received and may be accessed at any later time of personal convenience (Varleta et al., 2017). This feature of SMS helps the recipient to retrieve healthcare information at a later time if the recipient does not have full-time access to a phone, the phone is drained of battery power, the individual is busy, and when one wishes to share the information with their family and friends.

The benefits discussed above augment the case for using a mobile phone SMS for this study to disperse healthcare information to the rural Kenyan population on the five chronic diseases mentioned earlier to improve health outcomes.

## 2.6 MHEALTH ENABLERS AND INHIBITORS

As noticed earlier, many mHealth initiatives do not go beyond the initial pilot stage (Kiberu et al., 2017; Manyati & Mutsau, 2021; Opoku et al., 2019; Stephani, 2019) therefore, it was necessary to understand what would be the factors that enabled and hindered the long term use of mHealth.

Health literacy about the disease condition should be available to the individuals when they need it and where they need it, and this has a positive influence on them adopting mHealth (Kreps, 2017). It is important to assess the population's need for health literacy before proposing the mHealth initiative, thereby making it consumer-centric. However, how the information is developed and distributed to improve health consumers' health literacy is crucial to the adoption of mHealth (Jusoh, 2017). Subsequently, many factors influence an individual's willingness to receive health literacy. This study sought to evaluate the factors that would motivate rural Kenyan population to receive health literacy on chronic diseases through mobile phones to better their health.

For the successful adoption of mHealth, the information being shared needs to be relevant, understandable by the population, in the language of their choice, specific to the needs of the population and be delivered to them on time (Aamir et al., 2018; Brown et al., 2018; MoH, 2016). Suitable language literacy is also necessary for the population to benefit from voice and text messages used in mHealth (Khatun et al. 2016; Kreps, 2017; MoH, 2016). Hence, this study tested if language literacy would be one of the factors that influenced the adoption of mHealth by rural Kenyans.

Whereas sensitisation and the need to gain health literacy on chronic diseases could be a motivating factor, ignorance towards the same has been argued to be a possible barrier to mHealth (Khan et al., 2018; Kreps, 2017; Watkins et al., 2018). This study investigated if the need for health literacy could influence rural Kenyans' perceptions of using mobile phones to receive education and awareness about risk factors, signs and symptoms, a healthy diet and a healthy lifestyle to prevent chronic diseases.

The age of the individual is one of the contributing factors that would influence the uptake of mHealth (Ilozumba et al., 2018; MoH, 2016). The younger population is generally more conversant with technology and would find it easier to use it than older people. This study evaluated if individual determinants like the preferred language and age of the user affected the uptake of mHealth in a rural Kenyan population.

In addition to language literacy and age of the individual, several other factors affect the uptake of mHealth. Social and cultural forces can both motivate and hinder the adoption of mHealth (Cislaghi & Heise, 2018). The authors argued that religious as well as community leaders are significant influencers who could have a high level of influence on the decision-making process of community members (Cislaghi & Heise, 2018). Being social beings, individuals’ decisions would be influenced by what others feel and say, and what others adopt or reject. This research explored the likely bias presented by social influence on the uptake of mHealth by the rural Kenyan population.

Another influencer in mHealth adoption is individuals' perceptions of their susceptibility to and the severity of health conditions (Rollins et al., 2018). A population that is perceived to be vulnerable to a certain disease condition or its effects would be motivated to receive mHealth services, and the lack of such vulnerability could discourage its adoption. This study made a step further to validate the effect of vulnerability to chronic diseases on utilising mHealth by rural Kenyans.

Trust in technology by the population is another factor to look into (Chib et al., 2015). Trust can be a combination of factors perceived by the population, such as the benefits (usability), ease of use, and self-confidence in using the mHealth solution, which cumulatively influence the uptake of mHealth (Emani et al., 2018; Gholampour et al., 2018; Rönnby et al., 2018). These technological factors were studied further in the following chapter to contribute to this study's theoretical framework. The results of empirical tests later in the research, endorsed that these factors were significant in decision-making towards the uptake of mHealth by rural Kenyan population under study.

Government policy that promotes the use and adoption of mHealth and provides the relevant infrastructure and environment would greatly enhance the uptake of mHealth (Watkins et al., 2018) whereas, the lack of involvement of government stifles its development (MoH, 2016). This research proposed that, for multi-stakeholder participation to be achieved, the government should engage with the private sector and provide a motivating ground for mHealth initiatives to be run, notwithstanding the global agenda, which the international health organisations also need to promote.

Despite the various opportunities provided by mHealth, there still are many barriers to its adoption in developing countries (Aamir et al., 2018; Brown et al., 2018; Sun et al., 2016). The culture of communities, and government policies and regulations affect the uptake of mHealth in most countries (Feroz et al., 2018; MoH, 2016; Sun et al., 2016). The quality of mobile phone networks in remote regions is poor, erratic, and sometimes completely absent (Aamir et al., 2018; Brown et al., 2018; MoH, 2016). Limited internet access makes the use of smartphone-based applications possibly redundant in these regions (Aamir et al., 2018; Brown et al., 2018; MoH, 2016). When a community is not ready and does not see the need for mHealth, the uptake is low (Van Olmen et al., 2020). Based on this literature, the study aimed to evaluate the contextual inhibitors of the rural Kenyan population to receive health literacy on chronic diseases using mobile phones.

Having explored the existing literature on factors that were potential enablers and inhibitors of mHealth adoption, theories and models were studied in the subsequent chapter which provided a theoretical underpinning to understand the effect of these factors better.

Figure 2.2 summarises some of the factors that influence mHealth adoption.


**Figure 2.2: Potential Factors that Could Influence Mhealth Adoption**
**Source: Author's synthesis**

## 2.7 CONCLUSION

A review of the literature gave rise to at least four broad categories of factors that influenced mHealth adoption, namely individual, social, health, and technological factors. In the light of the review, the study aimed to evaluate the theories and models from diverse disciplines of social science, technology acceptance, and health behaviour which could enhance the understanding of these factors affecting mHealth adoption. Thus, the subsequent chapter develops the case of individual, social, health and technological factors that inform the perception of mobile phones' use for receiving health literacy on chronic diseases by the rural Kenyan population.

# CHAPTER THREE

# THEORETICAL DESIGN

## 3.1 INTRODUCTION

Chapter three presents nine different theories and models that cumulatively assisted in explaining the various elements from the individual, social, health, and technological backgrounds that could potentially influence mobile phone adoption by the population in a low-resource setup. The purpose of this chapter was to understand and expound on several behaviour change theories and models from the diverse fields of social behaviour, technology-acceptance behaviour, and health-related behaviour in order to achieve the aim of this study which strived to develop an all-inclusive model for a sustainable mHealth adoption in a low resource setting.

The nine theories and models examined here were, namely social norms theory (Perkins & Berkowitz, 1986), social cognitive theory (Bandura, 1989), theory of reasoned action (Ajzen & Fishbein, 1975), theory of planned behaviour (Ajzen, 1991), diffusion of innovation theory (Rogers, 1983), technology acceptance model (Davis, 1989), unified theory of acceptance and use of technology (Venkatesh et al., 2003), health action process approach (Schwarzer, 2003), and health belief model (Rosenstock, 1974). The primary motivation of this chapter was to understand the assumptions, the building blocks and their interdependence, and the strengths and limitations of each of the theories and models as underlined by other researchers, in order to evaluate which of these factors could potentially influence mHealth adoption behaviour of the study population.

Behaviour has been defined to be anything a person does in response to internal or external events (Davis et al., 2015). Therefore, to understand the behaviour change, it was paramount to understand the diverse individual, social, health, and technological factors that inform the change. Regarding this study, the theories and models under scrutiny in this chapter explain the phenomena of individual, social, health, and technology-related behaviour change.

Kivunja (2018) explains that a theory or a model is formed of a set of interrelated constructs (concepts), definitions, and propositions that present a systematic view of a phenomena by specifying relations among these concepts, in order to explain and

predict the phenomena (Kivunja, 2018). This definition may be interpreted as a theory/model presents elements: constructs that form the building blocks of a theory/model which are inter-related, and through their relationship exhibit a given concept. Several authors (Gawronski & Bodenhausen, 2015; Kivunja, 2018; Sfetcu, 2019) identify a set of principles as described below that verify the validity of a given theory or model, which would, in turn, assist in gauging its strengths and limitations.

a) Parsimony: This is achieved by explaining a given phenomenon in the simplest way possible.

b) Scope: The characteristics that indicate how much of a given phenomenon the theory seeks to explain.

c) Plausible: The extent to which the theory can provide an explanation between two or more facts.

d) Logical consistency: The extent to which a theory makes sense in terms of its concepts and positions.

e) Testability: The extent to which a theory can be put to empirical scientific testing. It should be noted that some theories cannot be tested.

f) Falsifiability: The testing of theories must be conducted to refute an explanation; in other words, whether there is another possible explanation.

The subsequent sections of this chapter applied this set of principles to evaluate the strengths and weaknesses therefore, the applicability of the theory/model to the current study which aimed to assess the factors that would influence mHealth adoption in a rural setting.

### 3.2 SOCIAL NORMS THEORY

Social Norms Theory (SNT), suggested by Perkins and Berkowitz (1986), was adopted in this research to explore the impact of social elements on the use of mobile phones in receiving education and awareness of chronic diseases by rural Kenyan population.

Social norms are the unwritten rules, behavioural patterns, collective attitudes and individual beliefs about others' behaviour and the perception of what others might term as permissible behaviour (Dempsey et al., 2018). The SNT proposes two types of social norms: injunctive and descriptive (Rosas et al., 2017). Injunctive norms refer to

an individual's perception of what others approve or disapprove, while descriptive norms are perceived behaviours that others engage in (Dempsey et al., 2018; Rosas et al., 2017). In this study, it would be useful to assess the extent to which injunctive norms achieved the individual community member's approval to the use of a mobile phone for healthcare education. Descriptive norms would come into play where individuals believed that their significant peers utilized mobile phones to receive healthcare education and awareness of chronic diseases, which could further prompt them to follow suit. The peers in this scenario would mean the community leaders, religious leaders, family and friends whose opinion counted for the community members.

Berkowitz (2003) and Dempseyand others (2018) have pointed out that individuals may also generally misunderstand their peers' behaviours and attitudes. In the SNT, these misperceptions are classified into pluralistic ignorance, false consensus, and false uniqueness (Rosas et al., 2017) as is illustrated in Figure 3.1 below.

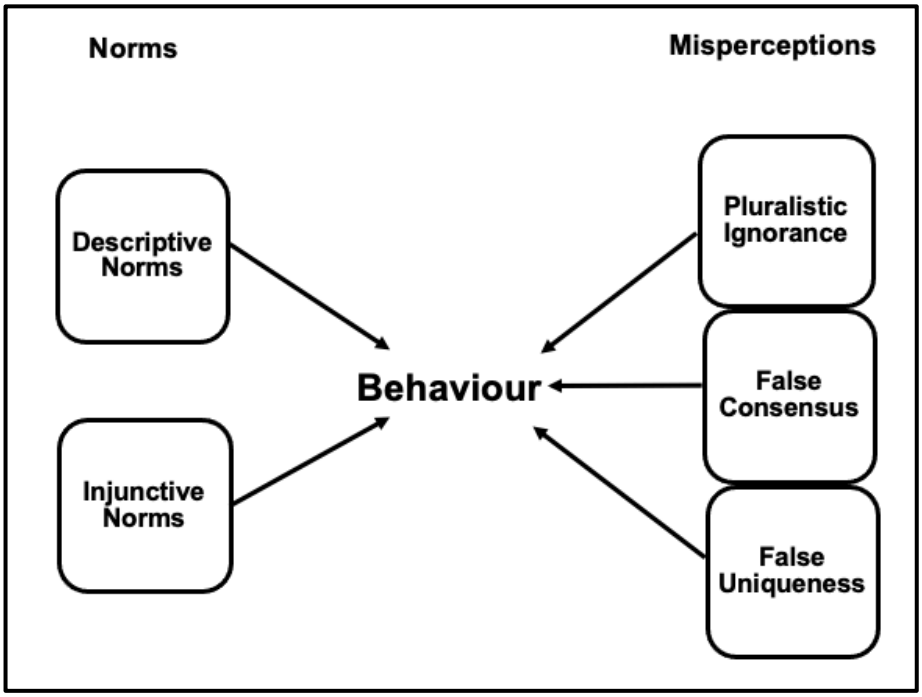


**Figure 3.1: Social Norms Theory**
**Adapted from: Perkins & Berkowitz (1986)**

Pluralistic ignorance describes situations in which people generate false beliefs about their peers' behaviours as being different from theirs, which is normally not the case (Berkowitz, 2005; Perkins & Berkowitz, 1986). The SNT suggests that risk behaviours are normally overemphasised under pluralistic ignorance whereas healthy behaviours

are undervalued (Berkowitz, 2005; Perkins & Berkowitz, 1986). Berkowitz (2004, 2005) notes that the resultant effect of these misconceptions is that individuals can be caused to alter their behaviour to appraise misperceived norms. Altering behaviour leads to rationalising the problem behaviour while, in turn, subduing healthy behaviour (Berkowitz, 2004, 2005). Regarding this study, an example of pluralistic ignorance would be observed in the study population's behaviour, where individuals believed that social norms prevented them from going for early screening to prevent cancer (healthy behaviour). In contrast, the consumption of alcohol (risk behaviour) could be promoted by peers engaging in it. However, this misbelief, could influence the possible acceptance of using mobile phones for healthcare education and awareness about chronic diseases by the community members.

The second misperception of the social norms approach is false consensus, which describes a situation in which individuals perceive their peers' behaviour to be similar to their own when it actually is not (Rosas et al., 2017). It has been argued that false consensus and pluralistic ignorance are mutually reinforcing and self-perpetuating (Berkowitz, 2005; Perkins & Berkowitz, 1986). The study population could refute the use of mobile phones for health literacy if they conceived that their significant peers would also disapprove mHealth adoption.

The third and last misperception of the SNT is false uniqueness, which is a situation in which some individuals misleadingly believe that they are exceptional when they are in fact not (Berkowitz, 2004; Pollard et al., 2000). Such persons believe that the risk behaviour that they practice is far less than the norm perceived by their peers. In the light of this misperception, this research examined the extent at which the rural Kenyan population may believe that they are the only ones (unique) who smoked much less than their peers, and how such a stance shaped their choices about receiving healthcare education and awareness of chronic diseases through mobile phones. As a reminder at this juncture, chronic diseases are promoted due to adverse lifestyle behaviours such as excessive consumption of alcohol or tobacco use.

Various researchers (Dempsey et al., 2018; Kroshus et al., 2015; Moore et al., 2016; Wamoyi et al., 2019; Wegs et al., 2016) have applied SNT to explain different forms of behaviour and have highlighted several of its strengths, four of which are discussed below.

The first strength was found by scholars who acknowledged the importance of exploiting social norms as a tool to attain a change in people's behaviour to improve their health and well-being (Cislaghi & Heise, 2018). For interventions to be adopted by individuals, it is paramount to understand the interplay of their social norms. In this research, the power of SNT would be employed to justify the influence of social norms on individuals' mHealth adoption behaviour in order for better health outcome for the study population.

The second merit of the SNT is realised when the population perceives a hazard like a health-related threat (Dempsey et al., 2018). In a threat environment, the theory assists in understanding why people behave in a certain way and, at the same time, how certain individuals may influence others – both positively and negatively. The strength of this theory lies in explaining risk behaviour among varied populations. This feature of the SNT approach was valuable for this research in the quest to understand how peers' influence could inform the positive or negative decision on mHealth adoption for health literacy by individuals who believed that they were susceptible to chronic diseases.

The third significance of the social norms approach is seen in an experiment that was carried out to gauge the effectiveness of social norms regarding the reduced consumption of sugary beverages. This experiment revealed that exposure to health information is a great determinant of positive social behaviour (Rosas et al., 2017). It was inferred from this research that receiving healthcare education on chronic diseases by the study population could be an antecedent to better health behaviour. Thus, it was paramount to further understand the factors that would motivate the population on receiving health literacy through mobile phones.

Lastly, a study carried out among women cancer patients revealed that they undertook treatment based on positive sentiments in the community. The women showed a greater tendency towards chemotherapy in circumstances where there was a more significant (mis)-perception of the desirability of chemotherapy by peers (Zikmund-Fisher, et al., 2011). The principle of false consensus leads to positive outcomes, making it a strength of the social norms approach. Similarly, the study population would readily accept to receive healthcare information through their mobile phones if they wrongfully believed that the community leaders showed a positive attitude to the

use. Hence, when the selected study participants perceived the community members' appeal for using mobile phones for healthcare education on chronic diseases, they would also readily accept using their mobile phones for the same cause.

Despite the above strengths, the SNT has a few drawbacks too, four of which have been discussed here. First, SNT is seen when social norms are considered the sole cause of behaviour change while marginalising other factors (Cislaghi & Heise, 2018). Social norms and the associated misperceptions should be treated as integral, but not as the core variables that contribute to behaviour change.

Secondly, Moore and others (2016) pointed out that contrary to SNT's hypothesis, the people intoxicated with alcohol in drinking environments are influenced by their peers' actual behaviour rather than a misperception of their belief. Thus, the peers' influence is dependent on the environment in context and cannot be generalised.

Third, Dempsey and others (2018) suggested that there needs to be a clear distinction between the testing impact of misperceptions on behaviour and other types of social norms that are considered which could also play a significant part in people's behaviour.

Fourthly, it has been proposed that rigorous testing be conducted on interventions based on the SNT approach, according to which various methodologies should be utilised that suit the real-world health environment (Dempsey et al., 2018). The pre-intervention and post-intervention perceptions needed to be studied too.

Having considered the strengths and weaknesses of the SNT as presented above, it may be noticed that the theory proposes only one core element which is the social norms that could potentially influence individual behaviour. The aim of this enquiry was to investigate factors from the individual, social, health, as well as technology related backgrounds in order to inform the all-inclusive resultant model thus, other theories and models needed to also be considered. Meanwhile, the SNT did shed light on at least social influence led behaviour change in individuals. Hence, other theories were reviewed which similarly used social norms as one of their building blocks.

One such theory which is discussed below was the social cognitive theory.

## 3.3 SOCIAL COGNITIVE THEORY

Social Cognitive Theory (SCT), developed by Albert Bandura in 1989, was another guiding framework used in analysing the impact of individual and social factors on mobile phones in gaining education and raising awareness of chronic diseases in rural Kenya. The SCT postulates that humans have outstanding flexibility to acquire a variety of attitudes, skills, and behaviours in diverse situations where a given behaviour is reinforced by observing the behaviour of others through modelling and thus, involving cognitive processes and not simply by way of passive observation as proposed by the SNT (Beauchamp et al., 2019; Lee et al., 2018; Stacey et al., 2015). This research examined the veracity of these assumptions in understanding how perceived behaviour towards using mobile phones for education and awareness of chronic diseases by individuals would be influenced by their personal attitudes, skills, experience and knowledge of mobile phone use (individual factors), as well as through observing and vicarious learning from their peers' or significant others' use of the mobile phones (social factors).

The SCT, as depicted in the Figure 3.2 below, comprises three broad categories of contributing building blocks that shape individual behaviours: individuals' cognitive factors, environmental factors, and behavioural factors (Bandura, 1989, 1999; Burke et al., 2009; Nabavi, 2012). Each of these categories have sub-elements.

The first category of contributing elements under the SCT captures personal and cognitive factors: personal factors include one's age, gender, and socio-economic status; cognitive factors include elements such as the knowledge, outcome expectancies, and attitude of an individual (Bandura, 1989, 1999; Burke et al., 2009; Nabavi, 2012). Knowledge is defined in the SCT as a justified true belief of an individual (Burke et al., 2009; Nabavi, 2012; Sell et al., 2016). Outcome expectancies refer to the anticipated result of an individual's particular behaviour (Beauchamp et al., 2019; Burke et al., 2009; Sell et al., 2016). Attitude refers to an individual's positive or negative evaluation and beliefs about a specific behaviour (Bandura, 1989, 1999; Burke et al., 2009; Nabavi, 2012). In this research, these cognitive elements are useful in analysing whether individuals in rural Kenya would consider using mobile phones for education and awareness of chronic diseases if they believed that they had knowledge of using mobile phones; that such use would lead to better health outcomes

(expectations) and whether their positive attitudes would lead to them using mobile phones. The influence posed by the suggested personal factors such as the individual's age, gender, and socio-economic status would also be of importance when gaining an understanding of the mHealth (technology) adoption behaviour of the study participants. Hence, these factors were considered significant for this enquiry.

The second group of factors under the SCT are the environmental factors, which capture elements such as social norms – a collection of beliefs, attitudes and behaviour towards a certain phenomenon as established by society, influenced by the people of influence in the society and influenced by family (Bandura, 1989, 1999; Beauchamp et al., 2019; Sell et al., 2016). These are factors that the SNT studied above had proposed and the SCT has reinforced. Therefore, social norms were thus far considered as one of the building blocks to be tested by this enquiry.

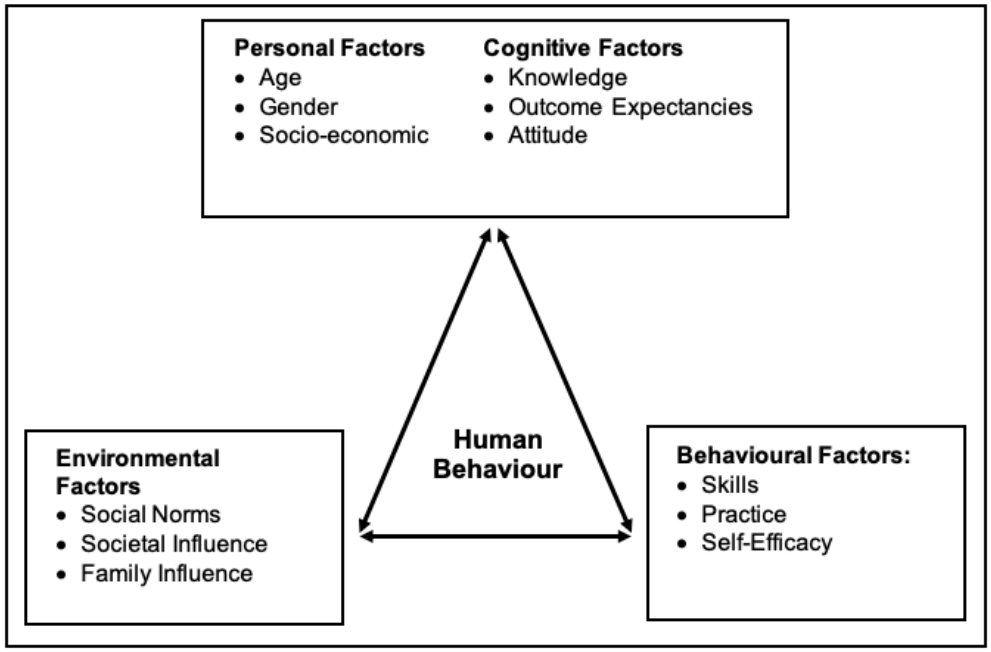


**Figure 3.2: Social Cognitive Theory**
**Adapted from Bandura (1989)**

The third and final group of factors under the SCT is a collection of individual behavioural factors, including elements like the individuals' skills, practices and self-efficacy (Bandura, 1989, 1999; Burke et al., 2009; Nabavi, 2012). Skills as per the SCT refer to the knowledge an individual has on how to perform a specific action (Bandura, 1989, 1999; Beauchamp et al., 2019; Sell et al., 2016). Practice denotes the mastery of a given set of actions based on past experience (Bandura, 1989, 1999;

Sell et al., 2016). Self-efficacy entails the individuals' perceptions of confidence in their ability to perform a particular deed (Bandura, 1989, 1999; Beauchamp et al., 2019; Nabavi, 2012). Self-efficacy is seen to influence an individual's aspirations and outcome expectancies; one may aspire to demonstrate a given behaviour or expect a given outcome, but may not have the confidence (self-efficacy) to arrive at the desired behaviour; alternatively, when one has high confidence in a certain behaviour, it is possible to achieve a positive behavioural outcome (Bandura, 1989, 1999; Burke et al., 2009; Sell et al., 2016). Self-efficacy is acquired through vicarious learning and is shaped by experience, social modelling, social persuasion, and the individual's physical and emotional state (Rawlett, 2014).

The three contributing categories of SCT elements influence each other bi-directionally, an aspect known as reciprocal determinism (Bandura, 1989, 1999; Beauchamp et al., 2019; Burke et al., 2009). This implies that personal and cognitive factors influence behavioural factors and vice versa, behavioural factors influence environmental factors and vice versa, and environmental factors affect personal and cognitive factors and vice versa. This could also be interpreted as peoples' behaviour such as mHealth adoption for health literacy resulting from a combination of several external and internal factors, where external factors would include their social environments. In turn, internal factors could potentially comprise their skill, practice, self-efficacy, vicarious learning, experience, outcome expectancies, and their attitude towards using the mobile phones. This research thus, strived to understand how each of these internal and external factors could inform the rural Kenyan population's perception of adopting mobile phones for gaining education and awareness on chronic diseases.

Several researchers have used SCT constructs to understand and explain the change in behaviour of individuals in diverse scenarios (Gothe, 2018; Lee et al., 2018; Stacey et al., 2015; Xu et al., 2017). Of all the constructs, self-efficacy and outcome expectancies have been found to have a significant influence on the change in health behaviour (Lee et al., 2018; Stacey et al., 2015; Xu et al., 2017). High levels of self-efficacy have been seen to promote higher outcome expectancies, thereby bringing out positive behaviour change (Gothe, 2018). This enquiry proposed to test the significance of the three key categories of constructs of the SCT – individuals'

cognitive factors, environmental factors, and behavioural factors – to determine how they would shape the perceptions of the rural Kenya population towards the use of mobile phones for education and awareness of chronic diseases.

Bandura's SCT has several strengths (Nabavi, 2012), four of which are highlighted as useful in this study. Firstly, it has been found to be falsifiable, as it has been applied in several scenarios over diverse instances of research that can prove it false. Thus, it is validated as a sound theory (Nabavi, 2012). Regarding health behaviour, several authors (Lee et al., 2018; Stacey et al., 2015; Xu et al., 2017) have successfully used SCT in explaining behavioural change. This research hence, espoused on this particular strength of SCT to develop hypotheses on factors that could potentially lead to mobile phone use for education and awareness of chronic diseases.

Secondly, SCT fulfils the principle of scope and testability (Feist et al., 2018). It shows that SCT can organise many psychology-based research findings, as its triadic causation model allows diverse studies to explain observable behaviours using self-efficacy. SCT guides many behaviours that may be explained using self-efficacy. Thus, it is practical and allows an explanation of action towards a given behaviour (Feist et al., 2018; Gawronski & Bodenhausen, 2015). This enquiry advocated to test the theory for its scope by using the variable self-efficacy of individuals at using their mobile phones, to influence their mHealth adoption behaviour.

Thirdly, for internal consistency, Bandura's SCT is rated high because of its strong empirical foundation (Feist et al., 2018; Gawronski & Bodenhausen, 2015). Past research data can be used to understand how its constructs influence behaviour. Empirical data from the SCT was applied in this research to design data capturing tools to assess the perceptions of the rural Kenyan population on their use of mobile phones to gain education and awareness of chronic diseases.

The fourth strength of SCT is its parsimonious nature, which means that it is simple, straightforward, and unencumbered by hypothetical explanations (Feist et al., 2018; Nabavi, 2012). The three assumptions of SCT are that individuals acquire a variety of attitudes, skills and behaviours in diverse situations; they learn through observation; and they experience vicarious learning through modelling and cognition. Based on these assumptions, this enquiry measured the perception of knowledge, outcome expectancies, attitudes, skills, practices, and self-efficacy of the study population. It

also measures the effect of their vicarious learning through observation, modelling, and cognition in the wake of social norms and the influences of society that would lead them to use mobile phones to receive education and awareness of chronic diseases. Moderating factors such as age, gender and socio-economic status were also captured to understand how they shaped the population's behaviour.

In addition to the above strong points, certain scholars have argued that there are four main drawbacks of SCT. Firstly, Beauchamp and others (2018) pointed out that although SCT could explain why one demonstrated a given behaviour however, it could not explain whether one was able to maintain the behaviour over time in the face of various barriers, obstacles, and other competing demands. To fulfil the objectives of this research, the behaviour change in terms of using mobile phones for education and awareness of chronic diseases needed to be scalable and be maintained over a length of time. Thus, other models and theories needed to be studied to identify the factors that, together with those of SCT, would comprehensively explain the change in behaviour and aid in sustaining it over time.

The second limitation of SCT is its lack of acknowledgement that behaviour is influenced not only by people's own self-efficacy, but also by the collective efficacy of other proxy agents (such as a coach or a fitness trainer), as well as by community agents (Williams & Rhodes, 2016). Scholars have argued that, while high self-efficacy can bring about positive outcomes, these outcomes in turn, can influence a higher self-efficacy in future actions (upward spiral), while low self-efficacy can lead to hindered performance, which in turn may cause low self-efficacy (downward spiral) (Beauchamp et al., 2019).

The third shortcoming of SCT is in its assumption that self-efficacy leads to outcome expectancies, but that a bidirectional relationship does not exist (Bandura, 1998; Beauchamp et al., 2019; De Vries, 2016; Williams & Rhodes, 2016). Some authors have refuted this postulation of the SCT and suggested that behaviour change can be as a result of perceived high self-efficacy by an individual while outcome expectancies can also lead to increased belief in self-efficacy (Beauchamp et al., 2019; De Vries, 2016; Williams & Rhodes, 2016).

The fourth and final downside of SCT is the paucity of considering the influence of socio-structural factors like the lack of availability and accessibility of healthcare

systems on health behaviour (Beauchamp et al., 2019). The healthcare system is insufficient and limited by the rural landscape of the study area, both in its availability and accessibility. Therefore, this research needed to also assess the impact of the healthcare system's inadequacy on the perceived use of mobile phones to gain education and awareness of chronic diseases by the study population.

All in all, the three categories of factors namely individuals' cognitive factors, environmental factors, and behavioural factors, that comprise the SCT were all considered important for this enquiry but due to some of the highlighted limitations of the theory, yet other theories and models had to be considered before finalising on the factors to be tested in the field.

The next theory to be studied was the diffusion of innovation theory.

### 3.4 DIFFUSION OF INNOVATION THEORY

Diffusion of Innovation Theory (DOI), conceived by Everett Rogers (Rogers, 1983), is one of the oldest social science theories and, in this research, it served as an explanatory framework to guide an analysis of the influence of individual, social, and technological factors on the use of mobile phones in gaining an education and raising awareness of chronic diseases in rural Kenya. The DOI theory aims to explain the process through which a given innovation is transmitted via various networks amongst members of a particular social system over a certain time (Rogers, 1983, 1995). In this study, DOI theory is fundamental in explaining and understanding factors that would lead to the acceptance of mobile phones (technology) by the rural Kenyan population (social system) for education and awareness of chronic diseases.

According to DOI theory, innovation is an idea, a process, or a technology that is perceived as new or previously unfamiliar to individuals within a particular area or social system (Rogers, 1995; Sahin, 2006). The theory presents diffusion as the process by which the information about the innovation flows from one person to another, over time and within the given social system (Sahin, 2006; Zhang et al., 2015). This study uses DOI to identify the perceived acceptance (diffusion) of mobile phones for health literacy in the rural Kenyan population (social system) to fulfil the research objectives.

The DOI theory postulates four principal determinants of the diffusion of an innovation: communication channels, attributes of the innovation, characteristics of the adopters, and the social system (Sahin, 2006). The communication channels refer to the medium through which people obtain information about an innovation and perceive its usefulness (Rogers, 2010; Sabus & Spake, 2016). Owing to the inadequate healthcare infrastructure in the study population targeted in this enquiry, the channel of communication that was proposed was the mobile phone SMS instead of any print medium or the face-to-face sharing of information by the health personnel as elaborated in section 2.5 of Chapter two.

The DOI suggests five perceived attributes of an innovation, namely relative advantage, compatibility, complexity, trialability, and observability (Glanz et al., 2008; Sahin, 2006). Emani and others (2018) expound on the five characteristics of an innovation that are considered for diffusion. Figure 3.3 below depicts these characteristics. The first attribute is the relative advantage, which refers to the degree to which an innovation is believed to be superior compared to the idea or process that it displaces (Emani et al., 2018; Glanz et al., 2008). The greater the comparative advantage of the innovation, the greater the level of its adoption. The comparative advantage of mobile phone SMS for health literacy was expounded upon in Chapter two section 2.5 as being free of cost, quick, targeted and up-to-date information, 24/7 availability and accessibility, and the ease of sharing the information with others.

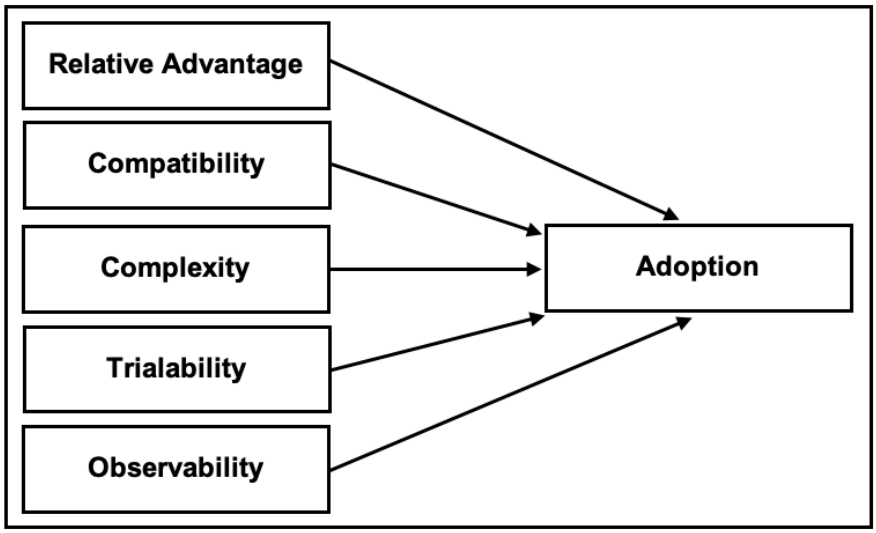


**Figure 3.3: Diffusion of Innovation Theory**
**Adapted from Rogers (1983)**

Compatibility is the second attribute and refers to the degree to which the innovation is believed to be in line with the adopters' present values, previous experiences, and in meeting their needs (Emani et al., 2018; Kaminski, 2011). The rate of innovation adoption becomes high if prospective adopters can adapt and modify the innovation to satisfy their needs and beliefs. This research tested the applicability of the compatibility attribute to evaluate their rate of adoption of the said innovation by examining the perception of individuals on their past experiences with the use of mobile phones, their need to receive healthcare information, and then to tie it to the utility value of mobile phone SMS in providing them with the necessary healthcare information for better health outcomes.

The third attribute under DOI is complexity, which refers to the scale at which an innovation is believed to be challenging to comprehend and use (Glanz et al., 2008; Kaminski, 2011). Innovations that are easily understood will be adopted easily compared to innovations that are considered difficult to understand and use. Thus, complexity is inversely proportional to the rate of innovation adoption (Sahin, 2006). This study evaluated the use of several features of a mobile phone, such as video message, internet applications, voice message, internet-enabled message, and text message to assess individuals' perceptions on the complexity and use of each. Such an evaluation improved the understanding of the relative advantage provided by text messages compared to the rest of the channels of communication through a mobile phone.

The fourth attribute is trialability, which entails the level on which innovation might be tested on a limited basis (Emani et al., 2018; Rogers, 2010). Innovations that may be experimented with on a limited basis by prospective adopters are adopted more easily than those that cannot be tested (Emani et al., 2018). This study selected mobile phone text messages (SMS), as most rural Kenyans were familiar with them and would not need a long testing period therefore, hypothetically aiding in the adoption of mHealth through SMS.

The fifth attribute under DOI is observability, which refers to the degree to which the outcomes of a certain innovation are visible to others. Innovations easily identified by and visible to others are adopted more easily (Emani et al., 2018; Rogers, 2010). The significance of this study was that it helped in evaluating the influence of role-modelling

and peer observation (Sahin, 2006) on the rate of adoption of mobile phones to receive healthcare information on chronic diseases. Learning from observation through the social peers is an attribute that was also stressed upon by the SCT studied in section 3.3 above and was considered by this enquiry.

Various researchers have used DOI theory to understand the adoption of innovation and have established that positive adoption by individuals is dependent on the innovation's attributes (Bhattacharya & Singh, 2019; Lin et al., 2016a; McMullen et al., 2015; Olsson et al., 2016; Sabus & Spake, 2016; Zhang et al., 2015). This study assessed the influence of these five attributes of a mobile phone, namely relative advantage, compatibility, complexity, trialability, and observability, on their acceptance by the rural Kenyan population to receive healthcare education and awareness of chronic diseases.

As presented in Figure 3.4 below, the DOI theory proposes five distinct categories of innovation adopters, namely innovators, early adopters, early majority, late majority, and laggards (Rogers, 2010; Sahin, 2006).

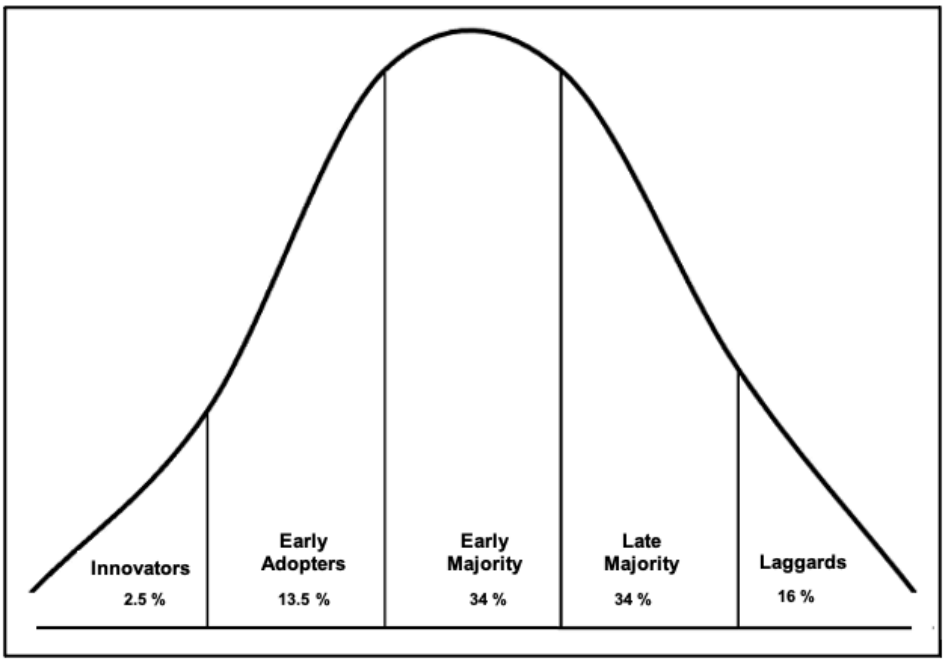


**Figure 3.4: Five Distinct Categories of Innovation Adopters**
**Adapted from Yuksel (2015)**

When an innovation is introduced into a community, it is first received by the innovators, who comprise 2.5% (Kaminski, 2011; Yuksel, 2015). The early adopters

(13.5%) then take up the innovation after witnessing its usability, followed by the early majority (34%), who form a bigger category of the population that buys into the idea. A similar number of people (34%), comprising the late majority, adopt the innovation following wide adoption by the early majority. The final group to adopt an innovation is the laggards, who include extremely sceptical users and form 16% of the population (Yuksel, 2015). Guided by the five suggested attributes of an innovation that lead to its adoption (relative advantage, compatibility, complexity, trialability, and observability), this study investigated the proportion of the rural Kenyan population that would fall into the five given categories of adopters of mobile phones to receive healthcare education and awareness of chronic diseases.

With regard to this study, the four elements of DOI theory that were tested are: the communication channel that uses targeted text messages through mobile phones bearing healthcare information on chronic diseases that would be delivered on an individual device; attributes of innovation, which included the features of mobile phones such as voice, text message, video, and internet applications; characteristics of adopters in terms of their demographic grouping, attitude, skills, practice, knowledge and self-efficacy at using the innovation and how these could possibly influence the classification of individuals into innovators, early adopters, early majority, late majority, and laggards; and the social system, which comprised the family and community set-up and its influence on the perceived diffusion (acceptance) of mobile phones in the study population.

According to the DOI theory, the social system is the unit of individuals who form a family, community, or organisation where the adoption of innovation is supposed to be studied (Manueli et al., 2007). Characteristics of the social system that could influence the decision-making process towards the innovation of an adoption are the social structure, community beliefs, cultural values, opinion leaders, change agents, sharing the same neighbourhood, working in the same organisation, or even sharing similar interests. This study evaluated the potential influence that the social system would pose on the rural population for them to adopt mobile phones to gain education and receive awareness of chronic diseases.

The DOI theory further suggests that the innovation-decision process is classified into five distinct stages, as shown in Figure 3.5 below: knowledge, persuasion, decision,

implementation, and confirmation (Lai, 2017; Sahin, 2006). In the first stage of DOI, an individual gains knowledge about the innovation, how it works, and why it is important (Kaminski, 2011; Lai, 2017). The second stage of DOI theory is the persuasion stage, in which an individual develops either a positive or negative attitude towards the innovation. Persuasion follows the knowledge stage, but does not necessarily lead to adoption or rejection (Kaminski, 2011; Rogers, 2010).

Decision-making forms the third stage of DOI theory. In this phase, the individuals resolve to either adopt or reject the innovation based on their experience in the persuasion stage (Kaminski, 2011; Sabus & Spake, 2016). There can be three types of resultant decisions: adoption, active-rejection, or passive-rejection (Sahin, 2006). In the active-rejection decision, an individual first adopts the innovation to try it out and then rejects it after some time. Passive-rejection is when the individual decides to reject the innovation without giving it a try (Lai, 2017; Sahin, 2006). The fourth stage of DOI theory is the implementation stage, in which the innovation is operationalised (Kaminski, 2011; Rogers, 2010). The final phase under DOI theory is the confirmation stage, in which individuals seek support for their decision to adopt the innovation (Sabus & Spake, 2016; Sahin, 2006).

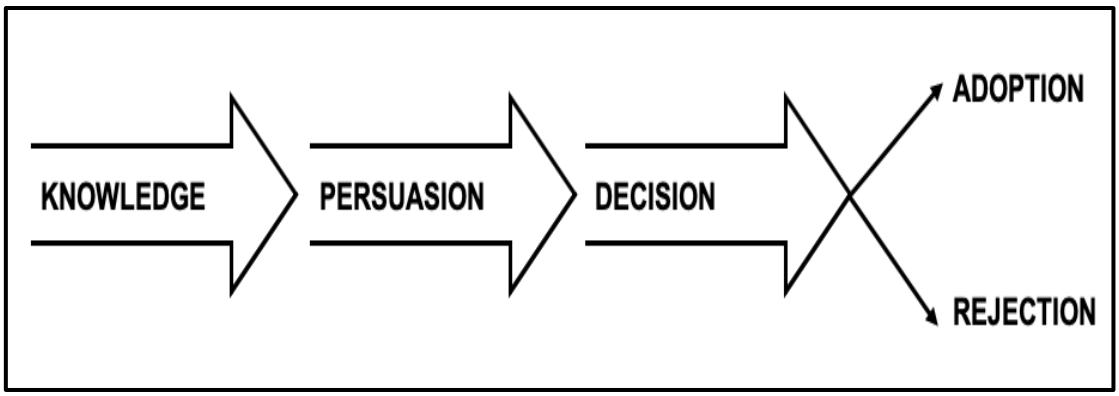


**Figure 3.5: Process of Diffusion of Innovation**
**Adapted from Rogers, 2003 (Sahin, 2006)**

Regarding this study, introductory knowledge about the use of mobile phones to receive healthcare education and awareness of chronic diseases was provided to the study population. Individuals were sensitised to the utility, and potential benefits of receiving healthcare information. During the persuasion stage, the study examined how the rural Kenyan population gained an informed understanding of the innovation (mobile phones), depending on the perceived attributes of the innovation in terms of

its usefulness, ease of use, and reliability, in the presence of social influence from the family, friends, community leaders, religious leaders, and their associated cultural beliefs. After the persuasion stage, individuals were ready to make an informed decision to adopt mobile phones to receive healthcare education and awareness of chronic diseases in the long term, or to adopt them for a short while and then reject their use or, in the worst-case scenario, refuse to try and reject them at the onset. In the implementation stage, individuals who adopted mobile phones could request training and extra skills to fully utilise the innovation. While this study endeavoured to gather the perceptions of the rural Kenyan population on acceptance of mobile phones, it also assessed their knowledge, skills, practices, and self-efficacy to understand the level at which additional assistance in terms of training would be necessary upon viable adoption. The final stage of diffusion of innovation is when mobile phone adopters seek substantiation for their decision. Thus, in light of this study's principal aim of assessing the factors that would lead to a sustainable use of mobile phones for health literacy, the influence of features like their durability, relative advantage or usefulness, ease of use, absence of superior innovation, and absence of negative social influence were included as valuable elements to be tested.

Several researchers have applied DOI theory successfully to test the characteristics of innovation through different stages and then to explain the level of its adoption based on the contributing factors of DOI: family- and community-level health interventions (Bhattacharya & Singh, 2019), online patient portals (Emani et al., 2018), electronic health record alerts across multiple primary-care clinics (Lin et al., 2016a), and the factors influencing patient acceptance and the use of consumer e-health innovations (Zhang et al., 2015). The diverse applications of the DOI theory demonstrated its strengths as a single model that could predict the adoption of diverse types of innovations by different kinds of individuals and in different contexts. This strength of DOI theory therefore, contributed credence in investigating mobile phone adoption by individuals in rural Kenya in line with the study objectives which were to explore the stimulus provided by individual, social, and technology-based elements for a sustainable adoption of mHealth.

Some authors, however, have identified several drawbacks to DOI theory (Bhattacharya & Singh, 2019; Lin et al., 2016a; McMullen et al., 2015; Min et al., 2019).

For example, McMullen and others (2015) suggested that DOI theory lacked the aspect of incorporating the effect of individual's resources, individual cognition and external motivation factors to comprehensively explain the process of adopting an innovation that does not depend solely on the characteristics of the innovation (McMullen et al., 2015). The context of the organisational or community setting affects how an innovation is adopted (Lin et al., 2016a). Also, Min and others (2019) noticed that individual demographic factors and readiness to use an innovation came into play when evaluating the rate of adoption of an innovation. Another angle presented by Min and others (2019) included studying the various barriers to adopting an innovation that might help better explain individual adoption behaviours. According to Bhattacharya and Singh (2019), people resist change; it therefore, adds to the explanation of their adoption behaviour of an innovation. One way to promote adoption would be to introduce demand-centric innovations rather than supplier-centric ones (Bhattacharya & Singh, 2019). This study, therefore, endeavoured to consider these limitations and to explore their effect on the rural Kenyan population with regard to using mobile phones for health literacy on chronic diseases in terms of the following factors as recommended by the above critique: individual's resources, individual cognition, external motivation factors, the context of the community setting, individual barriers to adoption, and individuals' nature to resist change, and finally, to suggest that innovations should be consumer-centric rather than supplier-centric. Such factors were considered by the earlier theories studied in the previous sections of this chapter and were utilized to be tested by this enquiry. Therefore, building on the strengths of the SNT and the SCT, and considering the contributing characteristics of an innovation (mobile phone SMS) as impressed upon by the DOI, this enquiry went ahead to study yet more theories in order to consolidate an understanding of the elements that would result in a sustainable use of mHealth by the study population. The next in line to be studied was the theory of reasoned action.

## 3.5 THEORY OF REASONED ACTION

The Theory of Reasoned Action (TRA) was a theoretical lens used in this research to understand the individual and social factors that influenced an individual's change in behaviour regarding the use of mobile phones to acquire health education and raise awareness on chronic diseases in rural Kenya.

This theory was advanced by Ajzen and Fishbein (1975), who found that an individual's behaviour is determined by their behavioural intention to perform the action, where behavioural intention is determined jointly by the person's attitude and subjective norms concerning the behaviour in question (Buabeng-Andoh et al., 2019; Hosseini et al., 2015; Nguyen et al., 2018). Figure 3.6 is a pictorial representation of the TRA. Attitude is defined as an individual's positive or negative feelings about a given behaviour (Ajzen & Fishbein, 1975; Nguyen et al., 2018) and is determined by the individual's behavioural beliefs about the outcome and evaluations of those behavioural outcomes. Subjective norms are an individual's perception of their significant others' approval or disapproval of a given behaviour (Ajzen & Fishbein, 1975; Hosseini et al., 2015). The theory further states that individuals' decisions are often influenced by other people – their likes, dislikes and their choices of a certain behaviour (Glanz et al., 2008). Behavioural intention refers to an individual's motivation or willingness to exert an effort to perform the target behaviour (Ajzen & Fishbein, 1975; Buabeng-Andoh et al., 2019).

This study examined the extent to which rural Kenyan's behavioural intention to use mobile phones would be guided by their positive or negative attitudes towards its use, along with their perception of whether their significant others, be they family, friends or community members, would approve or disapprove of using them to receive health literacy information.

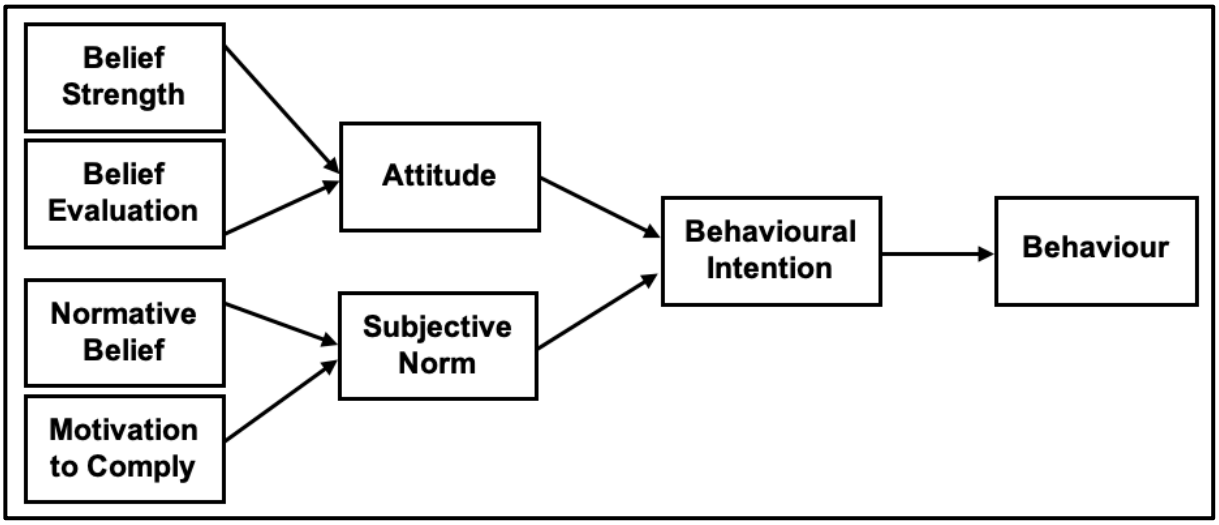


**Figure 3.6: Theory of Reasoned Action**
**Source: Ajzen & Fishbein (1975)**

The TRA has been employed to explain dietary as well as general behaviours by various authors, who found a varying degree of influence of attitude and subjective norms on behavioural intention (Biasini et al., 2021; Caputo, 2020; Dewi & Zein, 2017; Esmaeili et al., 2016; Shwetha et al., 2017). This proves the extent of scope and falsification as strengths of the TRA. The theory's strength also lies in it being parsimonious, as it provides a simple explanation of behavioural intention as a result of only two variables, namely attitude and subjective norms (Asnawi et al., 2020). This study thus learnt, and further evaluated the significance of attitude and subjective norms in the perceived intention to use mobile phones for receiving education and awareness of chronic diseases by individuals in rural Kenya.

Several researchers have acknowledged its strengths, notwithstanding some of the limitations of TRA, and consequently this study highlighted at least five possible improvements to the theory (Dewi & Zein, 2017; Dippel et al., 2017; Hosseini et al., 2015; Lorenzo-Blanco et al., 2016; Otieno et al., 2016), as explained below.

Firstly, Otieno and others (2016) propose a need to incorporate some direct and indirect determinants of behaviour, such as facilitating conditions and user readiness towards behaviour change. Awareness of innovation, social pressure and user readiness for the technology together would make the TRA better in guiding a change in behaviour towards the acceptance of technology (Otieno et al., 2016). Some of these elements were discussed in the theories studied in the previous sections.

The second drawback of the TRA is suggested by Dippel and others (2017), who express the need to include additional variables, for instance knowledge, beliefs, historical experiences and cultural connectedness, when understanding behaviour. This study assumed that adoption of mobile phones would be facilitated by a lack of and the need for healthcare knowledge about chronic diseases, and the positive past experiences and skills of rural Kenyans in using mobile phones.

The third limitation was observed by Zhang and others (2014), who established that the intention to adopt mHealth is influenced by gender, which suggests it to be a moderating factor previously not included in the TRA. The authors also highlighted that both attitude and subjective norms had a negative and non-linear effect, whereas the TRA originally presumed a linear relationship (Zhang et al., 2014). This study further subsumed testing of inter-variable influence of the constructs in the proposed

research model. The study also considered age, gender, socio-economic level, and language literacy as moderators of behaviour change; in this case, the use of mobile phones to receive education and awareness of chronic diseases.

The fourth shortcoming of the TRA was highlighted as the assumption that human behaviour is always volitional, with individuals having complete control over their behaviour, and that behavioural intention would necessarily be backed by reasoning, leading to a given behaviour (Al-Mamary et al., 2016). This has been refuted by several studies (Dippel et al., 2017; Esmaeili et al., 2016; Lorenzo-Blanco et al., 2016), in which certain types of behaviour, such as smoking, unhealthy eating habits, risky sex habits and the like, do not necessarily follow reasoning but are seen to be a result of peer pressure and community norms. In the light of the above limitation, this study acknowledged long-term habits, unhealthy lifestyles, and risky behaviour as a collective consequence of attitudes, social norms, and pressure from friends, family, community, and opinion leaders, by including social influence as one of the constructs.

The fifth weakness of the TRA has been pointed out by other authors, who have suggested that a big change in behavioural intention does not necessarily bring about a larger change in behaviour; the magnitude of influence of behavioural intention on behaviour is not defined in the TRA (Nguyen et al., 2018). This study assessed both the direction and the magnitude of influence of behavioural intention on the final behaviour, namely the use of mobile phones in rural Kenya.

Owing to some of the weaknesses of the TRA presented by the existing literature, this enquiry further proceeded to study the theory of planned behaviour.

### 3.6 THEORY OF PLANNED BEHAVIOUR

The Theory of Planned Behaviour (TPB), as propounded by Ajzen (1991), guided this study in understanding and explaining the individual and social factors that could lead to behaviour change, which in the case of this enquiry was the use of mobile phones to receive healthcare education and awareness of chronic diseases in rural Kenya (Ajzen, 1991).

The TPB (Ajzen, 1991) is an extension of the TRA (Ajzen & Fishbein, 1975). Whereas TRA explains several behaviours that are volitional or under an individual's control, the TPB, on the other hand, accounts for behaviours that are both volitional and non-

volitional (Ajzen, 1991). Figure 3.7 depicts the theory in the form of a structural diagram. The TPB posits that behavioural intention, which is an individual's motivation or willingness to exert effort to perform the target behaviour (Ajzen & Fishbein, 1975), is not a sufficient predictor of the actual behaviour, thus leading to the introduction of an additional construct, called perceived behavioural control (PBC) (Ajzen, 1991; Nguyen et al., 2018) which is an individual's perception of ease or difficulty of performing a given behaviour (McDermott et al., 2015). Regarding this study, it was assumed that, in the light of TPB, individuals' choice to use mobile phones for education and awareness of chronic diseases would not depend solely on their behavioural intention, but also on their perceived ease of using the mobile phones.

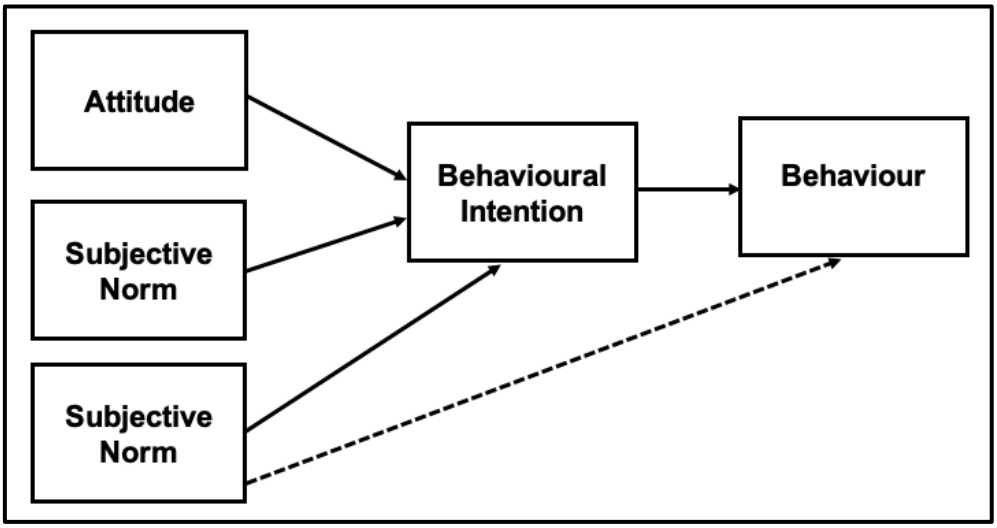


**Figure 3.7: Theory of Planned Behaviour**
**Source: Ajzen (1991)**

The TPB, as discussed by Ajzen (2015), postulates that human behaviour is dependent on three fundamental factors – behavioural beliefs (attitude towards behaviour), normative beliefs (subjective norms), and control beliefs (perceived behavioural control). Attitude is defined as an individual's positive or negative feelings about performing a given behaviour (Ajzen & Fishbein, 1975; Nguyen et al., 2018) and is determined by the individual's behavioural beliefs about the outcome, and evaluations of those behavioural outcomes (Chung & Fong, 2015). Using the rural Kenyan population as a case study, this research explored if an individual's preference (attitude) to use or not to use mobile phones was informed by their perception and assessment of the resultant outcome.

Subjective norms are an individual's perception of their significant others' approval or disapproval of a given behaviour (Ajzen & Fishbein, 1975; Hosseini et al., 2015). This research tested the validity of the assumption that, if individuals believed that their peers, family, friends, community or other opinion leaders approved of their use of a mobile phone, they would exhibit a positive behavioural intention towards it.

Perceived behavioural control represents an individual's perceptions of ease or difficulty in acting towards a given behaviour (McDermott et al., 2015). As such, perceived behavioural control is a collective influence of self-efficacy and controllability. Self-efficacy is explained by the difficulty perceived in performing a particular behaviour and the ability of an individual to surmount the challenges (Bandura, 1989), while controllability is a combination of external factors which individuals believe they have the ability to influence (Ajzen, 2002). The aspect of perceived behavioural control is critical to understanding the application of the TPB and is based on observed human behaviour. Consequently, individuals who have a high degree of perceived control over their behaviour demonstrate a high level of confidence in adopting the corresponding behaviour (Ajzen, 2002; McDermott et al., 2015). Therefore, the perceived degree of effort required of individuals to utilise the mobile phone while overcoming the perceived barriers for receiving education and awareness of chronic diseases would shape their behavioural intention and, ultimately, their behaviour towards its use, as later analysed in this research.

Various researchers (Abamecha et al., 2019; Caputo, 2020; Chung & Fong, 2015; Lash et al., 2016; McDermott et al., 2015; Menozzi et al., 2015; Shruthi et al., 2019) have used the TPB to understand and support human behaviour in different scenarios and observed varying degrees of influence of attitude, subjective norms and perceived behavioural control on behavioural intention, which then leads to the resultant behaviour. The strengths of the TPB are well demonstrated by the parsimony of its simple structure, testability in different disciplines, and falsifiability in miscellaneous behavioural changes (Abamecha et al., 2019; Chung & Fong, 2015; Lash et al., 2016; McDermott et al., 2015; Menozzi et al., 2015; Shruthi et al., 2019). In the light of TPB's strengths, this study applied the constructs of this theory, namely attitude, subjective norms and perceived behavioural control, to understand the perceived intention to use

and the actual use of mobile phones by individuals in rural Kenya for receiving education and awareness of chronic diseases.

Certain limitations have also been noticed in the TPB when explaining behaviour, six of which are discussed here. The first drawback of the TPB is highlighted by Lash and others (2016), who found that, although the TPB was instrumental in explaining dietary intention, it failed to account for prolonged dietary behaviour among the participants. Regarding this study, individuals who would accept mobile phones for receiving education and awareness of chronic diseases may need to continue to maintain the behaviour change for long, for sustainability of the intervention. Therefore, other theories and models that suggested long-term behaviour change furthermore, need to be considered.

Secondly, Lash and others (2016) pointed out that there could be an indirect effect of the respondents' demographic factors (age, gender and race) and environmental influences on their dietary behaviour (Lash et al., 2016). Owing to the technology aspect of behaviour change in this study which endeavoured to meet the objectives of explaining a sustainable use of mobile phones for health literacy, certain moderating demographic characteristics of individuals, such as their age, gender, socio-economic status, and literacy levels were included to analyse the perceived use of mobile phones by individuals in rural Kenya.

Presenting a third weakness of the TPB, Chung and Fong (2015) confirmed that, although the TPB was successful in establishing the connection between its variables and weight loss, the performance of behaviour was subjective, owing to the perception of an individual, and this may not provide the degree of influence of the determinant constructs. In the light of this observation, this enquiry aimed to assess the factors that lead to individuals' perceptions of their use of mobile phones for healthcare education and awareness of chronic diseases, which points to the position that the perceived behaviour change could be subjective.

The fourth shortcoming of the TPB was pointed out by Rich et al. (2015), who concluded that TPB could be applied to predict adherence to medicine by patients with chronic illnesses. However, the behaviour was also influenced by factors beyond the patient's control, including social and economic factors. In this study, factors such as SI and the economic status of individuals were considered to be significant and thus,

included when assessing and explaining the influence of TPB factors on behaviour towards mobile phones use.

The fifth downside of the TPB is that it assumes behaviour to result from a linear decision-making process, and does not consider that it can change over time (Sulaiman et al., 2019). This research observed that, although individuals in rural Kenya may start to use mobile phones for receiving healthcare education and awareness, they might fall back on their behaviour after some time due to unidentified reasons. It was therefore, paramount to understand the various influencing factors that would bring about a long-term sustainable use of mobile phones.

The sixth disadvantage of the TPB as postulated by Gomes and others (2018) was that a positive attitude to physical activity may lead to an intention to exercise, but may not necessarily translate into actual exercise (Gomes et al., 2018). The intention of the study participants to use mobile phones may not therefore, lead to their actual use. Learning from the above criticism, one can infer that the TPB is not entirely capable of describing long-term behaviour change. As this study aimed to understand the factors that would result in a sustainable long-term use of mobile phones for health literacy, elements from the theories previously studied needed to be augmented by yet other models of technology acceptance as evaluated in the subsequent sections.

## 3.7 TECHNOLOGY ACCEPTANCE MODEL

The Technology Acceptance Model (TAM), proposed by Davis (1989), was an underpinning conceptual lens that was applied in this study to understand and describe the individual, social, and technological factors that would shape an individual's behaviour in regard to using mobile phones for receiving education and awareness of chronic diseases.

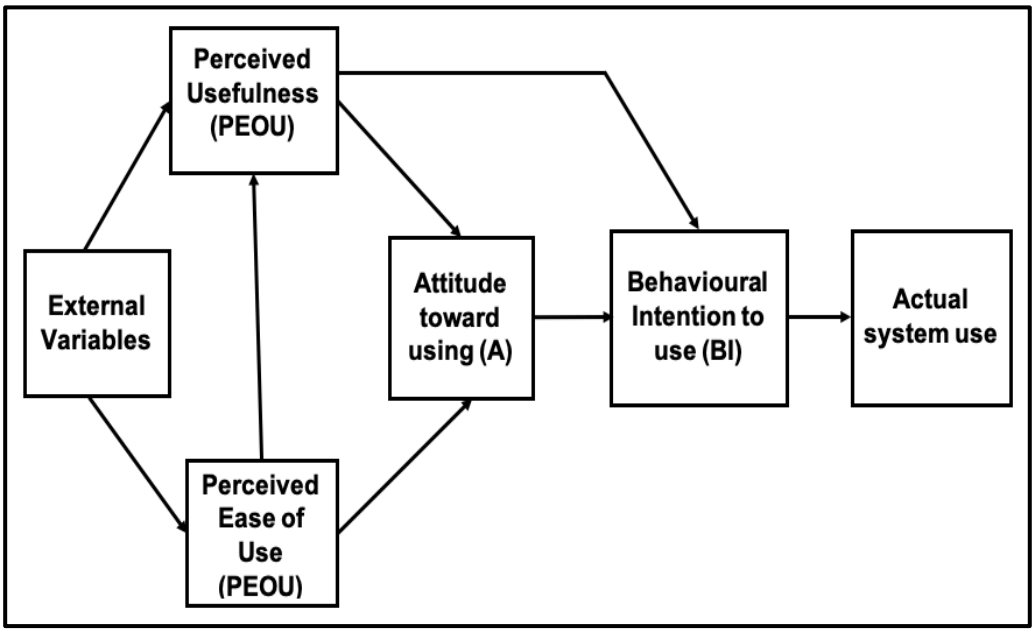


**Figure 3.8: Technology Acceptance Model**
**Source: Davis et al. (1989)**

Whereas the TRA had been used widely to explain diverse behaviours, Davis (1989) extended TRA into the TAM by adding two major constructs namely, perceived ease of use and perceived usefulness, that he believed together influenced an individual's attitude specifically to using an information technology system (Davis, 1989). This is illustrated here in Figure 3.8 above.

Perceived ease of use refers to the degree to which a person believes that using a particular system would be free from effort (Bamigbola & Adetimirin, 2020; Davis et al., 1989). Regarding this study, perceived ease of use would be the perception by an individual of the simplicity with which mobile phones may be used to receive education and awareness on chronic diseases. Perceived usefulness relates to the extent to which individuals believe that using a particular system would enhance their job performance (Davis et al., 1989; Klopping & McKinney, 2004) which could be termed as the suitability of mobile phones for the individuals when receiving health literacy on chronic diseases. Attitude refers to an individual's positive or negative evaluation and beliefs about specific behaviour (Ajzen & Fishbein, 1975; Falode, 2018). In this study, individuals' attitudes are their apparent views about the using mobile phones to receive education and awareness of chronic diseases. Behavioural intention describes an individual's motivation or willingness to exert effort to perform the target behaviour (Ajzen & Fishbein, 1975; Suki & Suki, 2017). Behavioural intention would refer to individual impetus towards adopting mobile phones to receive education and

awareness of chronic diseases. In 1989, Davis and others tested the TAM to measure individuals' intention to use a computer system and discovered that both Perceived usefulness and perceived ease of use had a direct influence on behavioural intention, thus the construct attitude towards using (a system) was removed (Davis et al., 1989). The resultant model is represented in Figure 3.9 below.

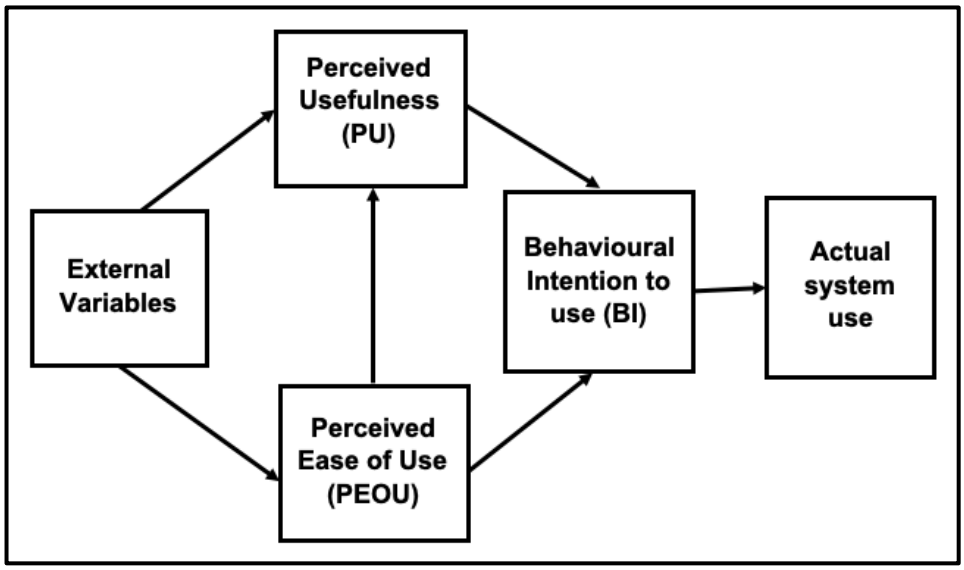


**Figure 3.9: Technology Acceptance Model Revised**
**Source: Davis et al. (1989)**

Consequently, this enquiry evaluated the influence of the perceived ease of use, perceived usefulness, and behavioural intention to use mHealth technology of the rural Kenyan population on sustainable mobile phone use for health literacy.

Venkatesh and Davis (2000) further enhanced the revised TAM to the TAM2 by including another construct, called subjective norms, which was adopted from TRA. Subjective norms are an individual's perceptions of the approval or disapproval of their significant others regarding a given behaviour (Ajzen & Fishbein, 1975). In TAM2, the intention to use technology is shown as a result of perceived usefulness, perceived ease of use and subjective norms, rather than the attitude towards using the system (Venkatesh & Davis, 2000). Figure 3.10 below represents the TAM2.

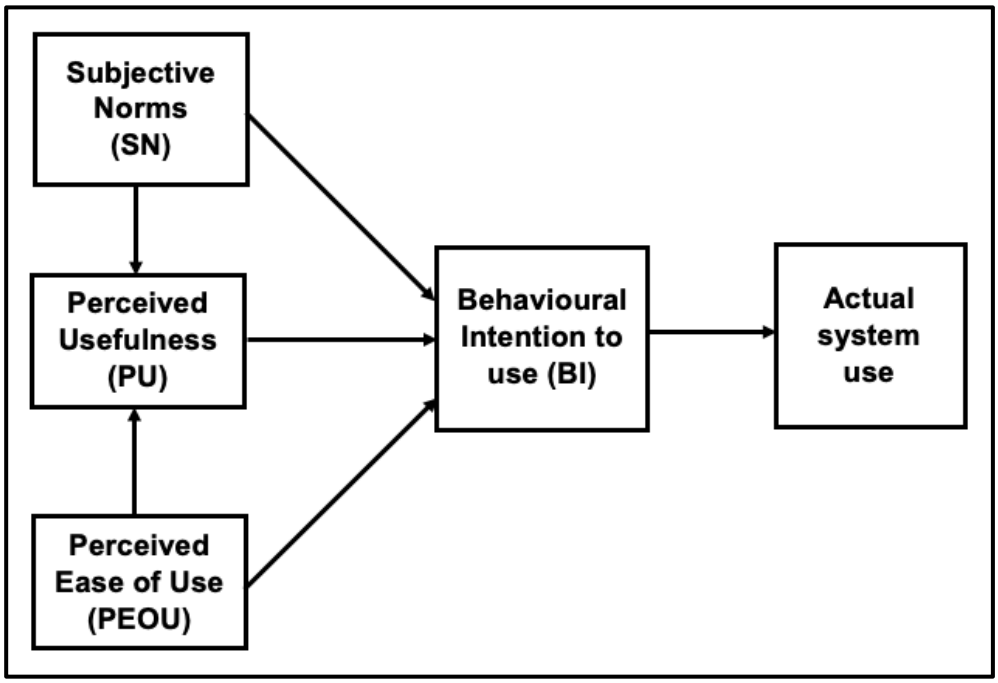


**Figure 3.10: Enhanced Technology Acceptance Model (TAM2)**
**Source: Venkatesh and Davis (2000)**

Various researchers have used the TAM extensively in understanding peoples' behavioural intentions towards the use of diverse information systems (Ehteshami, 2017; Holden et al., 2016; Hsiao & Chen, 2016; Lin et al., 2016b; Portz et al., 2019; Rönnby et al., 2018). Both the perceived usefulness of a given technology and its perceived ease of use have been instrumental in explaining its use and acceptance in several studies: nurses' intentions to use intensive care unit technology (Holden et al., 2016); the acceptance of wearable instrumented vests among the elderly (Lin et al., 2016b); patients' intention to use patient portals (Hsiao and Chen, 2016); users' intentions to accept barcode technology in academic hospitals (Ehteshami, 2017); long-term use of mHealth self-report monitoring among long-distance runners (Rönnby et al., 2018); and also users' intention to use a patient portal (Portz et al., 2019).

The TAM has been found to be a robust, powerful, and fitting model for predicting user acceptance of information technologies (Ehteshami, 2017; Holden et al., 2016; Hsiao & Chen, 2016; Lin et al., 2016b; Portz et al., 2019; Rönnby et al., 2018; Venkatesh & Davis, 2000). Despite its simplicity, the model performs reasonably well in predicting the use and adoption of technology, including telemedicine. This study considered the TAM constructs perceived use, perceived ease of use, and subjective norms as fundamental in understanding and expounding on the acceptance of mobile phones

for receiving education and awareness of chronic diseases by the rural Kenyan population.

It is worth noting that, although the TAM has successfully explained technology acceptance and its use, it does demonstrate some drawbacks in understanding health-specific behaviour therefore, certain additional factors needed to be considered to make the theoretical framework more comprehensive (Ehteshami, 2017; Holden et al., 2016; Hsiao & Chen, 2016; Lin et al., 2016b; Portz et al., 2019; Rönnby et al., 2018; Venkatesh & Davis, 2000). Holden and others (2016) suggest the need to include learnability and navigability in the list of variables to understand the relationship between perceived ease of use and intensive care unit technology use. Portz and others (2019) acknowledged the influence of external variables, such as computer self-efficacy and anxiety, on patients' intention to use the online portal. Hsiao and Chen (2016) suggest the need to include human factors (technology anxiety) and environment factors (organisational culture) when introducing new technology to individuals. Moderators such as age and gender have been suggested to influence users' behaviour when using a given technology (Davis et al., 2015; Venkatesh et al., 2003). In the light of the above critique, this study employed the key constructs of the TAM, namely perceived usefulness, perceived ease of use, and subjective norms, while also engaging additional factors such as age, gender, language literacy, socio-economic status and past experience with mobile phone usage.

After evaluating TAM, the next model that is the UTAUT model needed to be evaluated as the authors of this model claimed to have developed it as a unified model from an amalgamation of several theories of technology adoption suggested earlier.

## 3.8 UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY

The Unified Theory of Acceptance and Use of Technology (UTAUT), which was founded by Venkatesh and others (2003) is an integrated model of ICT adoption that resulted after combining eight of the existing theories. UTAUT offers a theoretical lens to identify and analyse the individual, social, and technological factors that guide the individuals of rural Kenya in the use of mobile phones for receiving education and awareness of chronic diseases.

The UTAUT, as illustrated in Figure 3.11 below, is a model that focuses on the acceptance of technology in the workplace and consists of the fundamental pillars that influence behavioural intention, namely performance expectancy, effort expectancy, social influence and facilitating conditions (Dwivedi et al., 2019; Venkatesh et al., 2003). Facilitating conditions and behavioural intention have a direct effect on the resultant behaviour (Madigan et al., 2017; Venkatesh et al., 2003). Gender, age, experience, and voluntariness of system use are provided as moderators for all the above constructs (Venkatesh et al., 2003; Yuan et al., 2015).

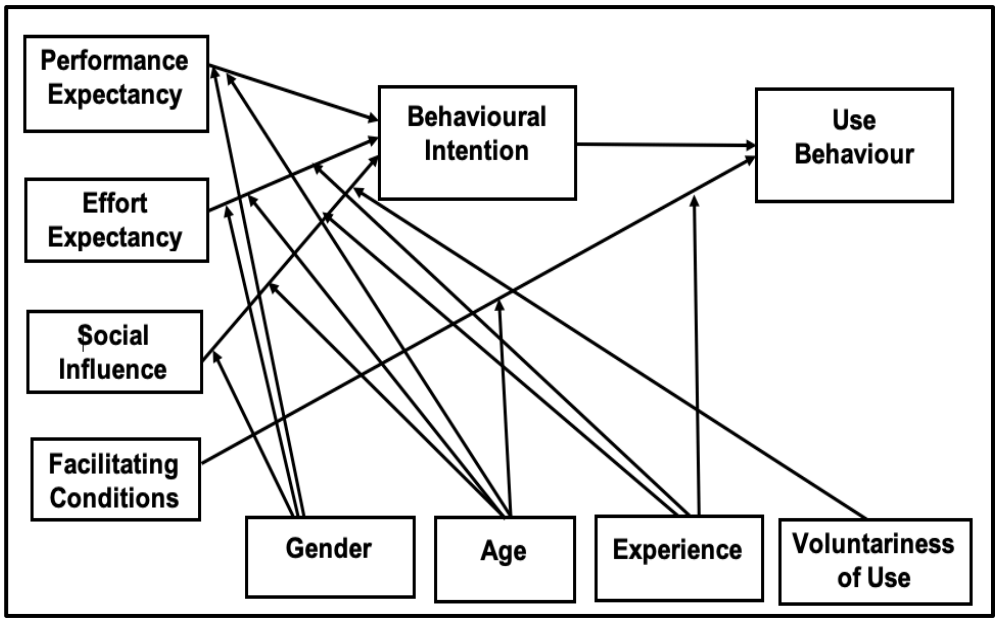


**Figure 3.11: Unified Theory of Acceptance and Use of Technology**
**Source: Venkatesh et al. (2003)**

Behavioural intention is a critical predictor of technology use and is defined as an individual's motivation or willingness to exert effort to perform the target behaviour (Ajzen & Fishbein, 1975; Venkatesh et al., 2003). Performance expectancy refers to the degree to which the usage of a certain technology would provide the desired benefits to the consumer of the technology and was adopted from variables used in other theories and models, such as perceived usefulness from the technology adoption model, relative advantage from DOI, and outcome expectancies from SCT (Yuan et al., 2015). Being the strongest influencer of behavioural intention, performance expectancy is moderated by age and gender (Chang, 2012; Dwivedi et al., 2019; Venkatesh et al., 2003). This study investigated the extent to which an individual's intention to use mobile phones for receiving education and awareness of

chronic diseases in rural Kenya would be influenced by the performance expectancy of mobile phones, and moderated by the age and gender of the individuals.

Effort expectancy is defined as the level of ease attributed to using a particular system or technology and was derived from the perceived ease of use in the technology adoption model (Dwivedi et al., 2019; Venkatesh et al., 2003). The effect of effort expectancy on users' behavioural intention is moderated by age, gender, and experience (Chang, 2012; Dwivedi et al., 2019; Venkatesh et al., 2003). Effort expectancy was one of the principal factors taken into consideration in this enquiry to assess the intention to use mobile phones for health literacy on chronic diseases.

Social influence is the level of importance that individuals attach to what others think about using the system (Chang, 2012; Venkatesh et al., 2003). The construct, social influence, was adopted from the subjective norms of TRA, TPB and TAM (Chang, 2012; Dwivedi et al., 2019; Venkatesh et al., 2003). The effect of social influence on user behavioural intention is moderated by four mediating factors: age, gender, experience, and voluntariness (Chang, 2012; Dwivedi et al., 2019; Venkatesh et al., 2003). Regarding this study, it was tested if the perceived intention to use mHealth was governed by the likes and dislikes, as well as approval or disapproval, of significant peers. This social influence was further mediated by the age, gender, experience of mobile technology, and choice of the individual to use a mobile phone.

Venkatesh and others (2003) defined facilitating conditions as the level of belief an individual had in their skill and as the availability of technical and infrastructural support to aid in using the system in question. It is an extrapolation of the perceived behavioural control derived from the TPB. Facilitating conditions do not influence behavioural intention, but rather affect the behaviour directly, and are moderated by age and experience (Chang, 2012; Dwivedi et al., 2019; Venkatesh et al., 2003). This study advanced the idea that, for rural Kenyan individuals to use mobile phones for health literacy, they needed to feel confident in using the technology and be convinced that the technical support and necessary infrastructure would be available to facilitate their use. Individuals' age and experience in using mobile phones determined their perceived acceptance of their phone usage.

UTAUT has been used in various contexts to evaluate behavioural intention and user behaviour towards the adoption of technology. While most of the studies have been

consistent with the original UTAUT proposed by Venkatesh and others (2003), certain relationships have been proposed to be insignificant (Chang, 2012; Dwivedi et al., 2019). The direct influence of facilitating conditions on behavioural intention was found to be significant by most researchers. However, this is in contravention to the original UTAUT, in which Venkatesh and others (2003) suggested that the FC had an influence on behaviour rather than on behavioural intention (Chang, 2012; Dwivedi et al., 2019). This study assessed the effect of facilitating conditions to confirm if they influenced the intention to use or the mobile phones' actual use.

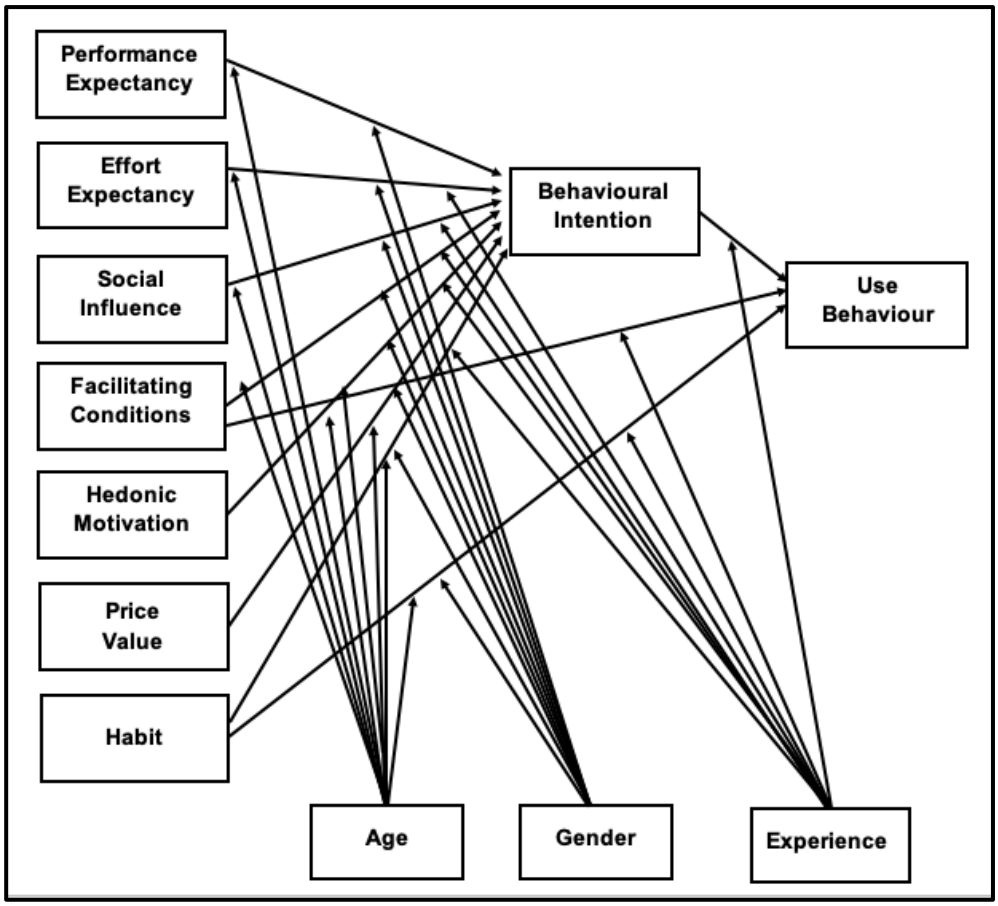


**Figure 3.12: Unified Theory of Acceptance and Use of Technology 2**
**Source: Venkatesh et al. (2012)**

The absence of factors like hedonic motivation, price value, and habit in the original UTAUT led to the development of the UTAUT2 as shown in Figure 3.12 above (Venkatesh et al., 2012), which incorporated the three additional constructs (Dwivedi et al., 2019; Yuan et al., 2015). It was meant to mitigate the omission of certain important relationships, improve the quality of the theory constructs, and eradicate insignificant relationships in the theory (Chang, 2012; Dwivedi et al., 2019). Venkatesh and others (2012) defined hedonic motivation as the pleasure an individual derives

from using a given system or technology. The aspect of enjoying and having fun has been established to be a significant predictor of intention to accept and adopt technology (Yuan et al., 2015).

The price value was an extrapolation of the concept of product value (Venkatesh et al., 2012) – whereby a consumer is attracted to a product that offers value for money (Dwivedi et al., 2019; Yuan et al., 2015). The price value is the trade-off between the user's psychological perceptions of the perceived benefits and the costs attributed to using the system, and directly influences behavioural intention (Dwivedi et al., 2019; Yuan et al., 2015). Habit is defined as an individual's self-reported perception of repeatedly engaging in a specific behaviour (Dwivedi et al., 2019; Venkatesh et al., 2012; Yuan et al., 2015). This construct was established to be a significant predictor of the use and adoption of information technology, while being moderated by experience (Dwivedi et al., 2019; Yuan et al., 2015). In this study, the use of mobile phones was to receive healthcare education and not for pleasure. The text messages sent to the users would be free of charge. Hence, price was not a factor to be considered. Habit or long-term sustainable use of mobile phones for receiving healthcare education would be considered important.

Both the UTAUT and the UTAUT2 have been used in several studies to understand individuals' behavioural intention to use and the actual use of information technology. However, several authors have found divergent levels of influence of the constructs (Alshehri et al., 2019; Jakkaew & Hemrungrote, 2017; Padhi, 2018; Raza et al., 2019; Yuan et al., 2015). Performance expectancy was reported to be positively correlated with behavioural intention to use a given technology: by Alshehri and others (2019) in relation to learning management systems; Raza and others (2019) for mobile banking; Padhi (2018) for open education resources in India; Jakkaew and Hemrungrote (2017) in the use of Google Classrooms; and Yuan and others (2015) in relation to health and fitness applications. The influence of performance expectancy as a significant contributor to the use of mobile phones was tested in this study, along with its mediators – age and the gender of the individual.

Social influence was not always significant in influencing users' intentions to use the technology (Padhi, 2018; Raza et al., 2019), while facilitating conditions also did not always have an influence (Alshehri et al., 2019; Padhi, 2018). In this study, social

influence was tested as a predictor of mobile phones' perceived use by the rural Kenyan population. An inadequate healthcare system and limited access to power supply and network coverage were the facilitating conditions that were tested in this study.

Effort expectancy has been found not to influence the users' choice in some cases, such as when using a learning management system (Alshehri et al., 2019). This study evaluated the significance of perceived ease of using mobile phones to receive education and awareness of chronic diseases and its mediators: the age, gender, and experience of individuals in rural Kenya.

The UTAUT and the UTAUT2 have managed to explain up to 70% of intention to use a given technology, making it a robust theory that demonstrates stability, validity and viability in user acceptance of technology (Venkatesh et al., 2003). One of its strengths is its applicability in diverse scenarios (Madigan et al., 2017). It has been shown to outperform the other models used previously to explain behavioural intention to use information technology (Lim et al., 2019).

Having studied the progression of all the seven behaviour change theories and models starting with the SNT in section 3.2 to UTAUT in section 3.8, it was concluded that UTAUT was a model that had integrated most if not all, of the elements that were postulated by the earlier theories and models as significant to explain behaviour change in adoption of mHealth for education from the various contexts of individual, social, and technology perspectives. Therefore, hypothetically the primary constructs that would inform the adoption of mHealth for health literacy on chronic diseases in rural Kenya from the individual, social, and technology contexts would be performance expectancy (perceived usefulness), effort expectancy (perceived ease of use), social influence, and behavioural intention. The moderating factors thus far seemed to be age, gender, and the experience of the study participants. To meet the aim of this enquiry which was to study the contributing factors towards the development of an all-inclusive model of mobile phone adoption for education and awareness of chronic diseases, certain theories and models from the health context also needed to be studied. Two of the deliberated theoretical lenses were the health action process approach and the health belief model. Section 3.9 below expounds upon the health

action process approach, followed by the health belief model as evaluated in section 3.10 below.

### 3.9 HEALTH ACTION PROCESS APPROACH

The Health Action Process Approach (HAPA) (Schwarzer et al., 2003), which was developed by Ralf Schwarzer , was applied in this study as a theoretical lens to understand the influence of individual and health factors on the use of mobile phones in gaining education and raising awareness of chronic diseases in rural Kenya. According to HAPA, the adoption, commencement, and sustainability of health behaviours are conceived as a process that entails two phases: the motivation phase and the volition phase (Schwarzer et al., 2003). The motivation phase is a process in which individuals develop an intention to either adopt a safety measure or alter risk behaviour to initiate healthy behaviours. On the other hand, volition sees individuals turn their intentions into actual behaviour (Schwarzer et al., 2003). The HAPA approach is presented graphically in Figure 3.13 below. In the light of these two phases, this study investigated the factors that mould individuals' perceptions of forming the intention to either accept or reject the use of mobile phones to receive healthcare education and awareness for better health outcomes in the motivational phase, followed by converting the positive intention into the actual usage of mobile phones in the volition phase.

The HAPA motivational phase constitutes three contributing elements, risk perception, outcome expectancies, and perceived self-efficacy, which lead to intention (Schwarzer et al., 2003). Risk perception in the HAPA refers to individuals' beliefs that there is a possibility of a health threat (Schwarzer et al., 2003). Outcome expectancies under the HAPA are the anticipated consequences that individuals believe in achieving if the intended behaviour is undertaken (Bandura, 1989; Schwarzer et al., 2003).

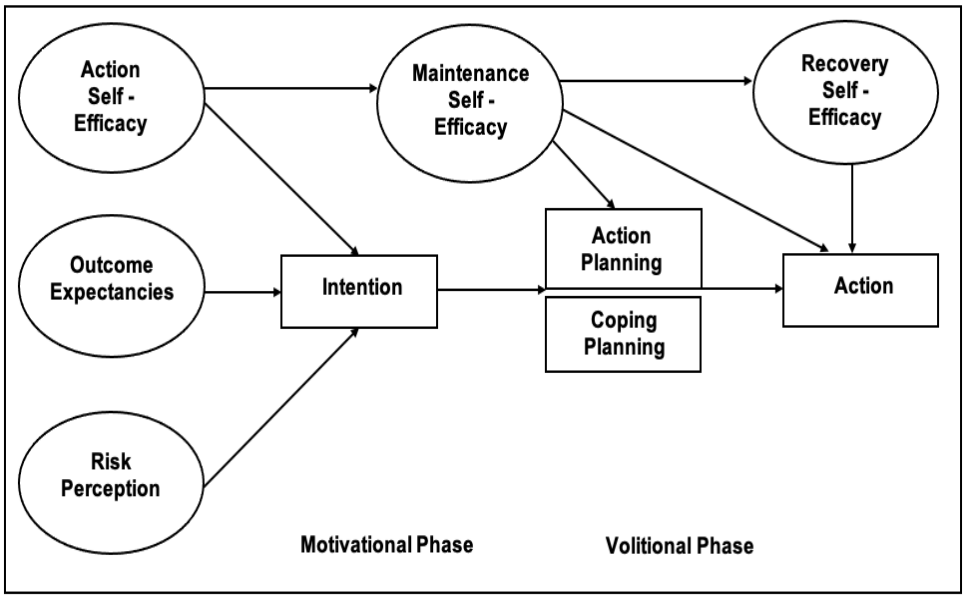


**Figure 3.13: HAPA Model**
**Adapted from Schwarzer et al. (2003)**

Perceived self-efficacy in the HAPA represents an individual's conviction of confidence in their ability to perform a recommended action (Bandura, 1989). The HAPA established a causal order, in which outcome expectancies are antecedents of self-efficacy, as individuals often make assumptions about the likely implication of behaviours before considering if they can act (Schwarzer, 2011, 2016). Concerning this study, the motivational phase under the HAPA was useful in analysing how individuals demonstrated an intention to use mobile phones to receive education and awareness when they recognised a health threat posed by chronic diseases, and believed that they had skills to carry out a lifestyle change that would lead to better health outcomes.

Zhang and others (2019) observe that the HAPA volition stage comprises action planning and coping planning, which together lead to the actual action. Action planning is a collection of action cues, such as when, where, and how to apply maintenance self-efficacy to convert intention into action, whereas coping planning constitutes recovery self-efficacy to remain on the course of an intention-to-action path (Schwarzer, 2011; Zhang et al., 2019). Therefore, the HAPA postulates three types of self-efficacies involved between the intention stage and the action stage: action, maintenance, and recovery self-efficacy. For this study's purposes, assumptions in this phase were useful in assessing how individuals who perceived themselves to having action self-efficacy showed an intention to using mobile phones. The

assessment was informed by the assumption that, for the intenders to convert into active users of mobile phones to receive education and awareness of chronic diseases, they needed to build skills for maintenance and recovery of the behaviour change so that they did not fall back.

Five key principles underpin practice under the HAPA. (Lippke & Plotnikoff, 2014; Schwarzer et al., 2011) The first principle states that change agents should divide health behaviour change into two phases: motivation and volition (Schwarzer et al., 2011). It proposes that people alter their behaviour as they advance from reasoning to action. Consequently, people develop intentions at the motivation stage before entering into the volition stage, where they actualise their intentions (Schwarzer et al., 2011). This study used this first principle of the HAPA to analyse and understand how individuals apply the three contributing elements of the motivation phase, namely risk perception, outcome expectancies, and perceived self-efficacy, to then get into the volition phase, which could turn into an intention to use mobile phones to receive healthcare education and awareness of chronic diseases.

The second principle under the HAPA outlines two groups in the volition phase: individuals who have translated their thought into action and those who have not taken this step (Schwarzer, 2011; Schwarzer et al., 2011). This second principle identifies intenders and those who are actors in health intervention (Schwarzer, 2011). The understanding one gets from the second principle of the HAPA is that it is the volition phase that would separate individuals in this research who want to translate their intention into the actual use of mobile phones from those who show intention but do not translate it into practice.

The third principle of the HAPA relates to post-intentional planning and proposes that intenders in the volitional reaction stage have sufficient motivation to change but are deficient in the skills (self-efficacy) required to turn their desire into action (Schwarzer, 2011). In this regard, Schwarzer and others (2011) propose that planning must guide individuals so that they can turn intention into action. In the light of the third principle of the HAPA, this study reveals that individuals who had the intention to use mobile phones to receive healthcare education and awareness of chronic diseases but did not turn it into practice due to insufficient self-efficacy may be assisted to up their skills, thus converting them into actual users of the said technology.

The fourth principle under the HAPA suggests two kinds of mental simulation, distinguished as action planning and coping planning (Lippke & Plotnikoff, 2014; Schwarzer et al., 2011). It suggests that the decisions that inform how, where and when the desired action is taken constitute action planning. On the other hand, coping planning is a set of actions taken in response to anticipated challenges to adopting the desired behaviour (Schwarzer et al., 2011). To translate their intention into an active change in behaviour by building skills for using mobile phones, the users need to formulate the where, when, and how strategies. Again, for them not to withdraw from this change, they need to identify how to counter perceived barriers to maintain the behaviour change. Regarding this research, the significance of these insights lies in appraising how, where and when in the decision-making stage the desired action of mobile phones' actual acceptance happens. To sustain the decision over the long term, the individuals needed to foresee future challenges and should be prepared to overcome them.

The fifth principle under the HAPA states that self-efficacy is stage specific, as its nature changes with the different phases (Schwarzer et al., 2011; Zhang, et al., 2019). This principle states that the change agent must exercise discretion when creating a distinction between action, coping and recovery self-efficacy. During the motivation phase in this study, individuals had to believe that they possessed skills (action self-efficacy) in using mobile phones to develop an intention to use them to receive healthcare education. Thus, to translate their intention into actual action in the volition phase, individuals need to develop action and coping plans by having self-efficacy in the maintenance and recovery of behaviour change in the event of barriers to mobile phones for education and awareness of chronic diseases. These barriers could be anything from a lack of knowledge, skills, practice of using mobile phones to social influence from the community.

Several researchers have used the HAPA to study the factors that lead to change in health behaviours in diverse scenarios by applying all or some of its contributing elements and the HAPA principles, thereby demonstrating its strengths of parsimony and falsifiability (Esmaeili et al., 2016; Hromi-Fiedler et al., 2016; Yeager et al., 2018; Zarski et al., 2018). Regarding this study, the five HAPA principles and various constructs, namely self-efficacy, outcome expectancies, and risk perception, provide a significant framework for appreciating the motivation and volition required by

individuals to craft an intention to use mobile phones. Thus, the various self-efficacies needed for the two phases help explain why some individuals, having shown an intention, may need extra planning and building of skills to transform their intention into action.

Although the HAPA is instrumental in explaining health behaviour change, three of its limitations, as revealed by various authors, are covered here. First, the insufficiency of using the HAPA alone in evaluating complex multifactorial behaviours was acknowledged. It was suggested that factors such as social support and knowledge should be included when considering behavioural interventions (Esmaeili et al., 2016; Hromi-Fiedler et al., 2016). The two missing variables highlighted by these authors have also been considered in other theories and models reviewed earlier in this research. Taking cognisance of this limitation, the enquiry included the influence of social structure and knowledge of mobile phone use as two crucial factors that could shape the perception of an individual's change in behaviour. Furthermore, the population under study already had availability, accessibility, the knowledge and experience of using mobile phones.

Yeager and others (2018) say the second limitation of the HAPA is that it does not include health symptoms as predictors of intention, and therefore proposed the need to include symptoms and their severity as potential predictors of intention. Excluding the effect of disease symptoms would mean discounting the part of the study population that was already suffering with chronic diseases and yet in need of healthcare education for maintenance of their health. This research acknowledged these constructs as significant predictors of health behaviour change thus, decided to explore another of the models from the health background as presented in the subsequent section.

Thirdly, the HAPA also fails to appreciate the role of past behaviours (Conner & Norman, 2005). This theory presumes that an individual's behaviour can be determined by developing positive messages, regardless of previous experiences (Conner & Norman, 2005). The intention to change behaviour, such as consuming excessive alcohol over a long time or the use of excessive salt in the diet, would be difficult to attain if only self-efficacy, outcome expectancies, and risk perception were considered. Whereas self-efficacy in achieving change in health behaviour was

necessary simultaneously, factors in terms of withdrawal effects, social exclusion, breaking of old habits and the like could act as barriers to forming an intention towards the desired behaviour change. Consequently, this study noted that past experience, such as long-term consumption of alcohol or having led an unhealthy lifestyle for a period of time, needed to be considered as moderators to a change in behaviour. Moreover, past experiences such as a lack of skills in the use of mobile phones, having limited access to electricity to power the mobile device, or having experienced limited network coverage could all shape the outcome of individuals towards mobile phone use to receive healthcare education.

After reviewing HAPA and to counter its limitations, another model from the health context that was the health belief model was consequently explored and is described in the below section.

### 3.10 THE HEALTH BELIEF MODEL

After evaluating various theoretical perspectives and models including the HAPA, the Health Belief Model ([HBM] Rosenstock, 1974) was one of the philosophical lenses used to understand how individual and health factors influenced mobile phone use in health education. It was necessary to explore the model to verify if existing health symptoms which were not considered by the HAPA could also pose an influence in mHealth adoption for better health outcomes by the study population.

The HBM (Rosenstock, 1974) suggests that people are prone to adopting a change in health behaviour if they perceive that a disease or health condition could pose a potential threat to them; and that the behaviour change would assist them to avoid that threat (Glanz & Bishop, 2010; Loke et al., 2015). This assumption is important in this study, because it helps to assess whether the perceived threat of chronic diseases could encourage the rural Kenya population to use mobile phones to receive education and awareness of health conditions. HBM proposes the following three assumptions governing an individual's decision to undertake a change in health behaviour – i) modifying factors, which in turn influence the ii) individual's beliefs, and lead to the iii) likelihood of action (Glanz & Bishop, 2010; Loke et al., 2015; Rosenstock, 2005). Each of these three assumptions has its sub-components, and these sub-components informed the research in different ways, as discussed below. Figure 3.14 below is an illustration of HBM.

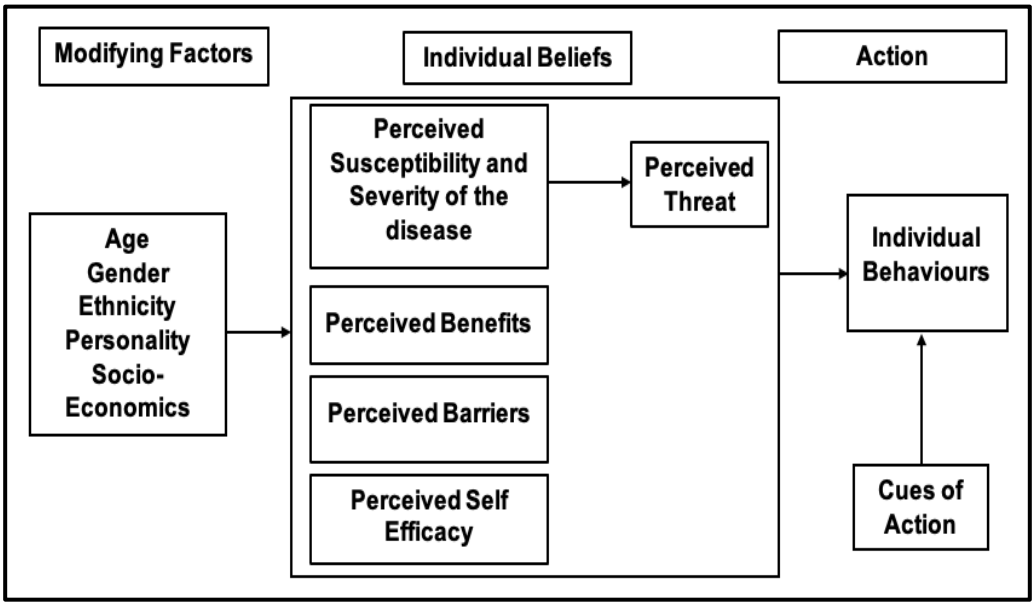


**Figure 3.14: Health Belief Model**
**Source: Rosenstock (2005)**

The first assumption in the HBM captures the modifying factors that could influence an individual's beliefs towards a change in behaviour, and these comprise age, gender, ethnicity, personality, socioeconomic status, and knowledge about a given health condition (Jeihooni & Rakhshani, 2019; Khani et al., 2017; Vermandere et al., 2016). This study sought to understand whether mobile phone use for health literacy could be affected by individuals' age, gender, level of education, income level, knowledge of how to use the mobile phone, and proficiency in the preferred language.

The second assumption in the HBM is the individual belief component, which refers to a combination of four distinct dynamics: perceived threat; perceived barriers; perceived benefits; and perceived self-efficacy (Cheung et al., 2019; Larki et al., 2018; Rosenstock, 2005). The HBM model advances the idea that an individual is likely to change behaviour if he or she believes that the action taken would benefit their health; that the benefits would outweigh the barriers to take the intended action; and that they would have the self-confidence to undertake and maintain such behaviour (Cheung et al., 2019; Didarloo et al., 2017; Marmarà et al., 2017; Rosenstock, 2005).

Based on the above assumptions of HBM, this research sought to test if an individual who believes he/she is threatened by chronic diseases would be prompted to use mobile phones for education and awareness. Further, the research analysed whether

people in rural Kenya perceive that the barriers to receiving the same education and awareness through an alternate channel would be higher than through a mobile phone. The research also examined if the study participants believed that mobile phones would lend additional benefits to them regarding education and awareness of chronic diseases. Lastly, the research explored if individuals would use mobile phones to receive education and awareness of chronic diseases if they considered themselves confident of changing their behaviour.

A perceived threat is one of the components of HBM, which refers to a combination of perceived susceptibility and perceived severity. Perceived susceptibility refers to the belief that one is vulnerable to a certain health problem. Perceived severity refers to an individual's belief of the intensity of a medical condition and its probable outcomes (Jeihooni et al., 2019; McElfish et al., 2016; Parsa et al., 2017). Perceived susceptibility implies that individuals are prone to changing health behaviour if they feel vulnerable to an illness or disease. In this study, perceived susceptibility was useful in assessing if the participants' perceived vulnerability to chronic diseases would motivate them to use mobile phones for education and awareness. For example, the study assessed if the individuals' awareness of being prone to heart disease would convince them to accept mobile phones to receive health education on lifestyle and dietary changes.

The study also explored if a person's belief that they were overweight or obese, and that they could be at risk to its associated suffering and complications, would lead them to consider adopting the use of mobile phones to obtain education and awareness of a healthy lifestyle to help them avert these diseases. Similarly, the study examined how vulnerability to other chronic disease conditions, such as cancer, high blood pressure and diabetes, would encourage people to use mobile phones to improve their health through education and awareness.

Another fundamental component of the perceived threat is perceived severity, which refers to an individual's belief about the intensity of a medical condition and its probable outcomes (Birhane et al., 2015; Didarloo et al., 2017; Diddana et al., 2018). This research evaluated if the study participants' perceptions of the acuteness of specific chronic disease conditions would lead them to use mobile phones to receive education and awareness of the said conditions. For instance, if an individual

experienced the suffering of a family member or a close friend due to cancer, would that lead them to accept the use of a mobile phone to receive education and awareness of cancer and its prevention? If they had experienced a loss of livelihood due to heart disease, would it then trigger them to accept mobile phone use to receive education and awareness of heart disease and other associated chronic diseases to curtail their suffering further? This research also examined the influence of perceived severity of other chronic disease conditions, such as diabetes, obesity, and high blood pressure, on the use of mobile phones by the study participants to receive education and awareness.

Perceived benefits constitute another element of individual belief in the HBM, and these refer to the perception that health outcomes will be positively affected if individuals engage in a particular behaviour (Asghari et al., 2016; Jeihooni et al., 2019; Parsa et al., 2017). Guided by these assumptions, this study analysed the extent to which people would be willing to use mobile phones for education and awareness of chronic diseases if they perceived that it would lead to an improved health outcome. The research sought to ascertain whether people's perceptions that mobile phone use would enhance their health through education and awareness specifically regarding chronic disease conditions could promote their acceptance of its use.

Another dimension of the individual belief in the HBM is the perceived barriers, which refer to the difficulties that prevent individuals from sticking to a specific behaviour (Diddana et al., 2018; Khani et al., 2017). This research assessed the individual, social, health, and technological factors that would lead to the use of mobile phones by the study participants. This study identified the aspects that could hinder mobile phone use by the study participants, such as the cost of owning a mobile phone, the availability of a signal, means of charging the mobile phone devices, knowledge to operate a mobile phone, proficiency in the language used for the education and awareness information, and pressure from significant others against its use.

The last sub-component of the individual beliefs assumption is perceived self-efficacy, which refers to the confidence of the individuals in their ability to perform and sustain the recommended action (Asghari et al., 2016; Diddana et al., 2018). This assumption advances the idea that individuals are likely to make a change in behaviour if they are certain of making the change and believe that the change would be sustainable by

them. Regarding this research, the impression one gets from this view is that individuals would use a mobile phone for education and awareness of chronic diseases if they believed that they could manage its use at the onset. In this regard, this research examined the veracity of the assumption. The research assessed how people's use of mobile phones could be changed by their perceptions of knowledge and the affordability of mobile phones, the availability of a signal, accessibility to an alternate power source, proficiency in the language used for health literacy, and the influence of the significant others.

The third and final assumption in the HBM is an action that points out that the likelihood of a change in individual behaviour could be motivated by a trigger referred to as Cues to Action. These cues could be an advertisement, a bodily response to illness, or an observation of others who suffer due to a particular disease (Samia et al., 2018; Khani et al., 2017; Vermandere et al., 2016). This study explored the possible triggers that could lead individuals to use mobile phones to educate and understand chronic diseases. Some of these cues could include the availability of free or low-cost devices, the availability of signal coverage, the provision of an alternate battery-charging system, encouragement from their significant others, media messages, as well as positive affirmations from their own experience or from others who had benefited from the using mobile phones for education and awareness of possibly other or similar disease conditions, and experience of using a mobile phone device.

The above synthesis of the three assumptions of the HBM and the sub-components in these assumptions shows that this model is an important framework in understanding people's perceptions of using mobile phones to receive education and awareness of chronic diseases for better health outcomes. The assumptions of the HBM were useful in informing some of the hypotheses for the theoretical framework guiding this study.

Several studies have highlighted the strengths of HBM in explaining health-related behaviour change, six of which are covered by this study. The primary strength of the HBM is its simplicity (parsimony) to understand health behaviour-related constructs that make it easy to test (Samia et al., 2018; Jeihooni et al., 2019). Over the years, the HBM has provided a useful theoretical framework for assessing the rationale behind a variety of behaviours in chronic diseases prevention and maintenance (Diddana et

al., 2018; Hosseini et al., 2017; Larki et al., 2018; Tola et al., 2016; Vermandere et al., 2016). It therefore, was a crucial model for this research, the aim of which was to evaluate reasons that could shape an individual's decision to use mobile phones for education and awareness of chronic diseases.

The second strength of the HBM stated in this research is that it is a reliable model that has been employed successfully by several authors to explain why certain individuals behave the way they do towards the prevention of chronic diseases (Birhane et al., 2015; Cheung et al., 2019; Jeihooni et al., 2019; Khani et al., 2017; Lari et al., 2017; Larki et al., 2018; Marmarà et al., 2017; McElfish et al., 2016; Parsa et al., 2017; Vermandere et al., 2016). For this study, the model was valuable for developing a framework of factors that could influence individuals' acceptance of mobile phones for education and awareness of chronic diseases in rural Kenya.

The third strength of HBM is that is useful in analysing the subjective beliefs of individuals. Like a perceived threat, each of its constructs, perceived barriers, perceived benefits, and self-efficacy measure individuals' subjective beliefs. As this study aimed to understand the motivation behind individual health belief systems, the HBM constructs were beneficial in testing and explaining the factors that influence an individual's choice to use a mobile phone for education and awareness of chronic diseases. The HBM constructs measure an individual's psychological assessment of a certain health-related behaviour. The model assumes that individuals' actions are a result of their opinions and understanding of a disease condition and its consequences. In this research, a model was an important tool for explaining the reasons behind high-risk health behaviours, such as smoking and excessive alcohol consumption, in the wake of knowledge that this lifestyle could lead to chronic diseases. Thus, in this study, the HBM was a valuable model to test the choice of both positive and negative health behaviours in individuals.

The fourth strength of HBM is that it helps researchers understand why individuals do not accept a certain health intervention despite its positive outcomes (Diddana et al., 2018; Khani et al., 2017; Orji et al., 2012; Vermandere et al., 2016). People's perceptions of the resultant benefits, barriers, and self-efficacy attached to the intervention that informs their decision about its acceptance or rejection, and the HBM, can help emphasise the cause. In this research, the HBM model was crucial in

explaining why the rural Kenyan population accepts or rejects using mobile phones for education and awareness of chronic diseases.

The fifth strength of HBM is that each of its constructs may be tested individually and in combination to understand individuals' choices about accepting a certain health-related behaviour change (Samia et al., 2018; Jeihooni et al., 2017; Mansouri et al., 2017). Therefore, this research employed the HBM model in testing all factors and analysing their influence as standalone and complementary factors regarding the use of mobile phones for education and awareness of chronic diseases.

Lastly, the self-efficacy component is one of the strengths of HBM in that it is useful in explaining the factors that influence individual decisions regarding health-related behavioural change (Asghari et al., 2016; Birhane et al., 2015; Diddana et al., 2018). In this regard, this study assessed whether the decision to accept education and awareness of lifestyle and dietary issues that could prevent something such as hypertension would be influenced by individuals' ability to accept and sustain the use of mobile phones. The construct of self-efficacy is re-affirmed by the HBM, similar to other models studied in the earlier sections of this chapter, as an important construct, adding to the model's strength and suitability to this study.

Once the HBM has been tested to understand individuals' views of the health-related behaviour change, certain interventions could be suggested. For instance, in the current study's setting, it would be beneficial to understand which of the factors in the HBM have an influence on the use of mobile phones for education and awareness of chronic diseases in the study population. One could argue that, if positive media messages act as a trigger for the population to accept mobile phones, these could be used extensively to bring about positive health outcomes in chronic disease conditions. The HBM explains changes in health behaviour in individuals rather than communities or institutions. This is aligned with the study's aim, as its intention was to understand an individual's health behaviour vis-à-vis an entire population as a whole.

Whereas the HBM is a substantial model to explain a change in health behaviour, several limitations have been noted by different authors (Diddana et al., 2018; Hosseini et al., 2017; Larki et al., 2018; Tola et al., 2016; Vermandere et al., 2016). This research covered nine of the HBM's drawbacks while also presenting an approach to counter these individual weaknesses.

Firstly, the element of cues to action has not been studied systematically, and is the most underdeveloped and least frequently measured variable of the HBM (Jeihooni & Rakhshani, 2019; Lipman & Burt, 2017). Cues to action refer to external factors that influence individuals to make health-related decisions (Samia et al., 2018; Khani et al., 2017; Vermandere et al., 2016). This can be an advertisement, a bodily response to illness, or the observation of others who suffer from a particular disease (Birhane et al., 2015; Orji et al., 2012; Vermandere et al., 2016). The level, degree, and type of cue may also differ, as it would depend on the type of research being conducted and can range from advertisements, the provision of healthcare education through text messages, media messages or even advice from a doctor (Jeihooni & Rakhshani, 2019; Marmarà et al., 2017). In this research, cues to action were not included in the quest to investigate people's perceptions of the individual, social, health, and technology-related factors that would influence mobile phones for chronic diseases education and awareness. It was observed that the trigger could add a bias to the perception of an individual. Thus, the theoretical framework focused on individual perception, while keeping external stimuli that could shape the health-related behaviour as a constant.

Secondly, it has been noted that the individual constructs of the HBM are significant in understanding the change in behaviour of individuals. However, not all of the constructs have been found to be significant in the different studies. For example, perceived susceptibility and perceived severity had a strong influence on pregnant women's dietary practices in Dessie town in Ethiopia; perceived barriers were found to have a moderate correlation; while perceived benefits were weakly correlated with dietary practices among the pregnant women (Diddana et al., 2018). Tola and others (2016) also established a positive correlation only between perceived severity of tuberculosis and adherence to its treatment. Hosseini and others (2017) observed that there was no significant relationship between perceived susceptibility, perceived severity and the duration of physical activity in middle-aged women in Isfahan. However, perceived benefits and perceived self-efficacy had a positive but weak correlation with the duration of physical activity, and perceived barriers had a weak and inverse correlation with physical activity among the women (Hosseini et al., 2017). In their study of self-care behaviour of hypertensive patients with limited health literacy, Larki and others (2018) found that perceived self-efficacy and perceived susceptibility

had a positive influence on low-salt adherence and non-smoking behaviour, while perceived benefits and perceived barriers had no significant association with the self-care behaviours under study. Thus, for this research to investigate the specific factors that would influence individuals to use mobile phones for education and awareness of chronic diseases in rural Kenya, a wide range of factors had to be tested, including from other theories and models other than the HBM constructs.

A third limitation of the HBM was highlighted by Larki and others (2018), who noted that there was a need for communication skills to be considered a significant variable in determining an individual's capacity to navigate healthcare systems. Similarly, this study considered experience in using mobile phones, knowledge of their use, and language proficiency as some additional modifying factors that could influence the individual's use of mobile phones for education and awareness of chronic diseases in rural Kenya.

Fourthly, Vermandere and others (2016) did not find strong support for the HBM, particularly in relation to human papillomavirus vaccine, and noted that additional variables, such as motivation by health workers and trust in the health system, needed to be considered for a comprehensive view of health behaviour change. In the light of this observation, this study aimed to study the personal traits, the influence of the healthcare providers, and the existing healthcare system, along with their contribution to the use of mobile phones for education and awareness of chronic diseases in rural Kenya.

The fifth limitation of the HBM was pointed out by Tola and others (2016), who argued that HBM places much emphasis on personal characteristics and cognitive factors, while disregarding social influences and the emotional aspects of behaviour. Guided by these viewpoints, this research sought to develop an all-encompassing model that studied a cumulative effect of individual, social, health, and technological factors on the use of mobile phones for education and awareness of chronic diseases in rural Kenya. Therefore, further theories and models that encompass these significant elements were examined before developing the resultant theoretical model.

The sixth limitation of HBM is highlighted by studies that have shown that there could be some indirect or mediating effects in between the original factors of HBM (Jeihooni & Rakhshani, 2019; Lipman & Burt, 2017), namely perceived susceptibility, perceived

severity, perceived barriers, perceived benefits, and perceived self-efficacy, which the HBM does not consider. This research tests the inter-variable influence of factors that could lead to the use of mobile phones for education and awareness of chronic diseases by rural Kenyans. Some of the assumptions that this study aimed to test were if perceived susceptibility influences perceived self-efficacy; if perceived susceptibility and perceived severity have an influence on perceived benefits; and if perceived benefits have an impact on perceived self-efficacy.

Another limitation cited by the same authors (Jeihooni & Rakhshani, 2019; Lipman & Burt, 2017) is that the sample size for testing HBM has invariably been small and that this could produce results that cannot be replicated. This study adopted a judicious sample size that would be a suitable representation of the sample population.

The eighth limitation is that the HBM does not consider factors such as social norms, social support, or social influence (Jeihooni & Rakhshani, 2019; Lari et al., 2017; Marmarà et al., 2017). This implies that accepting or rejecting a certain health behaviour may be a consequence of the social inducement of religious or community leaders, their community beliefs, or even social support accorded by family or friends. This study includes theories and models that incorporate social norms as their forming construct, while also using the building blocks of the HBM. Interpersonal communication and social influence are further important factors that should not be diluted. Individuals tend to learn from one another through the observation and imitation of significant others in their environs. This study assumed that people can have both motivating as well as a deterring effects on others. It therefore was important to understand interpersonal communication while assessing the factors that influence human behaviour.

Finally, another shortcoming of the HBM is exhibited in that it does not recognise habitual health behaviours. The HBM does not cater for habitual behaviours such as the high consumption of alcohol or smoking over a period of time (Jeihooni & Rakhshani, 2019; Lipman & Burt, 2017). Such habits may have a grave influence on an individual's decision to follow a certain health-related behavioural choice. This research incorporated the assessment of such habits to understand what would shape the participants' choices about accepting education and awareness of diet and lifestyle issues pertaining to the prevention of chronic diseases.

Most of the constructs of the HBM, namely modifying factors, perceived severity, perceived susceptibility, perceived benefits, perceived barriers, and self-efficacy seemed to be suited to this study. To overcome the model's inadequacies, the suggestions stated above, and the consideration of some of the strong constructs from other theories and models, guided the development of a comprehensive theoretical framework which reflected the individual, social, health, as well as technology associated factors that could potentially influence an individual's decision to adopt mobile phones for health literacy.

## 3.11 MULTI-THEORY FRAMEWORK FOR MHEALTH ADOPTION IN KENYA

The primary aim of this research was to assess the influence of factors from the four intertwined contexts of behaviour change which were individual, social, health, and technological backgrounds in order to understand a sustainable mobile phone use by individuals in rural Kenya for healthcare education and awareness of chronic diseases. Sections 3.2 up to 3.10 looked at various behaviour change theories and models from the fields of social behaviour, technology acceptance behaviour, and health-related behaviour change, namely SNT, SCT, TRA, TPB, DOI, TAM, UTAUT, HAPA and finally, HBM. The key points of consideration were their assumptions and constructs of the theories and models, the inter-dependence of these constructs, and the strengths and limitations highlighted by other researchers.

The subsequent sections of this chapter present an elaborate synthesis of these theories and models and the process by which appropriate constructs that were used as independent variables for the theoretical framework were extracted. The theoretical assumptions and the interdependence of the constructs informed the hypotheses for this study, which are also described in the following sections.

### 3.11.1 Individual Factors Influencing Mobile Phone Adoption

Based on the existing literature analysed in the previous sections of this chapter, age is one factor that has been considered as a significant independent variable for the theoretical framework developed for this study. The influence of age was tested on perceived ease of use, with the understanding that the ease or difficulty of using technology is influenced by the user's age. Further substantiation of age as a significant factor is provided by the existing literature.

Language literacy formed another variable that was considered in this study. Even though the theories and models explored in the preceding sections did not take it as an influential construct however, several studies found that when a mobile phone text message was sent to recipients in their language of choice, the behavioural intention being tested was heightened.

This study thus, assessed age and language literacy as two strategic contributors that could facilitate the adoption of mobile phones to receive healthcare education and awareness of chronic diseases by the rural Kenyan population.

#### 3.11.1.1 Age

Age influences the level of an individual's behaviour towards technology adoption (Venkatesh et al., 2003), which is highlighted in several theories and models explored in Chapter three, namely SCT (Bandura, 1999), TPB (Ajzen, 1991), TAM (Davis, 1989), UTAUT (Venkatesh et al., 2003), and HBM (Rosenstock, 1974). Similarly, several authors (Dewi & Zein, 2017; Dippel et al., 2017; Lash et al., 2016; McDermott et al., 2015) have concluded that age is a determining factor in behaviour change studies.

In investigating behavioural intention to use information technology, Maruping and others (2017) found , age influenced performance expectancy, social influence, and effort expectancy to use information technology. Age was a positive predictor for intention to use, as well as for the actual use of information technology among the sampled participants. Tavares and Oliveira (2016) identified age as a significant factor in evaluating the adoption of the eHealth patient portal by healthcare consumers. Older individuals used the eHealth portals more than young individuals (Tavares & Oliveira, 2016). Advancement in age led to increased health awareness and the need to access these services frequently via the online health portals. In this case, age was a significantly positive predictor for behavioural intention and for the actual use of eHealth portal.

Lv and others (2012) reviewed the relationship of age in terms of behavioural intention and use of mHealth services in different age categories. The authors established that, for middle-aged participants, age influenced self-efficacy and response efficacy, thus affecting their intention to accept mHealth and their actual use of mHealth services (Lv et al., 2012). On the other hand, for older participants, age influenced only self-efficacy. Guo and others (2015) identified that age affected perceived severity, perceived

vulnerability (susceptibility) and self-efficacy, which were the predictors of the intention to accept mHealth technology.

Ziefle and Röcker (2010) note that the willingness to use technology is affected by its usefulness, benefits, and ease of use. However, age significantly influences its ease of use. Older respondents are more inclined to accept technology that is easier to use (Ziefle & Röcker, 2010). In this case, age had a positive but indirect influence on the acceptance of healthcare systems.

According to Venkatesh and others (2003), UTAUT has demonstrated that, with increasing age, individuals find it difficult to process complex stimuli and show signs of reduced concentration on and attention to new innovations. Age moderates various constructs, such as social influence, effort expectancy and performance expectancy, all of which determine behavioural intention in the UTAUT model. Age is also one of the contributing factors influencing the effects of other constructs in the TAM. With regard to this study, the younger generation might find it easy to use mobile phones; however, the same could be an inhibiting factor for the elderly. This study evaluated age as one of the influencing variables for the perceived ease of use for healthcare education and awareness of chronic diseases.

H1: Age influences the perceived ease of mobile phone use.

#### 3.11.1.2 Language Literacy

Healthcare education and awareness through mobile phone text messages need to be provided in the language that users can understand best.

Kaunda-Khangamwa and others (2018) evaluated the use of the local language to adhere to case management instructions via text messages among health workers in Malawi. The type of language used was a positive moderator in enhancing adherence to case management instructions (Kaunda-Khangamwa et al., 2018). Aamir and others (2018) established that language played a significant role in enabling mHealth adoption in low- and middle-income nations. Frontline health workers believed that mHealth applications should be developed in the local language of the target population. Meanwhile, a foreign language was viewed as an inhibitor to the adoption of mHealth applications (Aamir et al., 2018).

Anderson-Lewis and others (2018) highlight the importance of text messages used in mHealth applications to be written in the target population's language. Using the local language enhances mHealth technology uptake, thus reducing the health disparities among less-privileged communities (Anderson-Lewis et al., 2018). Rao and others (2017) acknowledge the importance of language when designing text messages for mHealth technologies used to reduce and manage tobacco usage. Framing the text messages in the local language had a positive effect on the target population's behaviour outcomes (Rao et al., 2017). Effective health communication was attained after reducing the limited language proficiency that was found in previous mHealth systems (Rao et al., 2017).

Khatun and others (2016) established that the use of the local language was an important predictor of mHealth adoption in rural Bangladesh. Their findings highlighted a positive correlation between language and mHealth adoption, especially among individuals with low English language proficiency (Khatun et al., 2016). Kariuki and Okanda (2017) acknowledge that language is a predictor of mHealth adoption and usability in Kenya. The development of mHealth applications in English impeded the adoption and usage of the applications by individuals who did not understand English. The authors proposed that the designers of mHealth applications should include the selection of multiple languages, which would increase the perceived ease of use of these applications, thus increasing their behavioural intention to use the mHealth applications (Kariuki, 2017).

Haldane and others (2019) note that language was a significant factor in their analysis of preferences for mHealth system designs in Singapore. Users of the system preferred the inclusion of languages other than English in the mHealth applications (Haldane et al., 2019). Mwashuma and Chepken (2018) included the preferred language as a variable in assessing an effective healthcare information SMS model in Kenya. The sampled participants opted to get health messages in two of their preferred languages (English and Swahili) (Mwashuma & Chepken, 2018).

Feinberg and others (2017) used language preference as a variable in their analysis of the potential of mHealth in the prevention of heart diseases in Kerala. Participants preferred the SMS used in the mHealth applications to be sent in their local Malayalam language (Feinberg et al., 2017). It thus, highlights the importance of language in the

design of mHealth systems and their potential efficiency. In this case, the chosen language had a significant correlation with usage intentions among users of mHealth services.

In the light of the literature presented above on the positive correlation between the language of choice and adoption of especially mHealth services by individuals, it is proposed that language literacy should be considered as an important variable in evaluating the perceived factors that would encourage people in rural Kenya to receive healthcare education and awareness of chronic diseases through the use of mobile phones. This study assessed the veracity of the findings of Kariuki and Okanda (2017), who found that the preferred language had an influence on the perceived ease of use of technology instead of a direct impact on its adoption. This was a noteworthy assumption to be tested in this study, while the individuals' language literacy was taken as one of the variables that influenced the perceived ease of use of mobile phones. At the same time, the study assessed the influence of language on the perceived usefulness of mobile phones among the study population.

H2a: Language literacy influences perceived ease of mobile phone use.

H2b: Language literacy influences perceived usefulness of mobile phones.

### 3.11.2 Health Factors Influencing Mobile Phone Adoption

The HAPA (section 3.9) and HBM (section 3.10) were explored to understand the health-related factors that would influence the uptake of mobile phones by rural Kenyans. HBM (Rosenstock, 1974) assumes that people are willing to adopt a change in health behaviour if they believe that a disease or health condition that could otherwise pose a potential threat to them could be averted through behaviour change. Some of the constructs of HBM are perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and perceived self-efficacy. The other factors were considered in this chapter under the sections that discuss the influence of social and technology-related factors on mobile phone adoption. This section debates perceived susceptibility and perceived severity as the health-related variables. HBM states that perceived susceptibility and perceived severity collectively are observed as a health threat (risk), whereas HAPA (Schwarzer et al., 2003) also includes risk perception as one of the substantial factors that lead to an individual’s intention to change behaviour.

The behaviour change in consideration is adoption of mobile phones to receive health literacy for the awareness, prevention, and maintenance of chronic diseases. The two health-related variables that were conjointly considered while developing the theoretical framework for using mobile phones for health literacy on chronic diseases in rural Kenya were namely perceived susceptibility, and perceived severity.

#### 3.11.2.1 Perceived Susceptibility and Perceived Severity

As described by the HBM, perceived susceptibility relates to individuals who believe that they are vulnerable to certain disease conditions. In this case, vulnerability may influence the individual's choice to adopt mobile phones to receive healthcare education and awareness. The HBM explains perceived severity as an individual's impression of the seriousness of contracting an illness or disease. Regarding this study, individuals who believe that there could be dire consequences for the self, friends, family, or peers from contracting chronic diseases would show a positive attitude towards adopting mobile phones to receive the relevant education and awareness.

Birhane and others (2015) observed perceived susceptibility and perceived severity to be notable variables in evaluating breast self-examination among female teachers in Ethiopia. Perceived susceptibility was the significant predictor of breast self-examination among the sampled population, who considered themselves highly vulnerable to breast cancer and therefore were highly likely to engage in breast self-examination to enhance their chances of early detection (Birhane et al., 2015). The level of seriousness (severity) of the effects of breast cancer was also a key influencing factor for the participants' engagement in self-examination. Behaviour change resulted from the perceived susceptibility and perceived severity of cancer (Birhane et al., 2015).

Larki and others (2018) listed perceived susceptibility and perceived severity as integral variables in predicting self-care behaviour among hypertensive patients with low literacy levels in Iran. On the one hand, patients with low perceived susceptibility were not inclined to change their behaviour towards the adoption of positive self-care routines. On the other hand, patients with slightly higher perceived susceptibility were predisposed to positive self-care behaviour to improve their hypertension outcomes.

Patients who recorded high perceived severity were more inclined to adhere to their medication regimens than those with low perceived severity (Larki et al., 2018).

Vermandere and others (2016) included perceived susceptibility and perceived severity in the list of variables in their study of the uptake of human papillomavirus (HPV) vaccination in Kenya. Participants who had high perceived susceptibility of contracting cervical cancer were more willing to take up HPV vaccination (Vermandere, 2016). In this case, perceived susceptibility was positively associated with behavioural change (uptake of HPV vaccine) among the participants. Awareness of HPV vaccines increased perceived severity among the participants which in turn, increased their willingness to take up HPV vaccines.

Loke and others (2015) established that perceived susceptibility and perceived severity are important variables in predicting the type of delivery mode (behaviour) settled upon by expectant mothers. Different women have different perceptions of vulnerability to unique medical conditions with each type of delivery style. The study findings highlighted a positive relationship between perceived susceptibility, perceived severity, and behaviour (the mode of delivery) chosen by pregnant women.

Gholampour and others (2018) outlined perceived susceptibility and perceived severity as significant predictors in evaluating individuals' levels of participation in conducting faecal occult blood tests for colorectal cancer screening. The study established that educational interventions which focused on colorectal cancer increased the degree of individual perceived susceptibility and perceived severity. The interventions enabled participants to understand that they could contract colorectal cancer due to genetic factors, and led to increased participation in colorectal cancer screening among the sampled population.

Salari and Filus (2017) used perceived susceptibility and perceived severity as factors to investigate parents’ intentions to join a universal parenting programme and found them to have a significant influence. Parents were more likely to participate in these programmes if they felt that their children were vulnerable to unwanted behaviours (Salari & Filus, 2017). Perceived susceptibility and perceived severity both positively influenced the parents’ intent to join the programmes, which further led to the actual behaviour change of engagement in universal parenting lessons.

Kim and Zane (2016) used perceived susceptibility and perceived severity as prime concepts in assessing college students' health-seeking intentions. There was a direct correlation between perceived susceptibility and health-seeking intentions among the White American and Asian-American students sampled. The students who did not perceive themselves as vulnerable to any health conditions in the future did not seek help (Kim & Zane, 2016). Those who imagined the vulnerability and severity of the mental health threat revealed a strong relationship with the intention to seek professional help.

Tarkang and Pencille (2018) included perceived susceptibility in their list of variables to assess possible predictors of consistent condom use among migrant construction workers in Cameroon. The workers thought they were vulnerable to contracting HIV/AIDS, which led to more consistent use of condoms among them. In this case, there was a positive correlation between perceived susceptibility – to HIV/AIDS acquisition – and behaviour changes such as regular condom use. Perceived severity was not found to have an effect on the individuals' behaviour.

Vermandere and others (2016) illustrated that, if a person or population does not perceive health behaviour or agents to be threatening or risky, they produce no stimulus to act, whether to avoid, eliminate, prevent, or manage the threat. This makes perceived susceptibility and perceived severity important constructs that could help explain the necessity for considering the adoption of mobile phones as a proposed intervention to receive awareness on chronic diseases.

H3a: Perceived susceptibility influences perceived usefulness of mobile phones to receive healthcare education and awareness.

H3b: Perceived severity influences perceived usefulness of mobile phones to receive healthcare education and awareness.

H3c: Perceived susceptibility influences perceived ease of mobile phone use to receive healthcare education and awareness.

H3d: Perceived severity influences the adoption of mobile phones for education and awareness of chronic diseases.

### 3.11.3 Social Factors Influencing Mobile Phone Adoption

From the theories and models presented in Chapter three, the TRA, TPB and TAM2 consider subjective norms as constructs that directly influence behavioural intention to adopt the final behaviour. Subjective norms are individuals' motivations and the perceptions of most people who are important to them about whether they should or should not perform the behaviour in question (Ajzen & Fishbein, 1975). UTAUT has applied social influence as a construct that influences behavioural intention and refers it as the degree to which individuals perceive it important that others believe they should or should not use the new system (Venkatesh et al., 2003). Regarding the above definitions and applications, social influence and subjective norms may be used interchangeably to refer to factors that influence socially-inclined behaviour change. Both the SCT and SNT have considered social norms as constructs that inform the behaviour exhibited by individuals. Social norms in the SCT refer to a collection of social beliefs, attitudes, and community influences regarding a certain phenomenon (Bandura, 1989). The SNT defines social norms as unwritten rules, behavioural patterns, collective attitudes and individual beliefs about others' behaviour and the perception of what others might term as permissible behaviour (Dempsey et al., 2018). The DOI also emphasises the important role played by the social structure, community beliefs, cultural values, and influence of opinion leaders and change agents on individual behaviour. Considering the relevance and definitions given above, social influence, subjective norms, and social norms in the theories discussed above, may refer to the same variable. This study chose to test social influence as one of the significant variables that influence the rural Kenyan population's behaviour regarding the use of mobile phones to receive education and awareness on chronic diseases.

The DOI theory explains a social system as a unit of individuals who form a family, community, or organisation where the behaviour change is supposed to be studied (Manueli et al., 2007). Characteristics of the social system that influence behaviour change are the social structure, the beliefs of the community, the cultural values of the opinion leaders and change agents, and the perceptions of individuals sharing the same neighbourhood and working in the same organisation, or even sharing similar interests (Rogers, 2010; Sahin, 2006).

#### 3.11.3.1 Social Influence

Esmaeili and others (2016) say subjective norms were among the variables that affected adherence to dietary recommendations among an Iranian population. The general trend of the population showed a preference for unhealthy diets, which posed a negative social influence that led to non-adherence to dietary recommendations. Media messages that promoted unhealthy foods as the accepted norm also caused a negative influence on the population's choice of healthy food, thus reducing adherence to dietary recommendations (Esmaeili et al., 2016). Lorenzo-Blanco and others (2016) established that perceived social disapproval of drinking by the community was among the variables that affected reduced alcohol usage among Latino youths. In collectivist cultures like Latinos, the community's subjective norms as a unit play a central role in influencing the decisions taken by individuals (Lorenzo-Blanco et al., 2016).

Hosseini and others (2015) identified subjective norms that stem from social influence as a significant predictor of healthy nutrition and proper eating habits, such as breakfast consumption, among Iranian students. Dewi and Zein (2017) enlisted subjective norms as a variable in their study to assess the intentions to perform breast self-examination (BSE) among female university students. Social norms (normative beliefs and motivation to comply) influenced the intention to perform BSE, thus further enhancing their actual performance of BSE (Dewi & Zein, 2017).

Jekauc and others (2015) established that social support from friends and family was an important predictor of intention to attend a fitness centre among regular attendants, thus enhancing their actual workout attendance. Social influence from friends was a higher predictor of intention to attend fitness centres for college students because of the frequent interactions between friends, instead of interaction between family members (Jekauc et al., 2015).

For this study, it was crucial to understand and assess the social influence of family, friends, religious and community leaders on the perception of the rural Kenyan population about the adoption of mobile phones to receive education and awareness of chronic diseases.

H4a: Social influence affects perceived usefulness of mobile phones to receive healthcare education and awareness.
H4b: Social influence impacts perceived ease of mobile phone use.

H4c: Social influence has an effect on adoption of mobile phones for education and awareness of chronic diseases.

### 3.11.4 Technological Factors Influencing Mobile Phone Adoption

Technology-related factors that may influence the adoption of mobile phones for use in healthcare were extracted from a combination of technology-acceptance and social behaviour theories and models studied in the earlier sections of this chapter. Further literature on these factors has been added in the subsequent section to negotiate their importance for this study.

Different theories and models have used diverse terms to describe how a technological innovation could help improve a user's life. The TAM classifies it as the perceived usefulness, being the degree to which a person believes, that using a particular system would enhance their job performance (Davis, 1989). Perceived benefits as used by the HBM refer to individuals' beliefs that a specific action will positively affect their health (Rosenstock, 2005). The UTAUT defines performance expectancy as the degree to which individuals believe that using a particular system or technology will improve their job performance and is similar in definition to perceived usefulness in the TAM (Venkatesh et al., 2003). As defined by DOI, relative advantage represents the degree to which an innovation is believed to be superior compared to the idea or process that it displaces. This study uses the factor perceived usefulness to assess mobile phones' use to receive education and awareness of chronic diseases by the rural Kenyan population.

Another variable, the perceived ease of use is explored in the TAM to explain an individual's perception of ease or difficulty in acting on behaviour change. The TAM describes perceived ease of use as the degree to which a person believes that using a particular system would be free from effort (Davis, 1989). The UTAUT defines effort expectancy as the degree of ease of using a particular system or technology (Venkatesh et al., 2003). Complexity, as defined by DOI, represents the extent to which an innovation is perceived as relatively difficult to understand and use by an individual (Rogers, 1995). Self-efficacy as applied by the HBM, HAPA, TPB, and SCT refers to the level of a person's perceived capability to act successfully. The HBM describes self-efficacy as the confidence in individuals' ability to perform and sustain a recommended action (Rosenstock, 1974). The HAPA represents an individual's

confidence in their ability to perform a recommended action (Schwarzer, 2016). The SCT defines self-efficacy as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives (Bandura, 2004). The TPB includes self-efficacy as part of the perceived behavioural control construct and explains it as the difficulties perceived in performing a particular behaviour and an individual's ability to surmount the challenges (Ajzen, 1991). This study opted to use the variable perceived ease of use, as one of the independent variables that was tested through the theoretical framework to assess its influence on mobile phone use to receive education and awareness of chronic diseases by the rural Kenyan population.

#### 3.11.4.1 Perceived Mobile Phone Usefulness

Going by the definitions and the context in which different studies use them, perceived usefulness as defined by TAM may be taken as synonymous with perceived benefits in HBM, performance expectancy in UTAUT and relative advantage in DOI. Perceived usefulness is one's belief that the use of a technological intervention will enhance or improve performance in a given task (Deng et al., 2018). Deng and others (2018) noted that, if patients had a strong perception of the benefits of the given mHealth application, they exhibited a higher intention to adopt the service. Rönnby and others (2018) identified perceived usefulness as a significant variable in predicting the intentions to use the mHealth self-report monitoring system among long-distance athletes. The individuals had to self-record their data for the system to analyse it and thus showed a positive intention to use it if they perceived significant benefits.

Portz and others (2019) enlisted perceived usefulness as a notable variable in assessing the intent to use and the actual usage of a patient portal among older patients. The perception of the usefulness of the portal varied across different categories of patients, with those with higher degrees of sickness perceiving the portal to be more useful than patients who were less sick. Perceived usefulness of the portal was lower in patients who preferred physical engagements with their caregivers (Portz et al., 2019). The study established that improving the features of the portal (user interface and user experience) would enhance its perceived usefulness, increasing the intent to use and the actual usage of the portal across all patient categories.

Campbell and others (2017) revealed that perceived usefulness of mHealth interventions among low-literacy individuals in rural Uganda was informed by the perception that using the system would lead to enhanced HIV care services and improved access to social support from family and colleagues. Higher perceived usefulness meant increased adoption of the system. Dou and others (2017) evaluated the influence of perceived usefulness on patients' acceptance of smartphone technology in the management of chronic diseases in China and found it to be a strong predictor of intention to use the applications. The patients' perceived usefulness of the smartphone applications was influenced by good recommendations for the applications by the primary caregivers, which led to an increase in intention to use and, in turn, influencing the actual usage of the smartphone applications by the patients.

Ahadzadeh and others (2015) listed perceived usefulness of health-related Internet use as an important variable in mediating the relationship between perceived health risk and Internet use for health information seeking. Internet users who had the belief that the Internet was useful for providing information that would enable them to solve their health concerns demonstrated a positive intention to use the Internet, which further influenced their actual Internet usage. Preusse and others (2017) found that perceived usefulness of the system was a significant predictor of intention to use an activity tracker by old individuals. Facilitators of system usefulness included system qualities such as consistent data entry menus that were meant to record accurate data. Inconsistent data entry menus harmed the system's usefulness, negatively affecting the behavioural intention to use the system. This negative behavioural intention hindered the actual acceptance and use of the activity trackers among old individuals (Preusse et al., 2017).

Beer and others (2017) used perceived usefulness as a variable to measure the acceptance of robotic assistance by aged users after brief exposure to the robots. There was an increased positive attitude among older adults after seeing the robots performing selected assistive tasks. This shift in attitude increased the perception of the robots' usefulness, thus increasing the older adults' intention to accept the robots (Beer et al., 2017). A positive increase in the intention to accept the robots' assistive efforts led to a positive influence on actual acceptance of the robots among the older adults. Cheung and others (2019) examined the effect of perceived usefulness on the acceptance of wearable healthcare technology among Hong Kong users. They

established a significant antecedent to a positive behavioural intention of adopting wearable healthcare devices (Cheung et al., 2019). Positive behavioural intention to adopt the wearable devices led to the actual use of the technology among its consumers.

Tsai (2014) found perceived usefulness of telehealth systems in Taiwan to influence the intention to use them. The residents' positive increase in intention due to the perceived benefits of the technology that would deliver healthcare to rural and underserved areas by remote healthcare professionals led to a substantial increase in the actual usage of the telehealth systems (Tsai, 2014).

In the light of the above studies, perceived usefulness was ascertained to influence behavioural intention to use technology directly. This study assessed the influence of usefulness perceived by a rural Kenyan population on receiving healthcare education and awareness of chronic diseases through mobile phones.

H5a: Perceived mobile phone usefulness affects perceived ease of mobile phone use.

H5b: Perceived mobile phone usefulness has an influence on the adoption of mobile phones for education and awareness of chronic diseases.

#### 3.11.4.2 Perceived Ease of Use

Perceived ease of use, as applied in TAM, effort expectancy in UTAUT, complexity in DOI, and self-efficacy as defined by HBM, HAPA, TPB, and SCT all imply the degree to which a person believes that using a particular system would be free from effort. This study prefers to use the variable perceived ease of use, and evaluates its influence on the supposed behaviour of the rural Kenyan population in using mobile phones for healthcare education and awareness of chronic diseases.

In this study, perceived ease of use focused on the perception of an individual of the level of effort required to use mobile phone features such as voice, text messages, internet-based applications, and video without extra effort or training. Of the theoretical perspectives mentioned in the above studies, perceived ease of use directly influences the behavioural intention to adopt technology, thus it is suggested as a significant factor in its adoption. Therefore, this study evaluated its effect on the adoption of mobile phones by rural Kenyans in the process of receiving education and awareness of chronic diseases.

Lin and others (2016b) identified perceived ease of use as a considerable variable in evaluating factors that would influence the use of wearable instrumented vest for posture monitoring among the elderly. Those who perceived the wearable vests as easy to use were convinced that the vests benefited their lives and thus showed a positive intention to use the vests, thereby increasing their acceptance of the given technology. Portz and others (2019) used perceived ease of use as a variable in evaluating older patients' intention to use and their actual use of a patient portal. Despite user interface challenges and user experience difficulties highlighted by some of the sampled participants, most users thought that the portal was easy to use, thus increasing their intention to use it (Portz et al., 2019). The increased intention to use the portal further informed their actual usage of the portal to monitor and coordinate their treatment plans.

Campbell and others (2017) observed perceived ease of use as a noteworthy factor in evaluating user experiences of using mHealth interventions among the low-literacy population in rural Uganda. The ease of use of the interventions comprised SMS characteristics, features of the mobile phones, and knowledge about the technology among the target population. These characteristics influenced the intention to use the mHealth interventions, which affected the adoption of the intervention among the target population in rural Uganda (Campbell, et al., 2017). Ahadzadeh and others (2015) identified perceived ease of use as an important element in the assessment of health-related online use. Perceived ease of use was identified as a positive predictor of intention to use the internet for health-related purposes. The intention to use the internet then influenced the actual usage of the internet for health-related purposes (Ahadzadeh et al., 2015)

Preusse and others (2017) used the perceived ease of use as a variable in assessing the acceptance of activity trackers in older individuals. Lack of perceived ease of use of the activity trackers was characterised by parameters such as unpredictable navigation bars and inconsistent data entry menus, which acted as barriers limiting the intention to use the activity trackers. These barriers had a negative influence on the intention to use the trackers, thus negatively influencing their actual use (Preusse et al., 2017). Beer and others (2017) identified perceived ease of use as a positive predictor of behavioural intention in their assessment of the acceptance of robotic assistance among aged adults. Exposure to the robots performing tasks led to a shift

in perception about the ease of using the robots, which led to a positive increase in the behavioural intentions and the actual use of the robots by the patients (Beer et al., 2017).

Tsai (2014) noted that perceived ease of use was a significant antecedent of influencing behavioural intentions among telehealth technology consumers in Taiwan. Residents of marginalised areas reported positive perceptions of the ease of use of telehealth technology to provide remote healthcare, thus leading to the technology's actual usage (Tsai, 2014).

H5c: Perceived ease of mobile phone use has an influence on the adoption of mobile phones for education and awareness of chronic diseases.

### 3.12 Theoretical Framework

Having discussed the constructs from individual, social, health, and technology-related backgrounds, and coming up with their hypothesised interactions with each other and the final variable, namely the adoption of mobile phones, the theoretical framework was henceforth developed. Figure 3.15 is a diagrammatic representation of the seven independent variables that were selected for this study, along with their hypothesised influence on each other, and on the final dependent variable, that is the adoption of mobile phones by the rural Kenyan population to receive healthcare education and awareness of chronic diseases.

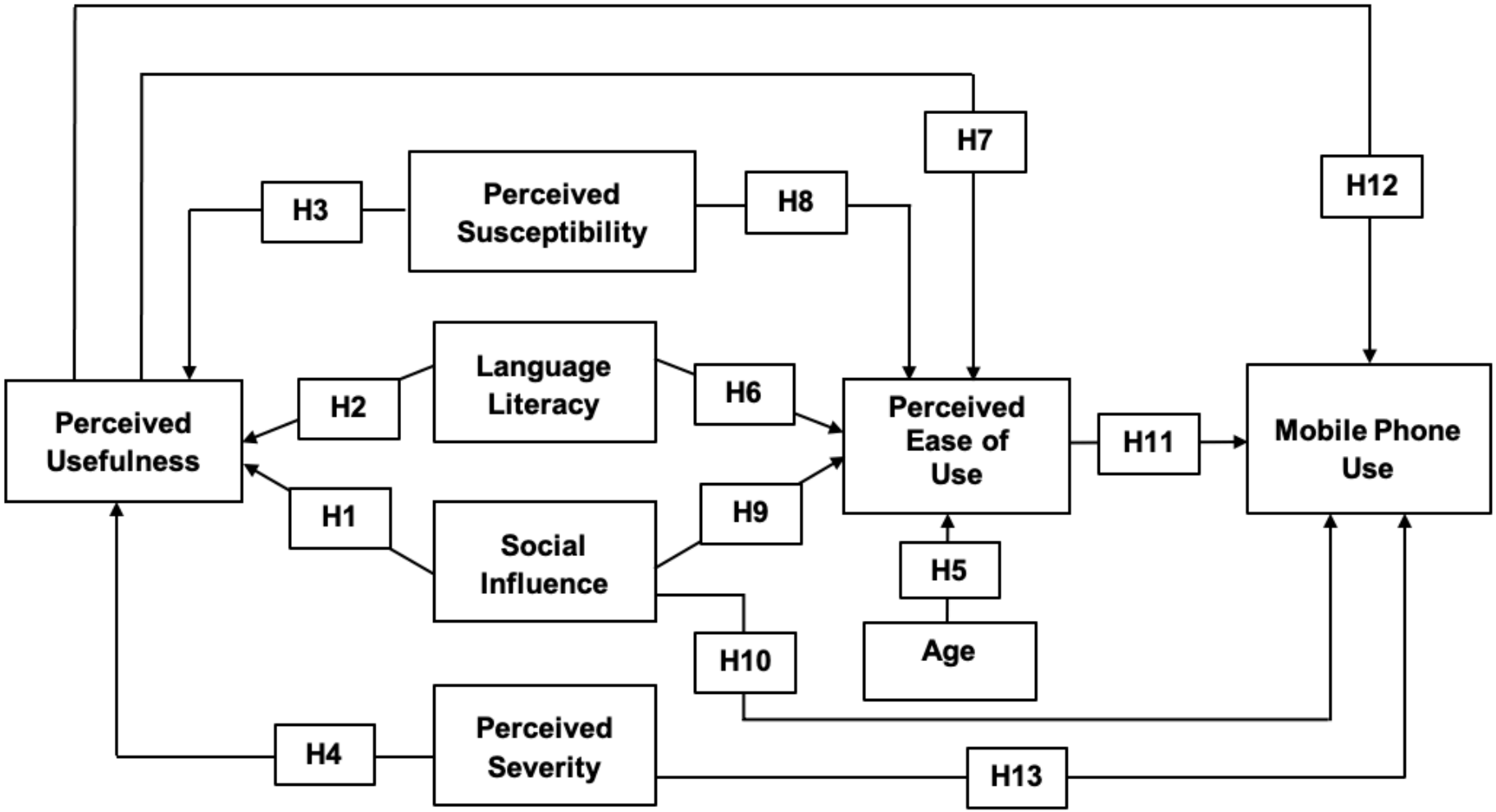


**Figure 3.15: Theoretical Framework**

### 3.13 Conclusion

The theoretical framework and variables presented in this chapter were developed from the various theories and model constructs. An elaborate discussion was presented on different constructs selected from the theories and models that were analysed in the previous chapter, along with a step-by-step procedure on how the researcher arrived at the resultant theoretical framework for mobile phone adoption by the rural Kenyan population. For this study, the seven constructs that were proposed to define the adoption of mobile phones for healthcare education and awareness in rural Kenya were extracted from existing literature, and the nine theories and models studied, namely SNT, SCT, DOI, TRA, TPB, TAM, UTAUT, HAPA, and HBM. This perspective helped determine the rationale and justification for the development of an appropriate theoretical framework.

# CHAPTER FOUR

# RESEARCH METHODS AND PROCEDURES

## 4.1 INTRODUCTION

This chapter presents a comprehensive outline of the research paradigm adopted by this study to explain the study beliefs and assumptions to understand how things work, and how to design the research to achieve the research objectives. The research paradigm was developed using the building blocks demonstrated in the Figure 4.1 below, namely ontology, epistemology, methodology and methods selected for the given research (Rehman & Alharthi, 2016).

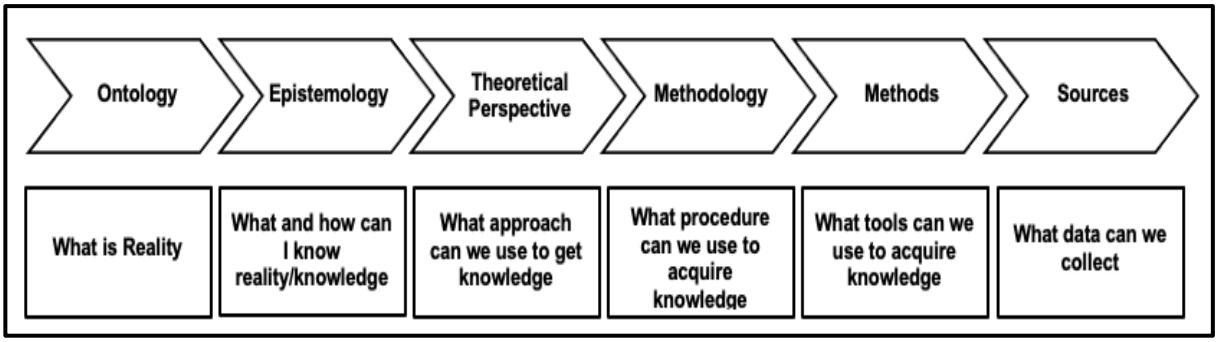


**Figure 4.1: Building Blocks of the Research Paradigm**
**Source: Adapted from Rehman & Alharthi (2016)**

After discussing the ontology and epistemology selected for this study, the chapter builds on the type of research methodology adopted for selecting research participants and the methods used for data collection, analysis and reporting. Processes used to ensure data validity and reliability are also addressed. Finally, the chapter outlines ethical considerations that guide the method of collecting, handling, interpreting and presenting the respondents' data.

## 4.2 RESEARCH ONTOLOGY AND EPISTEMOLOGY

The research paradigm that one chooses for research is a combination of beliefs and assumptions about the area of research (Bhattacherjee, 2012). The research paradigm informs the researcher's perception of truth and reality (ontology) and provides a framework for how the researcher discovers this truth and reality (epistemology) (Shah & Al-Bargi, 2016). The four components of a research paradigm are ontology, epistemology, methodology, and methods. The specific research paradigm selected for any given research provides a guiding framework for how data

regarding a certain observable phenomenon should be sampled, gathered, analysed and utilised (Saunders et al., 2016).

### 4.2.1 Research Ontology

Ontology refers to the science of being and deals with the nature of reality, and the presumptions investigators have about how the world works (Saunders et al., 2016). The ontological question deals with whether social reality exists autonomously of human thinking and comprehension or a product of individual cognition. The main question ontology seeks to answer is whether there is a collective social reality or compound context-specific realities (Saunders et al., 2016; Shah & Al-Bargi, 2016). Essentially, ontology encompasses notions of and associations between individuals, the society, and the world.

The three divergent yet overlapping ontological standpoints are objectivist, subjectivist, and constructivist (Shah & Al-Bargi, 2016). An objectivist perspective states that social reality exists independently of all social actors. This implies that the world is external and can be understood using a single objective reality (Bhattacherjee, 2012; Saunders et al., 2016). All research perspectives and beliefs conform to this single objective reality. In this case, the social scientist and natural scientist can discuss social phenomena in the same manner, given the single objective reality (Shah & Al-Bargi, 2016). This school of thought presupposes that people have limited involvement as a social reality researcher (Saunders et al., 2016). This means that humans only exercise their role as a response mechanism to this external reality.

Researchers who subscribe to subjectivism, on the other hand, reject the assumption advanced by objectivists (Shah & Al-Bargi, 2016). Subjectivists believe that truth and reality do not exist in an external world – rather truth and reality create human imagination (Bhattacherjee, 2012; Saunders et al., 2016). In this ideology, one is a response mechanism and is expected to influence the world using one's perceptions and experiences.

The constructivist approach suggests that social phenomena develop in particular social contexts (Shah & Al-Bargi, 2016). This type of approach explains that individuals and communities of individuals play a part in making their own social reality and that this reality is ever-changing as individuals keep up with their social interactions. This

doctrine proposes that individuals can create their realities, which change over time (Saunders et al., 2016).

This study chose to follow the objectivist ontology. The rationale behind this choice was that in order to investigate study participants' perceptions on adopting mobile phones for health literacy, the personal bias of the enquirer of this study had to be excluded. The perceptions of the study participants needed to be captured without any opinion from the researcher. This meant that the mode of gathering data had to allow the study participants the freedom to provide their true perspective without an interjection of the enquirer. As the researcher was only facilitating the process of the enquiry, without providing a personal viewpoint on any stage of data collection, the objectivist ontology was most suited to this research.

### 4.2.2 Research Epistemology

Epistemology is a philosophical assumption that seeks to understand the acquisition of knowledge and the relevant processes of learning and understanding social reality (Saunders et al., 2016; Shah & Al-Bargi, 2016). This philosophical assumption questions and determines what should be acknowledged as the acceptable knowledge in a certain field. Creswell and Creswell (2018) suggested four major research epistemologies, also called the worldviews, namely postpositivism, social constructivism, transformatism and pragmatism. Each of the four approaches have different assumptions when planning the research process.

The first of the worldviews which is called the postpositivist research approach asserts that the social world has an external existence and, as such, its attributes should be assessed through objective measures (Creswell & Creswell, 2018). In this type of worldview, the observer is supposed to be independent of the phenomenon being observed. Postpositivism focuses on the cause-effect nature of research, where a researcher wishes to resolve complex practical problems and explore concise causal associations with the help of methods of statistical analysis (Bhattacherjee, 2012; Saunders et al., 2016). Using this worldview, the researcher assesses various theories and identifies the most appropriate one(s) that meet the research aim and objectives of that particular study. As the postpositivists argue that there is a single reality that should be evaluated using variables, the researcher then identifies the connectedness

between variables and formulates the hypotheses. These hypotheses are consequently tested using quantitative methods like surveys (Bhattacherjee, 2012; Saunders et al., 2016; Shah & Al-Bargi, 2016). Being objective is the corner stone of using this type of research epistemology.

Social constructivists hold a divergent perspective. In their view, the comprehension of social reality is based on an individual's experiences of that particular reality (Saunders et al., 2016; Venkatesh et al., 2013). The social constructivists argue that reality can only be fully comprehended from a subjective perspective. Thus, the study participants are presented with open-ended questions to gather their opinions on a given topic of study, and the researchers then report their own perspective of the study participants' responses. The questions are formulated as broad and general unlike keeping them closed and specific in the postpositivist approach, so that the researcher can interpret the meaning out of the responses. The researcher's end goal is to construct the meanings provided by the study participants about the object or situation under study. Rather than starting with a theory (as in postpositivism), the researcher develops a theory or pattern of meaning from the responses gathered through the enquiry. The researcher's influence on the phenomenon being studied cannot be discounted in this research paradigm (Venkatesh et al., 2013). This type of enquiry generally follows qualitative research methods of conducting interviews and focus group discussions.

Another worldview of conducting research is the transformative mode of studying a given topic to effect a political or social change in society's marginalised groups (Creswell & Creswell, 2018). In this type of research, theoretical perspectives are combined with the philosophical assumptions to create a visualisation of the issues being studied, the people to be studied, and the changes that are needed to bring about a change in society. This approach endeavours at bringing about a positive change to the society which cannot be effected through the postpositivists or the social constructivists' approach of study. Thus, this type of research leads to an action rather than a theory. This type of worldview believes in involving the research participants throughout the enquiry, and in the end results in a positive transformation for the participants.

Lastly, Creswell and Creswell (2018) explain the pragmatic view of research where one problem may be solved using several available paths of enquiry. In this type of research epistemology, the researcher focuses on the research problem and can choose and mould the type of research methods to suit the context of the problem. Such research uses mixed research methodology, with both quantitative and qualitative methods being employed to gather an understanding of the situation and to solve the research problem (Bhattacherjee, 2012; Saunders et al., 2016). The end goal in this type of approach is to find the best solution to the problem by utilizing all available avenues of enquiry.

The researcher in this study selected the first type of worldview presented above that is, the postpositivist approach of enquiry. As this study aimed to assess the causal factors which would influence (effect) the study participants' uptake of mobile phones to receive health literacy, postpositivist approach therefore, was the most suitable mode of enquiry for this study. The planned structure for this research was to study existing theories and models to understand the mHealth adoption process in light of individual, health, societal, and technological influences. Upon evaluating these theories, variables would be identified and hypotheses formulated which showed the inter-connectedness of the variables. The hypotheses would then be tested using a survey questionnaire which would have structured and close-ended responses to the enquiry. The numerical responses needed to be analysed using structural equation modelling (SEM) analysis tools. The expected end result of the enquiry would be to report on the accepted hypotheses showing the variables and their inter-relationships, which would then result into the final model. Therefore, adopting the postpositivist approach was most suited for this study.

## 4.3 RESEARCH METHODOLOGY

The research methodology refers to a set of procedures used to structure a study through the different stages of research design, data gathering, data analysis, interpretation of results, and conclusions drawn by the researcher (Scotland, 2012). It is a systematic map to solve a research problem (Kothari, 2004). It leads to the heart of research that will make a certain study stand out as a unique one in the expansive

body of knowledge. The type of research methodology selected by a researcher is a consequence of the ontology and epistemology that is applied in the particular study.

The three distinct types of research methodologies as per Creswell and Creswell (2018) are namely quantitative, qualitative, and mixed methods approach. Quantitative methodology uses evidence-based, statistically analysed numeric data that may be replicated and scaled (Bhattacherjee, 2012). The reliability and validity of results using quantitative methods is deemed highly consistent and is considered a great strength of the said research methodology (Saunders et al., 2016). The results of quantitative methodology are free from the enquirer's bias and provide a true objective picture of the responses. Despite these strengths, quantitative methods are not suited to capturing the participants' knowledge, attitudes, and practices, which can best be collected using qualitative methodology (Atieno, 2009) as the numeric data cannot provide the subjective view of the study participants.

Qualitative methodology represents a detailed description of the data being collected, which is not broken down into statistical representations (Bhattacherjee, 2012). Qualitative methodology gathers the perceptions and opinions of the study participants. In order to formulate an understanding of the responses, the enquirer's viewpoint comes into play. The researchers following a qualitative methodology present the final analysis of the research problem in their own understanding of the study participants' responses (Kothari, 2004). One major drawback of qualitatively captured data is that the results are not replicable or scalable because the perceptions gathered from one group are very contextual and cannot be generalised (Atieno, 2009).

The third type of research methodology being the mixed methodology approach, combines both the quantitative and the qualitative methodologies in order to gain from the advantages of both types of approaches. Thus, the results may be replicated in a study conducted in a different environment provided, the enquirers were allowed to provide their contextual understanding of the relevant situation.

As this study had selected an objectivist ontology along with postpositivist epistemology, with the aim of developing a model from the factors that could influence the adoption of mobile phones by the study participants, it was necessary to keep the

researcher's bias out of the equation. This called for a quantitative research methodology, one that would allow close-ended responses by the study participants which could later be statistically analysed to understand their influence on the resultant factor.

The other factor that helped to forge forward the decision of using quantitative methods was that for qualitative methods of data collection, the participants would respond in their local Dholuo dialect. Since the researcher was not fluent in the Dholuo language, a translator would be needed to translate all the responses. This could allow for the translator's bias in data collection. At the same time, the research being self -funded did not allow for extra expenses such as translation of 315 responses from Dholuo to English language. The additional time required to translate all the responses was another limitation that promoted the choice of quantitative methodology instead.

Hence, taking into account all the available disadvantages and advantages of the quantitative approach, this study opted for the quantitative methodology.

## 4.4 RESEARCH METHODS

This study employed quantitative research methodology and used a survey questionnaire as the primary data-capturing instrument.

### 4.4.1 Quantitative Methods

The quantitative research methods consisted of conducting a survey using printed questionnaires handed out to the research participants, who met the selection criteria. The study aimed to assess factors that influenced the uptake of mobile phones by rural Kenyans to receive healthcare education and awareness of chronic diseases. Quantitative methods made it possible to design a research instrument that could capture the research participants' perceptions of these factors by designing structured questions that allowed them to choose one among the several given choices of responses (Saunders et al., 2016).

#### 4.4.1.1 Survey Questionnaires

This study aimed to gather the respondents' perceptions of the types of factors that would influence their uptake of mobile phones for health literacy. Thus, survey questionnaires were found suitable for the process. A survey is the most widely used

data-gathering technique in quantitative research to gather the knowledge, attitudes and belief of respondents (Saunders et al., 2016).

Survey questionnaires can highlight possible relationships between variables and produce models of these (Kothari, 2004). One of the study objectives was to investigate the potential influence of individual factors on a sustainable mobile phone use by the study population. Therefore, questionnaires were deemed suitable to meet this objective. Saunders and others (2016) advocate that, questionnaires make data collection free from the bias of the interviewer, as the response is in the respondents' own words following an objectivist approach to the study. Respondents receive adequate time to give well-thought-out answers; respondents who might generally be introvert and not easily approachable can also respond to the questions at their convenience in their own space. Surveys allow large samples to be targeted, thus producing results that represent the study population and can be relied upon (Saunders et al., 2016). The survey was adopted as the sole data collection instrument of the study. As the researcher had planned to use statistical analysis to produce the final model, quantitative data gathered by employing a questionnaire was important.

## 4.5 SAMPLING TECHNIQUE AND SAMPLE POPULATION

The study was conducted in Nyatoto sub-location, Central Division, Suba District, Homa Bay County, one of the 47 counties in the Republic of Kenya. Homa Bay County is divided into eight political constituencies, namely the Rangwe, Homa Bay Town, Ndhiwa, Suba, Mbita, Karachuonyo, Kasipul and Kabondo/Kasipul sub-counties. It is further divided into 40 electoral wards, 86 locations and 211 sub-locations. The study population came from the Suba sub-county, which is located in Nyatoto sub-location. As per the last national population census conducted in 2009, Nyatoto sub-location had 1 164 males and 1 811 females, totalling 3 476, within 676 households, all living in 15 villages (KNBS, 2010).

The following sections describe the type of sampling technique used, the calculation of the sample size, the data collection procedure, and the design, development, and validation of the data collection instruments, followed by the data analysis methods used in this study.

### 4.5.1 Sampling Technique

The two major types of sampling methods are probability and non-probability sampling (Kothari, 2004). Probability sampling is the procedure by which each unit of a given population has a definite chance of being selected – every participant has an equal probability of being chosen from the population (Etikan et al., 2016; Kothari, 2004). There are different probability sampling methods: simple random, stratified random, cluster sampling, systematic sampling, and multi-stage sampling (Taherdoost, 2016).

For non-probability sampling, subjective methods are employed to design a randomised approach to select a sample from the given population, thus each unit in the population does not have an equal chance of being selected (Kothari, 2004; Taherdoost, 2016). These subjective methods are dependent on the research aim of the specific study. There is a further division within the non-probability sampling approach: quota sampling, snowball sampling, judgement sampling, and convenience sampling (Taherdoost, 2016).

Homa Bay County was chosen through convenience sampling method as it would aid in meeting the objectives of the study. Homa Bay County is part of Nyanza, a region of Kenya with some of the highest HIV/AIDS and cancer prevalence compared to all other regions. The prevalence of other chronic diseases was also high in this region (Otieno et al., 2014). Subsequently, the county was well suited to conducting a study on use of mobile phone for chronic diseases education in the population. Hitherto, most pilot studies on mobile phones for health in Kenya had focused mainly on HIV/AIDS and infectious diseases. This study specifically focused on chronic diseases – an area of health that had remained underserved.

Nyatoto sub-location was also chosen through convenience sampling method due to its remoteness, vastness, very poor infrastructure, high levels of poverty and an acute lack of accessibility of healthcare facilities and health personnel. These factors made the study area well suited to conducting this research in a remote part of Kenya with constrained infrastructure, including limited access to health facilities. The study population would be a good representation of the low resource setting in rural Kenya.

Finally, the research participants for the survey were selected using a random sampling method. The samples were selected randomly on a first-come-first-served

basis for those who met the study's selection parameters (Etikan et al., 2016; Kothari, 2004). The study participants were selected without any bias towards their health profile or professional backgrounds. The pool of study participants resulted in a decent mix of those who were either free from chronic diseases, or who suffered from chronic diseases, or who had family members or friends that had experienced the suffering from chronic diseases.

The selection parameters for the sample of quantitative data gathered in this study were outlined as follows: any individual over the age of 18 years, resident in Nyatoto sub-location, having availability or accessibility to a mobile phone, and willing to participate in the study was eligible to be included in the study. The age limit of 18 years and above was used as the researcher wanted to survey individuals who were adults and did not need the consent of their parents or guardians to participate in the research. Moreover, according to the WHO (2012), the susceptibility and severity of chronic diseases is most rampant in age groups 18 to 65 years, with premature deaths occurring in the age groups 30 and 65, which tend to be an individual's main financially productive period of life. The participant needed to be a resident and not a visiting person to curtail the bias of misrepresenting the study population as being solely from Nyatoto sub-location. Access to a mobile phone was a primary requirement, since the study evaluated factors that would influence its adoption. In this case, access did not mean ownership or permanent availability; a handset could be shared, provided access to information sent through the phone would be accessible by all study participants.

### 4.5.2 Sample Population

Selecting the appropriate study participants, and ascertaining the sample size, are very important for accurate reporting of any research (Kothari, 2004). The researcher is advised to take as big a sample as possible for the study if resources for data collection permit. This ensures that another researcher using a similar sample of the same size would come up with comparable findings (Taherdoost, 2016).

The Kenyan population census is conducted every 10 years. At the time of data collection for this study, the latest census was dated 2009 (KNBS, 2010). Therefore, the researcher decided to go by the more recent statistics provided by the World Bank

(2013) annual report, which indicated that individuals aged 18 years and older comprised 60% of Kenya's total population. Therefore, applying these statistics to Nyatoto sub-location, 60% of its total population of 3 476, comes to 2086 people, which would form the study population. Due to time limitations, lack of funds, a lack of accessibility to reach the entire study population and affiliated resource constraints, a minimum representative sample size was calculated using Calmorin and Calmorin's (2007) formula:

$$SS = \frac{NV + [Se^2 (1 - P)]}{NSe + [V^2 \times P(1-p)]}$$

where,

SS = sample size

N = total population = 2 086

V = the standard deviation value = 2.58

Se = sampling error = 0.01

P = the largest possible proportion = 0.50 (adjusted for developing countries)

The sample size was obtained as follows:

$$\frac{(2086 \times 2.58) + [0.01^2 \times (1 - 0.50)]}{(2086 \times 0.01) + [2.58^2 \times 0.50 (1 - 0.5)]} = \frac{5381.88}{22.52} = 239$$

Two hundred and thirty-nine (239) participants would make up about 11.5% of the total population. For a sample to be representative it should be between 10% and 20% of the total population (Calmorin & Calmorin, 2007), therefore 11.5% would be an acceptable proportion. However, the actual data collection exercise gathered 315 responses, as has been explained in section 5.1 of Chapter five.

## 4.6 DEVELOPING, REFINING AND VALIDATING SURVEY QUESTIONNAIRE

The design and development of the research instrument was a multi-step, carefully planned process. The outcome of a study according to meeting the study's objectives depends heavily on an accurately designed research instrument (Kothari, 2004). The type of data that is collected using a survey questionnaire is either an opinion,

behaviour, or attitude of the research participant (Saunders et al., 2016). Regarding this study, the respondents' opinions on the factors that would influence their uptake of mobile phones to receive healthcare education and awareness of chronic diseases needed to be captured.

The first stage of the questionnaire design was to identify the variables that were to be tested (Jackson, 2009). These were extracted from the study hypotheses, which identified the following: the dependent variable, which in this case was the adoption of mobile phones; the independent variables, which were the individual, social, health and technological factors that influenced the dependent variable; and any extraneous variables, such as the basic literacy, language literacy, and demographics of the research participants that could possibly influence the adoption of mobile phones.

The second stage consisted of drawing up a data requirements table with the following columns: the name of the independent variable; the questions created to capture the theoretically proposed influence of the given independent variable on the dependent variable; and the mode of response for each question (Kothari, 2004). The type of response could vary – from an open-ended unstructured response; a binary choice response, which would generally be a yes or a no; or a Likert-type gradual scale that could be a four-, five-, or even seven-point response (Jackson, 2009). Regarding this study, a five-point Likert-type scale was used to test all study hypotheses (Hosseini et al., 2015; Preusse et al, 2017; Vermandere et al., 2016; Yang et al., 2016).

The third stage entailed pre-testing of the data table by getting expert opinion to verify whether the questions were appropriately developed to measure each independent and extraneous variable and its theoretically proposed influence on the dependent variable (Saunders et al., 2016). Five health professionals from Kenya Hospices and Palliative Care Association were selected using purposive sampling method for the process of pre-testing the questions. Palliative care is provided to patients with chronic and life-threatening diseases and their caregivers; thus, their expertise seemed appropriate to add value to this study. The sample used was purposive as the health professionals who were targeted needed to have experience in public health in chronic diseases. The data table was presented along with a complementary sheet that had the following options for every question: i) Very strongly represents the variable, ii)

Somewhat strongly represents the variable, iii) Unsure, iv) Somewhat weakly represents the variable, v) Very weakly represents the variable.

After analysing the feedback, some of the questions were modified. For instance, under the section on perceived susceptibility, the original question was worded as, “I feel at risk of getting chronic diseases”. This was subsequently divided into five questions, each capturing the respondents’ susceptibility to individual chronic disease namely, hypertension, obesity, heart disease, diabetes, and cancer. This led to the development of version one of the questionnaire.

The fourth stage in the questionnaire development was pilot-testing version one of the questionnaire on ten participants in the study site. This involved testing the research instrument by individuals who typically represented the study population but were not considered part of the study population (Kothari, 2004). The participants were randomly selected from the study site. The participants suggested that the questionnaire should be translated into the local Dholuo language.

The fifth stage in the questionnaire development was to translate the final questionnaire into the local Dholuo language for ease of understanding by the research participants. For this process, a research assistant was sought who was a local resident of the study area and had some previous experience translating English research instruments into the locally used Dholuo language. His research experience added value to the ease of translation, without losing the intended significance and meaning of the questions. The translated questionnaire is attached as Appendix III of this document.

After the questionnaire was developed, the next stage involved seeking the approval of the university supervisor and the university ethics committee. Subsequently, an information sheet containing information about the study's approved purpose, and contact details for the researcher and the supervisor was prepared. A consent form for the research participants’ approval to participate was also developed. This clarified that the respondents were free to withdraw from the study at any stage. At the time of data collection, each participant signed the agreement to give the researcher permission to collect their data before filling in the questionnaire. The evidence of this stage is presented in Appendix I and II of this document.

The final questionnaire in English is attached in the annexe section of this document (Appendix II). The title of the questionnaire matched the title of the study. The first page contained the date when the questionnaire was completed, the serial number of the questionnaire, the information about the study, and the participant's consent form. The questionnaire's date and its serial number were filled in by the researcher when administering the questionnaire; the document also included an introduction to the study, the ethics statement, and the consent form, along with the researcher and the supervisor's contact address.

Section A of the questionnaire captured the demographic information of the respondents: age bracket, gender, marital status, occupation, their monthly income, and education level. The subsequent sections tested the respondents' perceptions of the proposed influence by the independent and dependent variables on their adoption of mobile phones to receive healthcare education and awareness on chronic diseases. These sections were: B) language literacy level, which tested their proficiency in English, Kiswahili, and Dholuo, C) perceived susceptibility to chronic diseases, D) perceived severity of chronic diseases, E) perceived usefulness of mobile phones, F) perceived ease of use of mobile phones, G) social influence from the family, friends, community, community leaders, and religious leaders on the adoption of mobile phones, H) intention to use mobile phones, and I) actual mobile phone use.

The final section of the questionnaire was filled in by the researcher upon completion of the questionnaire. It contained the name, signature, and date when the questionnaire was filled. It was signed immediately after the respondent had completed the questionnaire and the researcher had verified that all questions were completed and the responses were legible. This was a step taken to ensure that the data would be of good quality at the later stage of transcription and transfer of data for analysis.

### 4.7 ETHICAL CONSIDERATIONS

The generally accepted ethical principles that mainly concern possible effects on human subjects (Clar et al., 2014; Rothstein et al., 2020) who are involved in research are were adhered to: non-maleficence (not harmful), beneficence (providing some benefit), autonomy (respecting the individual in terms of gaining informed consent,

confidentiality, no deception), and adhering to justice (fair to all, especially minorities). All these tenets were observed in the data collection process.

The researcher obtained permission from the University of the Western Cape for data collection within the study area. The ethics clearance document is attached in the annex section of this document as Appendix I.

### 4.8 DATA COLLECTION PROCEDURE

As the research was self-sponsored, resources such as finances and time at the researcher's disposal were limited. Therefore, for this study, questionnaires were administered to the research participants at central community places to reduce the time used for distribution. Assistance was provided by local community leaders to inform the community members of the venue, time and selection parameters for conducting the survey.

The potential study participants were screened to ensure that they fit into the set research criteria: an individual older than 18 years, being resident in Nyatoto sub-location, having availability and/or accessibility to a mobile phone, and willing to participate in the study was eligible to be included in the study.

### 4.9 DATA ENTRY AND CLEANING

At the end of the daily administering of the questionnaires, the research team which consisted of trained researchers from the study area, met to verify that all questions were answered neatly, the signature of the respondent was present on the questionnaire, the completed questionnaires were signed off by one of the research team members, and the date and unique serial number were filled in on all the questionnaires.

There were two centrally located electronic worksheets, A and B, which were created on one of the laptops, and they were accessible on the laptops of each member of the research team. The purpose of the two sheets, whose structure was designed as duplicate copies of each other, was to allow for double entry and proofreading to ensure data quality. The data from the questionnaires collected each day was entered into the central worksheets daily. One member entered the data on sheet A. The second member entered the data from the same questionnaires on sheet B. The third

member conducted proofreading to check the validity of the data such that it matched on both sheets. The lead researcher had access to all the data at all times to conduct impromptu checks on it. Throughout the data collection exercise, no questionnaire was lost or misfiled, as the research team was always available on-site to do the necessary checks.

## 4.10 DATA STORAGE AND SECURITY

Back-up files were stored using external backup storage devices and the cloud, using Dropbox software cloud storage and the cloud storage available on the Drive provided by the Google group of applications. The backing up of all data was done daily to avoid any possibilities of data loss. The original questionnaires and interview scripts were stored in lockable drawers at the research office for confidentiality and security purposes. The data will be available for five years from the date of collection.

## 4.11 DATA ANALYSIS

The study used quantitative data analysis, which keeps the researcher's bias out and focuses on extracting numerical values and their correlations to uncover the truth through a positivist approach (Muijs, 2010). In quantitative analysis, numerical data is gathered using survey questionnaires and analysed statistically to test the study hypotheses and reveal trends among the studied variables (Saunders et al., 2016). Quantitative analysis methods provide a combination of descriptive and inferential results. The people or things that provide data are known as units or cases, whereas the data that is collected from them are termed variables (Muijs, 2010).

The seven steps of quantitative data analysis as described by Bannon (2013) were to create a study map; enter data into statistical analysis software; check data integrity; perform univariate analysis; perform bivariate analysis; perform multivariate analysis; and to report on the results of analysis including hypotheses testing (Bannon, 2013).

The Statistical Package for the Social Sciences (SPSS) version 23 and AMOS version 23 were utilised for analysis in this study. The purpose of statistical analysis was to test the variables extracted from the various behavioural theories and models explained in Chapters three of this document, test their inter-dependencies and dependency on the adoption of mobile phones, and to test the theoretically proposed

hypotheses. Details of the data analysis strategy and procedure, the results, and the discussion of the results are all presented in the subsequent chapter.

## 4.12 CONCLUSION

This chapter presented the entire research road map. It began by highlighting the three distinct types of ontologies which are subjectivist, constructivist and objectivist, and explained why this research selected the objectivist ontology. The four key epistemological approaches were discussed namely postpositivism, social constructivism, transformatism and pragmatism, while reasons presented on why this research opted to use the postpositivist style of research approach. It went on to deliberate upon the three kinds of research methodologies which comprise the qualitative, quantitative, and the mixed methods methodology. This study chose the quantitative methodology which further used survey questionnaire as the prime data collection instrument. The next section illustrated the random type of sampling technique used, the calculation of the sample size which was at 239 participants, the data collection procedure, and the design, development, and validation of the data collection instruments, followed by the data analysis methods proposed in this study. After covering ethical considerations, the actual data collection procedure was demonstrated in the subsequent section of this chapter. The chapter concluded by providing an outline of the seven steps that would be followed in the next chapter which tackled with the complete data analysis process.

# CHAPTER FIVE

# DATA ANALYSIS AND DISCUSSION

## 5.1 INTRODUCTION

This chapter presents and discusses the results of the analysis of the collected data. The chapter adds to the development of an integrated model that addresses the perceived influence of individual, social, health, and technological factors on mobile phones used by individuals in rural Kenya to receive healthcare education and awareness of chronic diseases. The dataset comprised 315 respondents, corresponding to 15.1% of the study population, which exceeded the initially calculated sample size of 239 responses.

Statistically, having a greater number of respondents than the sample size calculated earlier enhanced the sufficiency of data for analysis, as the sample tended to be closer to the population size (Kumar, 2011). According to Creswell and Creswell (2018), a larger sample size is more representative of the population, limiting the margin of error and the influence of outliers or extreme observations. In most scientific inquiries, a sufficiently large sample size is recommended to produce significantly different variables (Kumar, 2011).

## 5.2 DATA ANALYSIS STRATEGY

This study employed five stages of data analysis, namely: i) management of collected data to ensure its completeness and quality, and for correction of errors using Microsoft Excel 2013 ©™ (MS Excel); ii) using the Statistical Package for Social Sciences ©™ (SPSS) version 23 to perform checks for missing data, as presented in section 5.3.1, for outliers, as explained in 5.3.2, for data reliability, as presented in 5.3.3, and tests for data validity, as discussed in 5.3.4; iii) analysing the demographics of the respondents using SPSS, discussed in 5.4; iv) followed by testing the model and v) testing the hypotheses. Both of the last two points were conducted with the aid of AMOS for SEM.

SEM was chosen as the statistical analysis method for this study because it has been used in previous psychological studies to determine and predict behaviour change among individuals (Byrne, 2010), and it has also shown advantages over other

regression methods (Civelek, 2018). SEM is an advanced set of statistical tools used to test a model against empirical data by simultaneously analysing the observed and latent variables to find possible relationships and patterns among them (Lowry & Gaskin, 2014). Latent variables, also referred to as factors, are theoretical constructs that cannot be measured directly, but are measured through the observed variables, which are called the indicators (Byrne, 2010). For this study, mobile phone use was a latent variable and was measured through the observed variables (indicators), such as perceived severity, perceived usefulness and others, as discussed below.

Lowry and Gaskin (2014) propose that, whereas multiple regressions and correlations may be used as the first-generation regression analysis that explores various relationships between factors, SEM is considered a second-generation analysis, as it has several advantages. Four of these advantages were realised in this study. Firstly, it allowed for the simultaneous analysis of multiple variables instead of a separate analysis of individual variables. The correlation between two or more observed variables, such as perceived usefulness and perceived ease of use, was presented alongside their interaction with the latent variable, i.e. mobile phone use. This saved time and effort while making it easier to understand the interactions. Secondly, using SEM, the reliability and validity of the proposed variables in the model were tested concurrently. The output is presented in sections 5.3.3 and 5.3.4, respectively. Thirdly, SEM helped in revealing the relationships among variables that were not previously hypothesised and measured directly. In this study, language literacy was hypothesised to influence the perceived usefulness and perceived ease of use of mobile phones. However, the analysis revealed that language literacy also had a significant effect on the outcome, namely mobile phone use. This was an important output, which was not measured earlier. It is further discussed in section 5.6 of this chapter. Finally, the model for this study that was being tested had multiple variables, multiple interactions, and several direct and other indirect relationships, which were all tested in parallel using SEM, which has been found useful to test similar complex models in past studies (Civelek, 2018).

## 5.3 DATA TREATMENT AND PREPARATION

### 5.3.1 Missing Data

Initial data management was done to ensure all questionnaires were duly completed. Each questionnaire was physically checked for completeness and legibility before capturing its data on an MS Excel spreadsheet. A questionnaire was considered to be complete if all the questions had been answered, duly signed by the respondent and signed off by the researcher.

An additional missing value analysis ([MVA], (Hair, Black, Babin, & Anderson, 2014) was conducted using SPSS by analysing each variable individually to check if all the variables tallied with the expected output of 315. The MVA test showed that there was no missing data. This test was crucial, because missing data would have influenced the outcome of the analysis. Several factors contributed to avoiding missing responses: i) the questions were unambiguous, with five-point Likert scale choices. This aided in narrowing down the responses to the choices provided instead of open-ended, unstructured answers, thus making it easier to code them; ii) once a questionnaire was filled in, it was checked for completeness and legibility at the survey site; and iii) care was taken during the transcription and data entry steps. The data was subjected to double entry to catch any potential errors during the entry process.

### 5.3.2 Outliers

Outlier observations are out-of-range (ambiguous/inconsistent) responses in a majority of the responses and could inappropriately influence the outcome of the analysis (Hair et al., 2014). The Mahalanobis distance was computed using SPSS (Lowry & Gaskin, 2014) to test multivariate outliers by testing the distance score of one observation from the mean of the cluster of other observations. Lowry and Gaskin (2014) suggest that, where the p-value calculated on the log of the Mahalanobis distance score falls below the ‘critical value’ based on the p-value ($p < 0.001$), then it is considered to be an outlier. The computation showed seven outliers in the dataset, all with a p-value score of below 0.001.

There are three recommended ways to treat outliers: elimination, manual modification of data, and estimation (Kwak & Kim, 2017). Careful observation revealed that, whereas most respondents had selected Agree, Neutral, and Disagree, these seven

respondents had preferred Strongly Agree or Strongly Disagree as their choice of answers or options to various questions from different sections of the questionnaire. Thus, these came up as extreme cases in the dataset. Since the actual number of responses collected (315) was higher than the computed sample size of 239, seven outliers were eliminated from the remainder of the analysis on the strength of the rich dataset.

### 5.3.3 Data Reliability

Reliability measures the internal consistency – the degree to which responses are consistent across the items within a given scale (Kline, 2011). It is a measurement of consistency in terms of obtaining the same result from a given sample (measure) under the same conditions. Testing reliability ensures that observed indicators consistently measure the variable and are strongly correlated (Kline, 2011). In this case, the individual questions were the indicators, and the section of the questionnaire formed a particular variable being measured, for instance perceived susceptibility was a variable that was measured using seven questions (indicators). The reliability of the observed variables was analysed using SPSS to determine the Cronbach's alpha values. A Cronbach's alpha value of 0.7 is considered adequate and acceptable to define a given construct, while a value of above 0.7 is considered good (Saris & Gallhofer, 2014). The Cronbach's alpha for each variable was above 0.800, the highest being 0.946 and the lowest being 0.802, as shown in Table 5.1. The questions for each measured variable (section of the questionnaire) were related to the specific variable and represented it adequately.

**Table 5.1: Reliability Test**

| Variable | Cronbach's Alpha |
|---|---|
| Language Literacy | 0.942 |
| Perceived Susceptibility | 0.802 |
| Perceived Severity | 0.926 |
| Perceived Usefulness | 0.859 |
| Perceived Ease of Use | 0.918 |
| Social Influence | 0.833 |
| Intention to Use Mobile Phone | 0.926 |
| Mobile Phone Use | 0.946 |

### 5.3.4 Validity

Variables measuring perceptions of social influence on an individual's intention to use mobile phones used a set of indicators such as the effect of family, cultural beliefs and the influence of significant peers in the society. These variables were measured through separate questions. Since all questions in this case needed to measure social influence, for example, all questions had to lead towards the same variable; this is known as the convergent validity of the variable. On the other hand, the discriminant validity of variables states that one variable's questions (indicators) should be worded so as not to measure more than one variable (Kline, 2011).

Principal component analysis (PCA) using SPSS was employed to determine the variables' convergent and discriminant validity. PCA is a technique for reducing the dimensionality of datasets, increasing their interpretability, while at the same time minimising information loss (Jolliffe & Cadima, 2016). The PCA approach is an exploratory factor analysis method that is used to represent covariance or relationships between and among variables (Lowry & Gaskin, 2014).

PCA relies on five assumptions (Lowry & Gaskin (2014): 1) The data should have multiple variables measured using a ratio or ordinal scale, such as a five- or seven-point Likert scale. All sections of the questionnaire had multiple indicator variables, and a five-point Likert scale was employed. 2) The variables need to have a linear relationship. This step is tested in PCA using a correlation matrix. 3) The data should have adequacy measured within the PCA by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for the dataset. A value above 0.8 is adequate, with values above 0.8 and equal to 1.0 being good. For this dataset, the KMO test returned a value of 0.910, which confirmed that the dataset was adequate. 4) The data should be suitable for data reduction by having good correlations between the indicators for the indicators to be reduced to a smaller number of components. The method used by SPSS to detect this is Bartlett's test of sphericity, which returned a p-value of 0.000. A p-value is a measure of probability and is significant when it is below 0.001. Thus, the dataset met the fourth assumption for PCA. 5) The data should have no outliers. Outliers were dealt with in the earlier section and the data being tested for PCA was free of outliers. Thus, all five assumptions for PCA were met sufficiently.

The dataset tested 8 variables: Language Literacy, Perceived Susceptibility, Perceived Severity, Perceived Usefulness, Perceived Ease of Use, Perceived Social Influence, Intention to Use, and Mobile Phone Use. Seven of these variables had seven indicators each, while Language Literacy had 12, producing 61 indicators.

Four stages were followed in the PCA process. In the first stage, the eigenvalue was used to construct the factors. The eigenvalue is a measure of how much of the observed variance in the indicators is explained by a factor (Jolliffe & Cadima, 2016). Any factor with an eigenvalue greater than or equal to 1 explains higher variance than a single observed indicator. The PCA test was done using the criteria of eigenvalues greater than 1. The test produced 10 factors, with a varying number of indicators, with some cross-loading on more than one factor.

In the second stage, the indicators that were used to measure the respondents' proficiency in reading, writing, speaking, and listening to the Dholuo language were found to cluster together as a separate factor. This was also supported by the proficiency levels in Dholuo of at least 88% of the respondents being above average. Since the purpose of PCA is to reduce the factors, it was decided to eliminate Dholuo from the languages tested. The indicators that measured English and Kiswahili's proficiency were retained, and the factor was named language literacy.

The third stage resulted in dropping low-loading indicators. Field (2013) suggests that if any indicators of variables have many correlations below 0.3, one could consider excluding them, thus such indicators were dropped to obtain factors that had better-correlated indicators. The indicators dropped were: voice call from mobile phone use; cultural beliefs, which was originally an indicator for social influence but was loading on perceived severity, with a loading of below 0.3; and easy forward from perceived usefulness. Voice call was measuring if respondents could use the voice call feature on a mobile phone satisfactorily. It seemed to have been a redundant question, as all respondents could use this feature well, thus the low factor loadings. Cultural beliefs were meant to measure if the respondents' societal norms would allow them to use mobile phones to receive health literacy. Instead of loading on social influence, the indicator loaded on perceived severity, with a low score, thus revealing a low significance of the factor. Lastly, the easy forward indicator measured the perceived

usefulness of a text message by being forwarded or shared easily. This also loaded with a score of below 0.3, thus revealing its non-significance on the factor.

The fourth stage assessed cross-loading of indicators on several factors (Lowry & Gaskin, 2014). Some of the indicators correlated above 0.3 and below 0.6, but were loading on more than one factor. Instead of using the eigenvalue greater than one, factors were restricted to seven in this stage, while coefficients were constrained at 0.55 and promax rotation was used. Promax is an oblique rotation that allows factors to be correlated Field (2013). Subsequently, having confirmed the indicators that were not representing a given factor well, these were excluded from that variable. At this stage it was revealed that the observed indicators for the two variables, namely perceived ease of use and intention to use, were clustered together. It may therefore, be inferred that if the rest of the contributing factors favoured the respondents' adoption of mobile phones, and if they believed that the least effort would be needed for them to use the mobile phone text messages, the resultant behaviour of the respondents would be direct usage (adoption) of mobile phones. The flip side would be that if the other factors were not suited to the respondents, or if they felt that it would be difficult to use mobile phone text messages, they would out rightly reject the mobile phones. There would be no room for swaying their intention towards adoption.

Subsequently, the combined indicators were grouped and confirmed to represent the perceived ease-of-use factor. This was later validated by confirmatory factor analysis, discussed in section 5.5, which saw the latent factor, that is, intention to use, being insignificant. The final output resulted in seven well-represented factors, namely Language Literacy, Perceived Susceptibility, Perceived Severity, Perceived Usefulness, Perceived Ease of Use, Perceived Social Influence, and Mobile Phone Use, which are shown in Figure 5.1 below.

Thus, for the principal component analysis, the final settings, which yielded satisfactory results as explained in the section above, were promax rotation, number of factors fixed at seven, and constraining the value of coefficients to 0.55. The PCA output brought about a value of 0.910 for KMO, proving adequacy, and Bartlett's test of sphericity proved significant at a p-value of 0.000 (< 0.0001).

| PERCEIVED EASE OF USE (PEOU) | | LANGUAGE LITERACY (LL) | | MOBILE PHONE USE (USE) | | SOCIAL INFLUENCE (SI) | | PERCEIVED SEVERITY (PSEV) | | PERCEIVED SUSCEPTIBILITY (PSUS) | | PERCEIVED USEFULNESS (PU) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| USE VIDEO | 0.960 | SPEAKING KISWAHILI | 0.946 | AWARENESS DIET | 0.857 | FAMILY USED | 0.925 | STRAINED FAMILY | 0.929 | RISK OF OBESITY | 0.854 | PERSONALIZED | 0.880 |
| USE VOICE MESSAGE | 0.945 | LISTENING KISWAHILI | 0.907 | RISK FACTORS CHRONIC | 0.851 | FAMILY APPROVED | 0.902 | ECONOMIC BURDEN | 0.855 | RISK OF HEART DISEASE | 0.851 | FUTURE REFERENCE | 0.807 |
| USE MOBILE PHONE | 0.937 | WRITING KISWAHILI | 0.900 | PREVENT CHRONIC | 0.846 | RELIGIOUS LEADERS APPROVED | 0.890 | PSYCHOLOGICAL STRAIN | 0.847 | RISK OF CANCER | 0.835 | NOT TIME BOUND | 0.798 |
| USE TEXT MESSAGE | 0.892 | READING KISWAHILI | 0.874 | AWARENESS LIFESTYLE | 0.813 | COMMUNITY USED | 0.888 | EARNING CAPACITY | 0.815 | RISK OF DIABETES | 0.773 | | |
| VOICE_MESSAGE | 0.887 | SPEAKING ENGLISH | 0.851 | SIGNS SYMPTOMS CHRONIC | 0.801 | RELIGIOUS LEADERS USED | 0.857 | QUALITY LIFE | 0.811 | RISK OF HYPERTENSION | 0.730 | | |
| VIDEO_MESSAGE | 0.851 | WRITING ENGLISH | 0.847 | MANAGE CHRONIC | 0.801 | COMMUNITY APROVED | 0.842 | LIFE EXPECTANCY | 0.761 | | | | |
| USE APP | 0.843 | LISTENING ENGLISH | 0.847 | TYPES CHRONIC | 0.786 | | | HEALTH PROBLEM | 0.605 | | | | |
| APPS | 0.805 | READING ENGLISH | 0.840 | | | | | | | | | | |
| TEXT_MESSAGE | 0.717 | | | | | | | | | | | | |
| USE INTERNET | 0.709 | | | | | | | | | | | | |
| RECOMMEND MOBILE PHONE | 0.689 | | | | | | | | | | | | |
| NO ASSISTANCE | 0.650 | | | | | | | | | | | | |
| INTERNET | 0.636 | | | | | | | | | | | | |

**Figure 5.1: Output of Principal Component Analysis**

## 5.4 DEMOGRAPHIC INFORMATION OF RESPONDENTS

This section describes the demographic information of the respondents who took part in this study. The youngest age bracket of 18 to 20 years comprised 3.8% of the respondents, while the oldest participants, aged 61 to 80 years of age, comprised 13.9%. The rest of the participants fell between 21 and 60 years old, making up 82.3% of the respondents.

The results showed that only 12.4% earned a monthly income of above Ksh 10 000. Another 41.3% reported a monthly income of between Ksh 3 001 and 10 000. The majority of the respondents (46.3%) specified their monthly income to be less than Ksh 3 000 (USD 30), hence a daily income of less than USD 1.00. The United Nations has stipulated an income of below USD 1.90 a day to be a state of abject poverty (WHO, 2012). Thus, at least 46.3% of the study population lived in abject poverty. Chronic diseases further posed a long-lasting healthcare burden on the affected and their loved ones, including the affected families being subjected to increased poverty at an accelerated rate, thereby stifling their opportunities for financial and social development (Anderson-Lewis et al., 2018; Beratarrechea et al., 2016; Dou et al., 2017). In this regard, this study is important since it proposed to educate the population of the study area on the prevention and maintenance of chronic diseases, thereby aiming to counter the potential incremental poverty caused by the chronic disease burden.

The most common occupations reported in the study area were fishing, at 32.4%, farming, at 26.0%, and business, at 11.4%, while 6.35% described themselves as housewives. The remaining 23.8% of respondents came from other miscellaneous occupations, such as teachers, community health workers, clergy, and the like.

Education levels for the study participants were varied, with 22.9% of them who had only completed secondary school, 50.5% had gone to acquire an additional certificate in different skills, while another 14% had a diploma or a degree level of education. This was representative of a fair academic distribution among the population under study. Only 12.7% of the participants reported no schooling or schooling only up to the primary level of education.

Figure 5.2 below presents the gender aggregated data on the various sections of the questionnaire.

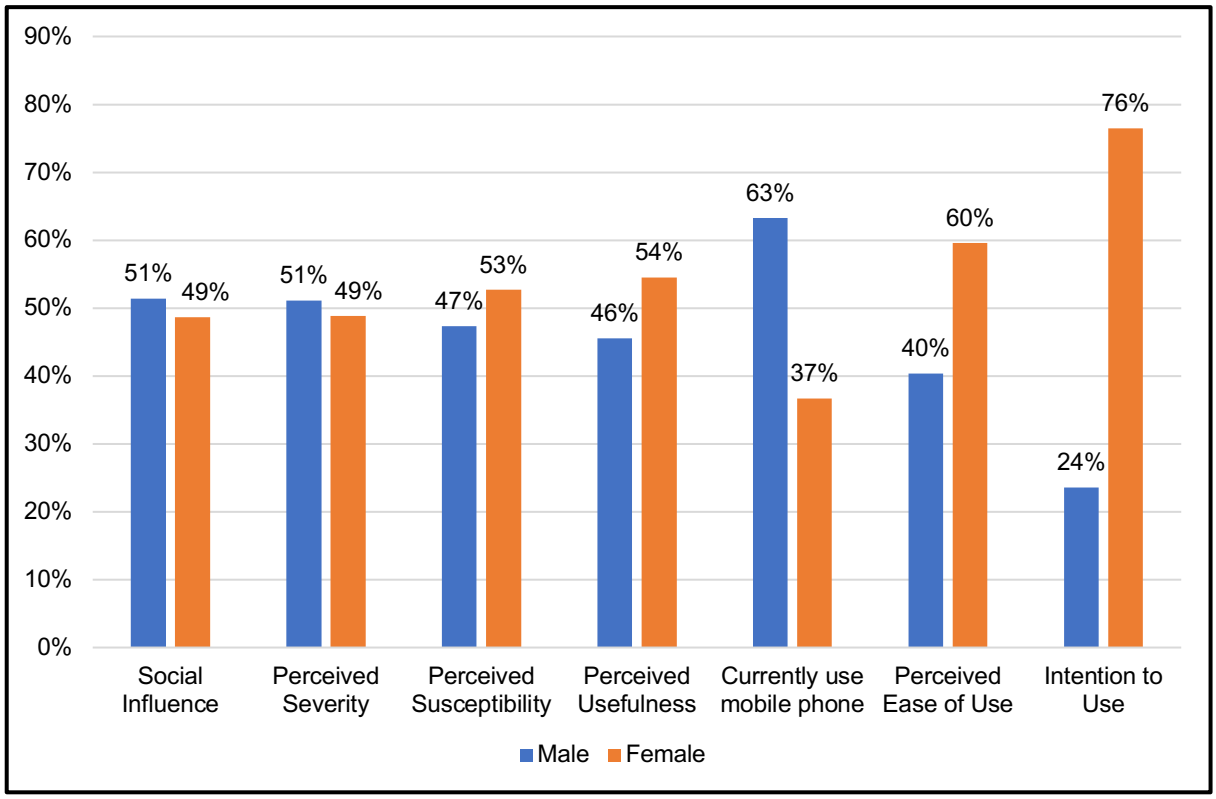


**Figure 5.2 Gender Aggregated Data**

Both male and female respondents showed similar opinion towards their significant peers informing their decision on using the mobile phones for education and awareness on chronic diseases. They also agreed likewise on feeling that the chronic diseases could have a severe effect on them. The female respondents showed a slightly higher susceptibility to the chronic diseases.

In the case of technological factors, 54% of the female and 46% of the male respondents were of the opinion that mobile phones would be beneficial to use for health literacy. Although only 37% of the females were currently using the mobile phones as compared to 63% of the males however, 60% of the females believed that it would be easy to use them to receive health literacy on chronic diseases as compared to their counterparts (40%).

What was interesting to note was that only 24% of the males exhibited an intention to use mobile phones for health literacy whereas 76% of the female respondents projected to use them. The above synthesis revealed that for successful adoption of

mHealth in the study population, the perceived ease of use of mHealth technology was of paramount importance. This would be tested again in the subsequent sections through the use of model testing techniques.

### 5.4.1 Language Literacy

The fluency level in the three languages, namely English, Kiswahili, and Dholuo, was tested using five-point Likert-scale type of questions. The options ranged from Strongly Agree to Strongly Disagree on being fluent in the language in question. The option Strongly Agree to fluency was coded as Very High fluency, and Strongly Disagree meant Very Low levels of fluency. The results are shown in Table 5.2 below.

**Table 5.2: Basic Language Proficiency**

| Language/ Proficiency | Dholuo | English | Kiswahili |
|---|---|---|---|
| Very high (%) | 68 | 16 | 14 |
| High (%) | 20 | 12 | 9 |
| Average (%) | 10 | 17 | 21 |
| Low (%) | 1 | 27 | 29 |
| Very low (%) | 1 | 28 | 27 |

In this study, 98% of the respondents confirmed having either average, high or very high proficiency in reading, writing, speaking, and listening to the Dholuo language. Only 2% stated their levels to be low and very low. Average or above-average proficiency in the English language was reported to be 45% cumulatively, while 44% reported average or above-average proficiency levels in Kiswahili. Dholuo is the native language of the people within the Suba sub-county, hence could be the reason for the higher proficiency scores of the respondents.

## 5.5 MODEL TESTING

Confirmatory factor analysis (CFA) was used to test specific hypothesised models of how observed variables relate to latent factors. CFA efficiency measurement relies on the testing of theory. The recommended indices to report on the good fit of a model are a combination of Pearson's chi-square (X2), degrees of freedom (Df), probability value (p-value), minimum discrepancy divided by its degrees of freedom (CMIN/DF), the Bentler-Bonett normed fit index (NFI), the relative fit index (RFI), Bollen's incremental fit index (IFI), the Tucker-Lewis index (TLI), the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the Akaike

information criterion (AIC). These model fitness measures are not affected by sample size and parameter estimates (Taasoobshirazi & Wang, 2016).

### 5.5.1 Measurement Model

The model contained the following variables:

Five observed, endogenous variables determined by the interaction of other variables in the model. These were USE (Mobile Phone Use), PEOU (Perceived Ease of Use), PU (Perceived Usefulness), SI (Social Influence), BI (Behavioural Intention to Use).

Four Observed, exogenous variables, which are not dependent on any other variables in the model as they are independent; however, they influence the exogenous variables. These were: LL (Language Literacy), AGE (Age), PSEV (Perceived Severity), PSUS (Perceived Susceptibility).

Five Unobserved, exogenous variables (error terms): ePEOU, ePU, eSI, eBI, eUSE.

The original model used all five observed endogenous, all four observed exogenous, and the five unobserved exogenous variables with the interactions as per the study hypothesis presented in the theoretical framework in section 3.15 in Chapter three. Table 5.3 below shows the steps taken to modify the model to arrive at a good measure of model fit.

Each step towards the model's adjustment was informed by the modification indicators suggested by the SEM procedure, and justified by the theory behind the interactions. In the step to achieve model M7, as illustrated in the Table 5.3 below, the variable BI was removed for three reasons: i) BI did not influence any other variable, including USE, which was the outcome variable; ii) BI did not have a significant influence directed from any other endogenous or exogenous variable in the model, with all standardised regression weights showing less than 0.1; and iii) as per the squared multiple correlations in the model, BI had a value of 0.024, which signified that the predictors of BI represented only 2.4% of its variance.

**Table 5.3: Steps for the Goodness of Model Fit**

| Model | Modification | X2 | Df | p-value | CMIN/DF | NFI | RFI | IFI | TLI | CFI | RMSEA | AIC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **M0** | Original Model | 256.29 | 18 | 0.000 | 14.24 | 0.75 | 0.50 | 0.76 | 0.51 | 0.76 | 0.21 | 310.29 |
| **M1** | M0 + SI <--- PSEV | 103.38 | 17 | 0.000 | 6.08 | 0.90 | 0.79 | 0.91 | 0.81 | 0.91 | 0.13 | 159.38 |
| **M2** | M1 + AGE <--> LL | 45.15 | 16 | 0.000 | 2.82 | 0.96 | 0.90 | 0.97 | 0.93 | 0.97 | 0.08 | 103.15 |
| **M3** | M2 + Remove USE <--- PSEV | 45.16 | 17 | 0.000 | 2.66 | 0.96 | 0.91 | 0.97 | 0.94 | 0.97 | 0.07 | 101.16 |
| **M4** | M3 + Remove USE <--- SI | 45.18 | 18 | 0.000 | 2.51 | 0.96 | 0.91 | 0.97 | 0.95 | 0.97 | 0.07 | 99.18 |
| **M5** | M4 + Remove USE <--- BI | 45.33 | 19 | 0.001 | 2.39 | 0.96 | 0.92 | 0.97 | 0.95 | 0.97 | 0.07 | 97.33 |
| **M6** | M5 + Remove USE <--- PU | 46.00 | 20 | 0.001 | 2.30 | 0.96 | 0.92 | 0.97 | 0.95 | 0.97 | 0.06 | 96.00 |
| **M7** | M6 + Remove the variable BI | 43.73 | 16 | 0.000 | 2.73 | 0.96 | 0.92 | 0.97 | 0.95 | 0.97 | 0.07 | 83.73 |
| **M8** | M7 + removed PSUS ---> PEOU | 46.26 | 17 | 0.000 | 2.72 | 0.95 | 0.92 | 0.97 | 0.95 | 0.97 | 0.07 | 84.26 |
| | **Criterion for goodness of fit** | - | - | - | | **≥ 0.90** | **≥ 0.90** | **≥ 0.90** | **≥ 0.90** | **≥ 0.90** | **≤ 0.10** | - |

The final step yielded M8 as the ultimate measurement model, after removing the interaction from PSUS to PEOU. The interaction had a magnitude of 0.06, which was very weak. This could be interpreted as that the population would not necessarily find it easy to use mobile phones if they were perceived to be vulnerable to chronic diseases. It is their apparent vulnerability that is influencing the mobile phones' usefulness, where the value of interaction of PSUS on PU bears a value of 0.18. The individuals would find it beneficial to use mobile phones to receive health information when they felt susceptible to chronic diseases.

The indices as per the final model exhibited a good fit, with an $x^2$ of 46.262, a p-value of 0.000, CMIN/DF of 2.721 (< 3), an RMSEA of 0.074 (< 0.08), and all the other indices above the recommended 0.90 (Blunch, 2012; Hasman, 2015; Kline, 2011). The AIC became reduced with every modification step and was indicative of a resultant better model (Kline, 2011).

The final measurement model is presented below in Figure 5.3, followed by a discussion of the variables, their magnitude of interaction with each other, the variance explained by each of the exogenous variables, and the effect of this study's interactions.

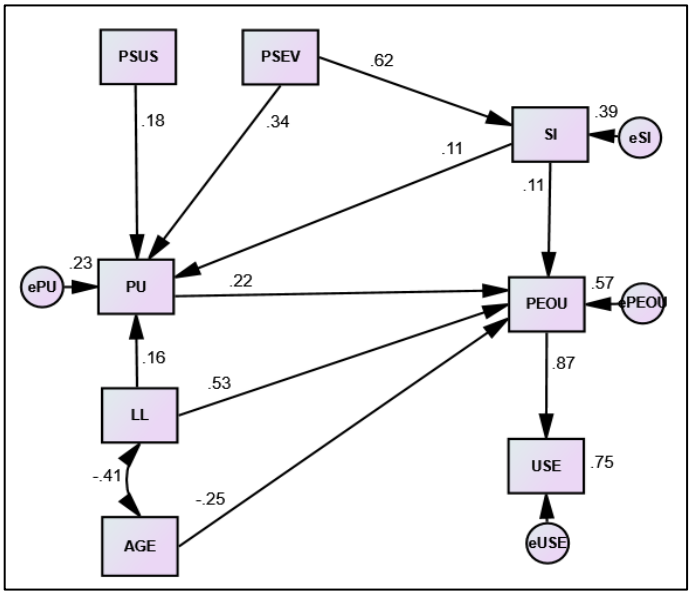


**Figure 5.3: Measurement Model Showing Relationships and Standardised Factor Loadings**

USE was the outcome variable. The squared regression coefficient, $r^2$, for USE was 0.75, which means that PEOU explained 75% of USE variance. PEOU was the only endogenous variable that directly influenced USE, where every one standard deviation increase in PEOU would bring about a 0.87 standard deviation increase in USE. This

could be inferred as mobile phones for receiving health literacy on chronic diseases are directly dependent on the population's perception of how easy it would be to use mobile phones.

Squared regression coefficient, $r^2$, for PEOU was 0.57, which means that 57% of its variance could be explained by its direct predictors, which are Age, LL, PU, and SI. The population's age influences the perception of how easy or difficult (PEOU) it would be to use mobile phones to receive health literacy on chronic diseases. This relates to the language (LL) used for the healthcare information through text messages, the perception of how useful (PU) it would be to receive the information and, finally, the influence of their social peers (SI) on the individuals.

Every one standard deviation increase in age would bring 0.25 standard deviations change in PEOU. As age is negatively influencing PEOU, older individuals would find it more difficult to use mobile phones. Thus, the majority of users of mobile phones would be from the younger population.

LL shows that every one standard deviation increase in LL would lead to 0.53 standard deviations change in PEOU. The population would find it easy to use the mobile phones and, as a result, would adopt their use for healthcare information if it was delivered in a language with which they were familiar.

PU presented an influence on PEOU, where one standard deviation increase in PU would bring about 0.22 standard deviations rise in PEOU. When the individuals found the benefits of using mobile phones to obtain health literacy, they would also perceive it easy to use the technology and adopt mobile phones.

SI also influenced PEOU, where one standard deviation increase in SI would bring about 0.11 standard deviations increase in PEOU. If significant others believed that mobile phones were easy to use, rural Kenyan individuals would mirror that belief and accept using mobile phones to receive healthcare information on chronic diseases.

The squared regression coefficient, $r^2$, for PU was 0.23, which means that 23% of its variance may be explained by its predictors, which are LL, PSUS, PSEV, and SI. LL shows a positive influence on PU, where one standard deviation increase in LL would bring about 0.16 standard deviations increase in PU. Rural Kenyans would find mobile phones beneficial if the healthcare information was delivered to them in a language in which they were proficient.

PSUS showed 0.18 standard deviations increase in PU with every one standard deviation rise in PSUS. If the population felt that they were vulnerable to chronic diseases, they would find mobile phones useful for their education and awareness of chronic diseases. Thus, their perception of mobile phones' usefulness was directly related to their belief in their vulnerability to the disease condition.

PSEV showed a good degree of influence on PU, where one standard deviation increase in PSEV would bring 0.34 standard deviations increase in PU. Those who had suffered due to chronic diseases or had experienced their friends' and family's effects were likely to see the benefit of using mobile phones to receive healthcare information about chronic diseases.

The population would believe it useful to adopt mobile phones if their significant others felt the same, and this is shown by the 0.11 increase with every one standard deviation increase in SI.

The squared regression coefficient, $r^2$, for SI was 0.39, which means that 39% of its variance may be explained by its only predictor, which is PSEV. Every one standard deviation increase in PSEV would lead to 0.62 standard deviations increase in SI. This yields the interpretation that the debilitating effects of chronic diseases felt by individuals would have a significant effect on their friends, family, or significant others in their judgement on the degree of ease of using mobile phones further, leading to their uptake.

LL and Age are highly correlated, with each one standard deviation of change in one leads to 0.41 standard deviations of change in the other. The two are negatively correlated, which would mean that, as age increases, language literacy decreases. The data results showed that the respondents from the age group 31 to 40 years exhibited the highest proficiency in each of the three languages, namely English, Kiswahili, and Dholuo. This was followed by age groups 21 to 30 years and 18 to 20 years. Conversely, the respondents from age groups 61 years to 80 years displayed the lowest proficiency in all three languages.

### 5.5.2 Structural Model

Figure 5.4 below is the graphical representation of the structural model, which shows the variables and their interactions.

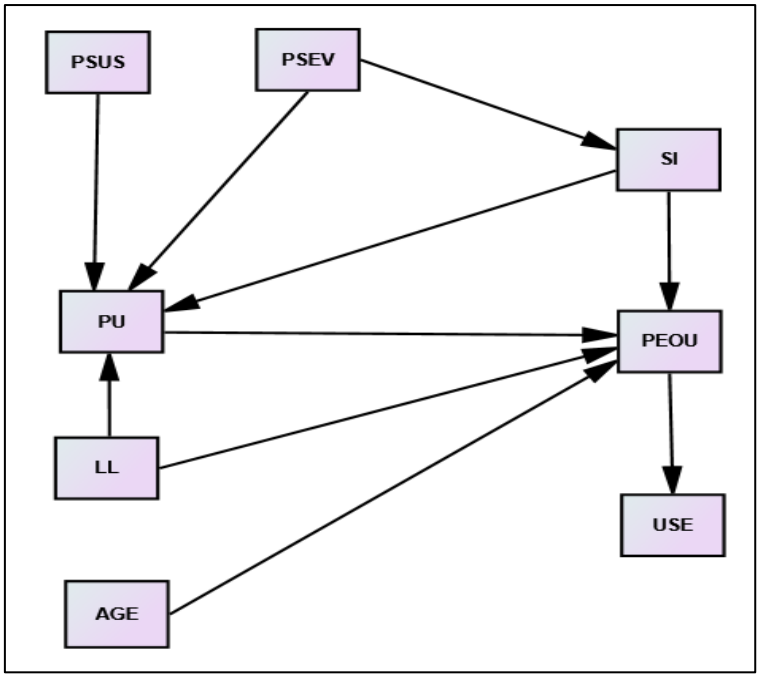


**Figure 5.4: Structural Model**

As per this model, individuals would find it beneficial (PU) to use mobile phones for receiving health literacy if they believed that they were vulnerable to chronic diseases (PSUS), and that chronic diseases had a debilitating effect (PSEV) on them or their near and dear ones. The population may also perceive the effectiveness of using mobile phones (PU) if their significant others (SI), like friends, family, or peers in the community, found them to be useful. The language (LL) used for healthcare information also influenced how the population perceived mobile phones' effectiveness (PU). If the information shared was easily understandable by people (LL), they would find it worthwhile to use mobile phones (PU). The converse would also be true here as, if the user's language was not the preferred one, they would not find it valuable to use mobile phones.

Those who have suffered or believe that they could suffer from the incapacitating effects of chronic diseases (PSEV) could influence others in the society (SI), which in turn could affect the apparent benefit (PU) and ease of use of mobile phones (PEOU).

Age, language literacy and perceived usefulness of mobile phones directly affect an individual's belief regarding the degree of ease or difficulty in using mobile phones. When the population finds it easy to use mobile phones, they are prone to adopting them to receive healthcare education and awareness of chronic diseases.

It is noteworthy to mention that behavioural intention was not a significant factor to mHealth adoption in this model.

## 5.6 HYPOTHESES TESTING

Statistical analyses were done to test the hypotheses formulated on the uptake of mobile phones for education and awareness of chronic diseases. The null hypotheses ($H_0$), which usually shows that observations are the results of pure chance, were statistically tested against the alternative hypothesis, which usually shows a real effect drawn alongside a component of chance variation (Kline, 2011).

A p-value of less than 0.001 is significant and shows strong evidence against the null hypothesis. In cases where $p < 0.001$, the null hypothesis was rejected and the alternative hypothesis was retained. Where the p-value was = 0.001, the alternate hypothesis was retained and the null hypothesis rejected. Regression coefficients of the factors, also called factor loadings, show the magnitude of the influence. This was denoted as β in the following hypothesis-testing procedure. The recommended value of β should be between 0 and 1; the closer the value is to 1, the higher the influence. Based on the measurement model's output and the p-values, the study hypotheses were tested, as shown in Table 5.4 below.

**Table 5.4 Hypotheses Testing**

| Hypothesis | | | β-value | p-value | Status |
|---|---|---|---|---|---|
| PU | <--- | SI | 0.114 | 0.070 | Rejected |
| PU | <--- | LL | 0.157 | 0.001 | Retained |
| PU | <--- | PSUS | 0.180 | *** | Retained |
| PU | <--- | PSEV | 0.335 | *** | Retained |
| PEOU | <--- | AGE | -0.247 | *** | Retained |
| PEOU | <--- | LL | 0.529 | *** | Retained |
| PEOU | <--- | PU | 0.221 | *** | Retained |
| PEOU | <--- | PSUS | 0.060 | 0.112 | Rejected |
| PEOU | <--- | SI | 0.107 | 0.006 | Retained |
| USE | <--- | PEOU | 0.867 | *** | Retained |

H1: Social influence affects the perceived usefulness of mobile phones to receive healthcare education and awareness

This hypothesis was not retained, as the p-value was higher than 0.001 (β = 0.114, p-value = 0.070), thus not significant. Therefore, the null hypothesis was retained.

H2: Language literacy influences perceived usefulness of mobile phones to receive healthcare education and awareness

Although the recommended p-value for a significant interaction is suggested as $p < 0.001$, this hypothesis was retained, as the p-value was equal to 0.001 ($\beta = 0.157$, p-value = 0.001). This was also backed by the literature, as discussed in section 3.11.1.2 of Chapter three. Hence, for this study, language literacy positively influenced the perceived ease of use of mobile phones.

H3: Perceived susceptibility influences the perceived usefulness of mobile phones to receive healthcare education and awareness

Perceived susceptibility ($\beta = 0.180$, p-value < 0.001) had a statistically significant influence on mobile phones' perceived usefulness. Thus, this hypothesis was retained.

H4: Perceived severity influences the perceived usefulness of mobile phones to receive healthcare education and awareness

Perceived severity ($\beta = 0.335$, p-value < 0.001) was statistically significant in relation to the perceived usefulness of mobile phones. Thus, this hypothesis was retained.

H5: Age influences the perceived ease of mobile phone use

Age ($\beta = -0.247$, p-value < 0.001) was statistically significant in relation to the perceived ease of mobile phone use. Thus, this hypothesis was retained. Hence, for this study, age affects the perceived ease of use of mobile phones, where the degree of ease of use decreases as the age of the user increases.

H6: Language literacy influences the perceived ease of mobile phone use

Language literacy ($\beta = 0.529$, p-value < 0.001) was statistically significant in relation to the perceived ease of mobile phone use. The β-value of this interaction (0.529) was the highest between an endogenous variable (LL) and an exogenous variable (PEOU) in this model. Therefore, in this study, language has great significance for the perceived ease of mobile phone use and this hypothesis was retained.

H7: Perceived mobile phone usefulness influences the perceived ease of mobile phone use

Perceived usefulness ($\beta = 0.221$, p-value < 0.001) was statistically significant in relation to the perceived ease of mobile phone use. Thus, this hypothesis was

retained. When the population believed that using mobile phones for chronic diseases, education and awareness would be beneficial, they also found it easy to use them.

H8: Perceived susceptibility influences the perceived ease of mobile phone use

Perceived susceptibility (β = 0.060, p-value = 0.112) was statistically not significant in relation to the perceived ease of mobile phone use. Thus, this hypothesis was not retained.

H9: Social influence affects the perceived ease of mobile phone use

Social influence (β = 0.107, p-value = 0.006) does not make a significant contribution to the perceived ease of mobile phone use. However, in the model, the perceived susceptibility to chronic diseases exhibits a strong effect on social influence, thus social influence cannot be dropped as an entire variable. Therefore, this hypothesis was retained and is backed by the literature.

H10: Social influence has an effect on the adoption of mobile phones for education and awareness of chronic diseases

This interaction between social influence and mobile phone use was dropped during the trimming of the model. Thus, this hypothesis was not retained for this study.

H11: Perceived ease of mobile phone use has an influence on the ease of use of mobile phones for education and awareness of chronic diseases

The perceived ease of mobile phone use (β = 0.867, p-value < 0.001) was statistically significant in relation to the actual mobile phone use for chronic diseases education and awareness. Thus, this hypothesis was retained. The β-value of 0.867 is significantly high, thus demonstrating the prominent effect that the perceived ease of mobile phone use has on the adoption of mobile phones for education and awareness of chronic diseases.

H12: Perceived mobile phone usefulness has an influence on the use of mobile phones for education and awareness of chronic diseases

Perceived mobile phone usefulness did not show a significant effect on the use of mobile phones. Thus, this hypothesis was not retained.

H13: Perceived severity has an influence on the use of mobile phones for education and awareness of chronic diseases

Perceived severity did not show a significant effect on the use of mobile phones. Thus, this hypothesis was not retained.

## 5.7 FACTORS INFLUENCING UPTAKE OF MOBILE PHONES

Factors that affect the use of mobile phones for chronic diseases education can be categorised into individual, social, health, and technology-related. Below is a discussion of each of these factors.

### 5.7.1 Individual Factors

The significant variables resulting from the analysis of the data gave rise to an individual group of factors, namely language literacy and age. Language literacy measured the proficiency of the respondents in English, Kiswahili, and Dholuo. Age was measured in brackets, ranging from 18 to 20 years, followed by ten-year intervals with the uppermost limit being 80 years.

#### 5.7.1.1 Age

Several studies have confirmed that the age of the user of technology has an effect on its adoption, either directly or indirectly through other factors (Dewi & Zein, 2017; Dippel et al., 2017; Lash et al., 2016; McDermott et al., 2015). This research demonstrated that the respondents' age had an inverse effect on their perception of how easy or difficult it would be to use mobile phones to receive health literacy through mobile text messages. The younger age group was likely to find it easy to use mobile phones; however, advanced age could be an inhibiting factor.

Maruping and others (2017) established that age is a crucial factor that determines the degree of ease or difficulty recognised by the user of technology. This study's respondents confirmed this, with the older generation admitting a lower degree of perceived ease of use of mobile phones.

Walrave and others (2020) found that age demonstrated a negative relationship between people using technology for contact tracing for COVID-19, the results being similar in nature to those found in this study.

Although this study suggests the use of mobile phone text messages, which is a feature that most of the population would have already experienced for the purposes of communication and the use of mobile money, it would still be necessary to consider

the age of the user in the case of providing health literacy to the rural Kenyan population.

#### 5.7.1.2 Language Literacy

Having tested the proficiency in the three languages, Dholuo was shown to be the language with the highest levels of proficiency, followed by Kiswahili and English, respectively. Previous studies have indicated that the language used for health applications on mobile or mHealth has a substantial effect on the adoption or rejection of such as initiative (Aamir et al., 2018; Brown et al., 2018; Kreps, 2017; Orr & King, 2015). For the successful adoption of mHealth, the information shared needs to be relevant, understandable by the population and in the language of their choice. Aamir and others (2018) found that, when the information was provided in a language in which the population was not conversant, the adoption rates were low. This may be attributed to the difficulty faced in understanding the context and importance of the given information. In Bangladesh, where English is not a local language of preference, it has been an inhibitor to the uptake of mHealth. Using a multi-language option for mHealth increases the perceived ease of use of mHealth in the target population, especially when using only English has proven to be an obstacle (Haldane et al., 2019; Kariuki & Okanda, 2017).

Aamir and others (2018) established that language plays a significant role in enabling the use of mobile phones for health in low- and middle-income countries. The language preferred by the local population is a crucial factor in using mobile phone texts for education health in varied rural settings (Anderson-Lewis et al., 2018; Khatun et al., 2016).

On the other hand, Kariuki and Okanda (2017) found that using a language that the local population was not comfortable with was one of the significant barriers to the acceptance of using mobile phones for health education. Based on the previous studies, it may be concluded that, for Kenyans living in Suba sub-county in Homa Bay, mobile phone text messages for education and awareness of chronic diseases should be developed in the Dholuo language for high impact. Similarly, the messages targeted towards rural Kenyans living in other regions of the country would need to be developed in the local language of preference, for the maximum adoption rates.

The results of this study demonstrated that language is a notable factor that has an effect on the perceived ease of use of mobile phones for health literacy. These results concur with the findings of the above authors. Subsequently, for the study population to adopt mobile phones, it would be advisable that the text messages on health literacy for chronic diseases are developed in their preferred local language, namely Dholuo.

### 5.7.2 Health Factors

The results of this study show that threats to one's health, through perceived susceptibility and perceived severity, also informed the adoption or rejection of mHealth.

#### 5.7.2.1 Perceived Susceptibility and Perceived Severity

Perceived susceptibility and perceived severity are together known as perceived disease (health) threat (Rosenstock, 2005), which has been found by past researchers to be a significant factor influencing the adoption of mHealth (Ilozumba et al., 2018; Orr & King, 2015).

Zhu et al. (2018) reported a perceived disease threat to positively influence the adoption of mHealth for monitoring chronic diseases. A higher degree of perceived susceptibility leads to an increased intention to change behaviour (Ahmad et al., 2020). It has been found that patients with low perceived susceptibility were not inclined to change their behaviour towards adopting positive self-care routines to improve their hypertension outcomes (Larki et al., 2018). Participants who had a high perceived susceptibility for contracting cervical cancer were more willing to receive HPV vaccination (Vermandere, 2016). Participants in a study showed an intention to change behaviour only when they perceived a health threat; otherwise, they did not seek a behaviour change (Birhane et al., 2015; Vermandere et al., 2016).

Furthermore, willingness to receive healthcare information for the prevention or maintenance of diseases was positively linked to the degree of perceived health threat (Hosseini et al., 2017; Larki et al., 2018). In line with this, Loke and others (2015) have confirmed that perceived severity is a significant factor in pregnant women's behavioural choices. Students who had perceptions of health risks associated with psychological distress exhibited the strongest intention to seek healthcare advice and assistance (Kim & Zane, 2016).

Kim and Zane (2016) demonstrated that perceived susceptibility to and perceived severity of health conditions motivated individuals to change behaviour. In this study, where the behaviour change comprised the adoption of mobile phones, it was established that perceived health threat of chronic diseases directly influenced the respondents' perceptions of the usefulness of a mobile phone to receive healthcare information on chronic diseases. The study also established that perceived usefulness further influenced the perceived ease of use of a mobile phone, which directly informed mobile phone adoption.

### 5.7.3 Technological Factors

Having examined individual and health factors, the two technological factors that were confirmed were perceived usefulness and perceived ease of use of mobile phones, as communicated by the study participants, and discussed below.

#### 5.7.3.1 Perceived Usefulness and Perceived Ease of Use

Perceived usefulness and perceived ease of use have been reported to influence an individual's willingness to adopt or reject mHealth to varying degrees (Emani et al., 2018; Gholampour et al., 2018; Rönnby et al., 2018). The uptake of different mHealth technologies is determined by the individuals' perceived ease of use and the perceived usefulness of the given technology (Dou et al., 2017; Portz et al., 2019). Campbell and others (2017) illustrated the importance of perceived ease of use and perceived usefulness in using mHealth interventions through mobile phone SMS. Preusse and others (2017) used perceived ease of use as a variable in assessing the acceptance of activity trackers by older individuals. When the study participants believed the technology to be difficult, they would not show a high intention to adopt mHealth technology. This study validated that the study participant's perceptions of mobile phones' usefulness influenced their perception of ease of use of mHealth technology. Perceived ease of use would subsequently inform their choice to adopt or reject mobile phones to receive healthcare information about chronic diseases.

### 5.7.4 Social Influence

Several of the previous studies have observed social influence to be a significant factor in moulding an intention to change one's behaviour (Dewi & Zein, 2017; Esmaeili et al., 2016; Lorenzo-Blanco et al., 2016). Based on past literature, it was hypothesised that social influence played a role in informing the study respondents' perceptions of

adopting mobile phones to receive healthcare information on chronic diseases. After analysing the data from the field, this element was verified to affect the respondents' beliefs about the ease of using mobile phones, even though the participants in this study did not find social influence to impact the perceived usefulness of mobile phones. At the same time, perceived severity of chronic diseases greatly shaped the community's belief in the ease of using mobile phones to receive health literacy.

Therefore, the study has verified that social influence affects users' perceptions of the degree of ease/difficulty of using mobile phones. The perceived ease of use directly informs a user's choice to adopt mobile phones; thus, social influence indirectly affects the adoption.

## 5.8 FINAL MODEL

Building upon the evidence provided in the findings and discussions of this study, the final model for the use of mobile phones for education and awareness of chronic diseases in the rural areas of Suba sub-county was proposed. The model, as summarised in Figure 5.5, highlights the various factors that directly and indirectly influence the use of mobile phones for education and awareness of chronic diseases.

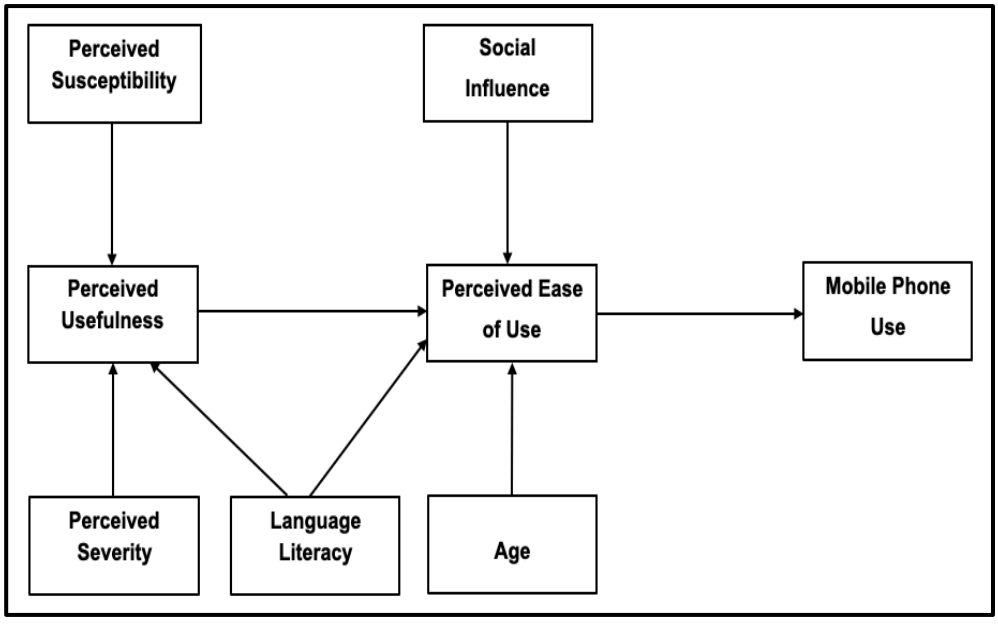


**Figure 5.5: Final Model**

The aim of this research was to investigate the various factors that could influence the uptake of mobile phones for receiving health literacy on chronic diseases education and awareness by the rural Kenyan population. The ultimate integrated model as

presented in Figure 5.5 pragmatically justified the need to triangulate various theories and models from the diverse fields of social, health and technology-related behaviour change. The ultimate model validated the recommendations made by the previous researchers (Kiberu et al., 2017; Manyati & Mutsau, 2021; Opoku et al., 2019; Stephani, 2019) on the paucity of empirical evidence on the sustainability and scalability of using mobile phones for healthcare that could alleviate specific healthcare system constraints and bring about improve health outcomes. Subsequently, the model accomplished the research objectives of analysing the social, health and technology-related factors that could collectively induce mHealth technology adoption by the rural poor of Kenya.

## 5.9 CONCLUSION

This chapter analysed the data collected from the field and developed a model that represents the factors that influence the user's adoption of mobile phones for receiving health literacy on chronic diseases. The steps that led to the final model started by defining a strategy for the analysis, including data management, demographic data analysis, reliability and validity testing, and model fitting, followed by the final hypothesis testing. There were 13 hypotheses to be tested. H1 was rejected, as social influence did not make a notable contribution to perceived usefulness of mobile phones. H2 was rejected because language literacy did not have an influence on perceived usefulness of mobile phones. H3 to H7 were all retained. H8 was rejected, as perceived susceptibility did not show any effect on the participants' perceived ease of use of mobile phones. H9 was retained, as social influence had an effect on perceived ease of mobile phone use. H10 was rejected on the grounds that social influence did not have an effect on the final use of mobile phones. H11 was retained. H12, which tested the effect of perceived usefulness on the uptake of mobile phones, was rejected. Similarly, H13, which tested the influence of perceived severity on the use of mobile phones, was also rejected. A total of eight hypotheses were thus, retained while five were rejected.

Ultimately, the final model demonstrates that perceived ease of use directly influenced the actual use of mobile phones for health literacy on chronic diseases. Behavioural intention was seen not to be significant to the behaviour towards mHealth adoption. This was commensurate to findings by several other authors who identified the

behaviour-intention gap where self-efficacy was found to moderate the intention-behaviour path (Amireault et al., 2008; Faries, 2016; Qi et al., 2020; Rhodes & De Bruijn, 2013; Sheeran & Webb, 2016; Webb & Sheeran, 2006).

Perceived usefulness, language literacy, social influence, and age were found to directly influence perceived ease of use. Perceived susceptibility, and perceived severity, directly influenced the perceived usefulness of mobile phones. Perceived severity had a direct effect on social influence.

# CHAPTER SIX

# CONCLUSIONS AND RECOMMENDATIONS

## 6.1 OVERVIEW OF RESEARCH

The research started off by recognising a problem in scalability and sustainability of mHealth adoption in the rural settings of Kenya. It formulated a strategy to address this problem. There is a noticeably high penetration of mobile phones in the country, which accounts for close to 130%. Most of the handsets being used in the country's rural regions are not internet-ready as the reach of data services in these areas is relatively poor at 23%, or non-existent in several cases. In the wake of inequity and inadequacy of healthcare infrastructure in these regions and the rise in chronic diseases, it would be a pragmatic decision to provide health literacy to these remote communities through mobile phone text messages. Several initiatives of mHealth had taken off in the past but did not graduate beyond the pilot stage. Thus, this research endeavoured to investigate the factors that would motivate adoption of mHealth for health literacy on chronic diseases in the remote and rural regions of the country, while making it sustainable over the long-term.

Chapters one and two of this thesis laid the foundations of the research problem by providing a background and motivation for this study. The background explained the prevalence of chronic diseases and the gap in the knowledge on the potential factors that could influence the adoption of mobile phones for health literacy regarding chronic diseases in rural Kenya. Evidence shows that chronic diseases kill approximately 41 million people globally each year, equivalent to 71% of all deaths globally. Of these, 15 million deaths occurring globally are between the ages of 30 and 69, the age bracket that comprises many families' primary breadwinners (WHO, 2021). Over 77% of these deaths occur in low- and middle-income countries like Kenya. To counter the adverse effects of chronic diseases, the WHO recommends educating and informing the population on the risk factors and signs and symptoms of these diseases. This would include providing education and awareness to the population on the damaging effects of excessive tobacco use, frequently consuming an unbalanced diet, harmful consumption of alcohol, and physical inactivity, which could promote the prevention and maintenance of chronic diseases (WHO, 2017). The study recommended the use

of mobile phone text messages to provide such healthcare education to the rural Kenyan population.

In Kenya, mobile phone penetration per capita is considerably high. The government population and housing census of 2019 recorded Kenya's population as of November 2019 at 47.5 million people (KNBS, 2019), with mobile phone subscriptions by early 2021 stood at 62.0 million (CAK, 2021). The prevalence of mobile phones provides a promising avenue for disseminating health education, as recommended by the WHO. This study was motivated by the limited research on the factors that would inspire the rural Kenyan population towards a persistent adoption of mobile phones for healthcare education and awareness on chronic diseases. Whereas mobile phones have previously been used at the community level, the main concerns addressed have been in primary care relating to HIV/AIDS, maternal and new-born health, and malaria (MoH, 2016). There has been little research on initiatives focusing on chronic diseases, and most of these community-level interventions did not show evidence of going beyond the pilot stages.

This backdrop helped in formulating the overall aim of this study, with the following two research objectives:

1) To assess the individual, social, health, and technological factors that could influence a sustainable mobile phone adoption by rural Kenyans for healthcare education and awareness of chronic diseases.
2) To develop an all-inclusive model for sustainable mobile phone adoption by rural Kenyans focused specifically on education and awareness of chronic diseases.

Chapter two discussed the literature on the readiness of mHealth landscape in Kenya, the benefits of mobile phone SMS in the wake of limited healthcare facilities and an inadequate number of trained healthcare personnel in the study area, and ultimately proposed the use of the mobile phone SMS to educate rural Kenyans on the prevention and management of chronic diseases. The chapter also explored the factors that would motivate or hinder the adoption of mHealth in a general scenario.

Chapters three developed the theoretical background of the research. A framework integrating theories and models from social norms, health, and technology-adoption behaviour was proposed as a consumer-facing model for chronic diseases education.

The model was informed by four theories of social behaviour change namely, SNT (Perkins & Berkowitz, 1986), SCT (Bandura, 1989), TRA (Ajzen & Fishbein, 1975), and TPB (Ajzen, 1991); three technology adoption models which were the DOI (Rogers, 1983), TAM (Davis, 1989), and UTAUT (Venkatesh et al., 2003); and two of the health behaviour models being HAPA (Schwarzer, 2003) and the HBM (Rosenstock, 1974).

It culminated in a discussion merging the assumptions and constructs proposed by these nine theories and models into one theoretical framework to be tested empirically. These theories provided seven constructs: perceived susceptibility, perceived severity, perceived usefulness, perceived ease of use, social influence, age, and language literacy. Thirteen hypotheses were formulated from the constructs. A survey questionnaire was developed based on the seven constructs extracted in Chapter three, while it also gathered the general demographics of the respondents.

This study benefited from triangulating theories and models from health and technology disciplines. The process of triangulation helps to validate the theories from diverse fields such as social science, health behaviour, and technology adoption that can explain a specific behaviour (Ammenwerth et al., 2003). Having analysed the nine theories and models, and employing the constructs from different theoretical lenses enhanced the development of a robust theoretical framework. The phenomenon of mHealth adoption among the rural poor was better understood as a result of combining the theoretical perspectives of health with the technology adoption models. However, if the constructs and hypothesis from different theories were conflicting rather than complimenting, triangulating them would have been challenging as Thurmond (2001) advocated.

Chapter four presented the research methodology of the study. An objectivist ontology was selected as the personal bias of the enquirer of this study needed to be disregarded while only the perception of the study participant was important for the data collection process. The epistemology that was suggested was the postpositivist approach. This allowed the enquirer to be independent of the participants' perception being observed. Postpositivist approach helped to investigate causal associations between the factors that would influence the study population's choice to adopt

mHealth for health literacy. Quantitative data was collected in order to analyse it using statistical analysis methods for testing of the hypotheses.

The study site was defined as Nyatoto Sub-location, Suba Sub-County, in Homabay County, located in Kenya's Western fringes. This location formed an ideal representation of low-resource settings in rural Kenya due to its remoteness, vastness, deplorable local infrastructure, high level of poverty, and acute lack of access to healthcare facilities and health personnel. Poor health infrastructure and an increased incidence of chronic diseases in the study population also informed the selection of the study site. A sample size of 239 responses was calculated using the formula prescribed by Calmorin and Calmorin (2007), to be collected through probabilistic random sampling method.

The questionnaire was formulated which tested each of the constructs of the theoretical framework by curating seven questions per section with five-point Likert-type scale of responses. The variables evaluated were the respondents' demographics; language proficiency in English, Kiswahili, and Dholuo; perceived susceptibility to chronic diseases; perceived severity of chronic diseases; perceived usefulness of mobile phones; perceived ease of use of mobile phones; social influence on the adoption of mobile phones; intention to use mobile phones; and the actual mobile phone use (adoption). The questionnaire underwent pre-testing, revision, followed by pilot-testing and finally was translated in the local Dholuo language, for ease of understanding by the respondents. Subsequent to this ethical clearance for the data collection procedure was sought form the University of the Western Cape. The chapter concluded by presenting the five stages of data analysis strategy that was implemented in the following chapter.

Chapter five presented a detailed step-by-step procedure of data analysis and discussion of the analysed data. The actual dataset comprised 315 respondents, with 147 males and 168 females, corresponding to 15.1% of the study population. It had exceeded the initially calculated sample size of 239 responses which was considered a positive for the analysis stage by enhancing the sufficiency of data.

An initial analysis had revealed that male and female respondents showed similar opinion towards their significant peers informing their decision on using the mobile phones for education and awareness on chronic diseases. They also agreed likewise

on feeling that the chronic diseases could have a severe effect on them. The female respondents showed a slightly higher susceptibility to the chronic diseases.

With technological factors, 54% of the female and 46% of the male respondents were of the opinion that mobile phones would be beneficial to use for health literacy. Although only 37% of the females were currently using mobile phones compared to 63% of the males, 60% of the females believed that it would be easy to use them to receive health literacy on chronic diseases as compared to their counterparts (40%).

Interestingly, only 24% of the males exhibited an intention to use mobile phones for health literacy, whereas 76% of the female respondents projected to use them. The above synthesis revealed that for the successful adoption of mHealth in the study population, the perceived ease of use of mHealth technology was of paramount importance. This was confirmed later through the model testing techniques and was the study's most significant finding.

The five-stage data analysis, comprised: management of collected data to ensure its completeness and quality using MS Excel 2013; SPSS was employed to check for missing data, outliers, data reliability and data validity; the demographics like age, gender, socio-economic level, and level of schooling of the respondents were analysed; followed by a rigorous testing of the model; and finally testing the hypotheses, both tests performed using AMOS for SEM was used for analysis because of its superiority in regression analysis where the reliability and validity of the model could be tested simultaneously (Lowry & Gaskin, 2014). SEM allowed the inter-relationships of all the variables to be tested simultaneously, along with the hypotheses, resulting in a model that demonstrated the direction and the magnitude of their relationships.

Eight principal components that needed to be evaluated: perceived susceptibility; perceived severity; perceived usefulness; perceived ease of use; social influence; intention to use; and the actual use (adoption). The reliability of all eight principal components was tested using SPSS to determine the Cronbach's alpha values, resulting in high scores of between 0.802 and 0.946 where 0.7 is said to be an optimum score. Both the convergent and discriminant validity of the components was tested using Principal component analysis (PCA) which is an exploratory factor analysis method of SPSS, a technique which is recommended in reducing the dimensionality

of datasets, increasing their interpretability, while at the same time minimising information loss (Jolliffe & Cadima, 2016). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy for the dataset resulted in value of 0.910, where a value above 0.8 is used to confirm that the dataset was adequate. The Bartlett's test of sphericity returned a p-value of 0.000, where p-value of below 0.001 confirms that the data was significant. The seven outliers found earlier were excluded from the PCA tests. Therefore, the validity of data was found to be adequate.

The PCA test was performed using four iterative stages to arrive at adequate factors, with the final settings of promax rotation, number of factors fixed at seven, and constraining the value of coefficients to 0.55. This resulted in seven strong, well-represented factors (latent variables), namely language literacy, perceived susceptibility, perceived severity, perceived usefulness, perceived ease of use, perceived social influence, and mobile phone use. The observed indicators for the two variables, namely perceived ease of use and intention to use, were clustered together therefore, the resultant variable was named perceived ease of use and intention to use was excluded. This stage was followed by CFA.

CFA revealed the scores to display good model fit, with the values as follows: Chi-square of 46.262, a p-value of 0.000, CMIN/DF of 2.721 (< 3), an RMSEA of 0.074 (< 0.08), and all the other indices above the recommended 0.90, as advised in the existing literature (Blunch, 2012; Hasman, 2015; Kline, 2011). An explanation of all of these scores is provided and their significance discussed in Chapter five. Thirteen hypotheses were tested using the structural model in AMOS; whereas eight were retained, the remaining five hypotheses were rejected. The representation of the final all-inclusive model that incorporated factors from the individual, social, health, and the technology adoption perspective was presented at the end of Chapter five as Figure 5.5.

## 6.2 RESEARCH CONTRIBUTION

This study made three types of contributions, namely theoretical, methodological, and executive, to the pool of knowledge with an integrated model that looks at adoption of mHealth for chronic diseases education and awareness, with the new knowledge being contextualised to technology for health in rural settings.

### 6.2.1 Theoretical Contribution

The primary theoretical contribution of this study comes from the final model that draws attention to a significant outcome that the behavioural intention is not suggestive of the behaviour of an individual. The degree of PEOU of a mobile phone is what poses a direct and sizeable influence on the actual adoption or rejection of mHealth for health literacy on chronic diseases.

The final model that resulted from this research exploited four different angles that jointly shaped the development of a strong, integrated model to address the effect of individual, social, health, and technological factors on the use of mobile phones by individuals in rural settings to receive healthcare education. The ultimate integrated model as presented in Figure 5.5 pragmatically substantiated the necessity to triangulate various theories and models from the diverse fields of social, health and technology-related behaviour change. The final model of this study corroborated the recommendations made by the previous researchers (Kiberu et al., 2017; Manyati & Mutsau, 2021; Opoku et al., 2019; Stephani, 2019) on the paucity of empirical evidence on the use of mobile phones for healthcare which could alleviate specific healthcare system constraints and improve health outcomes. Subsequently, the model achieved the research objectives of analysing the social, health and technology-related factors that could collectively induce mHealth technology adoption by the rural poor of Kenya. Other researchers will find this behaviour change model valuable to understand the adoption of health-related technology by rural populations, amalgamating the cumulative effects of individual, social, health and technological influence on the adoption of mHealth at the grassroots community level.

For this study, nine theories and models were consulted, four that focused on social behaviour change namely, SNT (Perkins & Berkowitz, 1986), SCT (Bandura, 1989), the TRA (Ajzen & Fishbein, 1975), and the TPB (Ajzen, 1991). The DOI (Rogers, 1983), TAM (Davis, 1989), and UTAUT (Venkatesh et al., 2003) explained technology adoption behaviour. The final two – the HAPA (Schwarzer, 2003) and the HBM (Rosenstock, 1974), evaluated health behaviour change. The constructs and their inter-relationships in the final model resulted from empirically testing the building blocks as well as the assumptions of the above theories and models.

PEOU was adopted from the technology adoption model and may be understood as the measure of effort that an individual needs to perform a behaviour. Perceived ease of use has been used as effort expectancy in the UTAUT model; as perceived behaviour control in TPB; and as self-efficacy in HBM, HAPA, as well as in SCT. In most of these theories and models, PEOU was perceived to influence an individual's behavioural intention to either adopt or reject a behaviour. However, the model for this study is unique whereby, PEOU is directly observed to inform the change in behaviour towards mHealth adoption.

PEOU in turn is directly influenced by the perceived usefulness (PU) of mobile phones for health literacy, the language literacy of the individual, social influence from an individual's significant others, and the user's age. Rural Kenyan individuals would find it easy to use mobile phone technology to receive healthcare information on chronic diseases only if they believed that mobile phones would benefit them (PU). This was particularly so if their friends, family, or social peers recommended using mobile phones, and if the information was provided in their language of preference, which was Dholuo. Younger users would be more familiar with using mobile phones than the older section of the population.

The belief by the rural Kenyan population that they could develop chronic diseases (perceived susceptibility), and those chronic diseases would be devastating to their lives (perceived severity) would make them see the importance of using mobile phones (PU) to acquire healthcare information.

Although the theories and models studied for this research indicated behavioural intention as the antecedent predictor of behaviour, the concept of behaviour-intention gap has been experienced by various other authors (Amireault et al., 2008; Faries, 2016; Qi et al., 2020; Rhodes & De Bruijn, 2013; Sheeran & Webb, 2016; Webb & Sheeran, 2006). Most of these studies found the perceived behavioural control or self-efficacy to be the factor that moderated the behaviour-intention gap. Correspondingly, this study found the perceived ease of use to be the key factor leading to behaviour.

Behavioural intention was one factor that was tested in the data analysis stage however, both the principal component analysis and the CFA resulted in excluding it from the set of significant factors. Therefore, it was concluded that the behavioural intention did not influence the behaviour in this study. This is an integral finding of this

study whereby, health-leaning technology adoption does not depend upon behavioural intention but on the perceived ease of use of the technology.

Whereas this study may be categorized under technology adoption, the technology under review was specifically mHealth for education and awareness of chronic diseases. The population investigated was in a rural setting thus, it may fall short in informing researchers who would wish to study mHealth adoption in urban areas.

### 6.2.2 Practical Contribution

This study has contributed significantly to developing a unified model from three fields of behaviour change, namely social, health, and technological factors. It was a significant study that tested the perception of rural Kenyan individuals of the factors that would influence the adoption of mobile phones by them to receive education and awareness of the signs, symptoms, and effects of chronic diseases. Using mobile phones for health literacy in rural Kenya is a crucial avenue owing to mobile phone penetration of more than 130% (CAK, 2021) in an area that otherwise is straddled with inadequate healthcare infrastructure. Thus, successfully educating the rural Kenyan population – which forms over 70% of the total Kenyan population (NCPD, 2018; WHO, 2017) – on disease prevention and management could reduce the burden of chronic diseases on the already over-stretched healthcare infrastructure.

Perceived susceptibility and perceived severity comprise individuals' perceived disease threat (Rosenstock, 1974). Chronic diseases annually are responsible for up to 27% of total deaths and over half of the total hospital admissions in Kenya (Kraef et al., 2020); over 50% of all Kenyans suffer from at least one chronic disease condition (Smit et al., 2020). A major assumption of this study was that, if people could understand their degree of susceptibility to and the severity of chronic diseases, the health authorities could motivate these individuals to receive healthcare advice on a better diet and lifestyle changes to prevent chronic diseases. While this could be true, the findings of this study have revealed that, in order to facilitate the use of technology for health literacy, the users need to feel at ease using it.

The study revealed that age is a factor that makes it either easy or difficult for a person to use mobile phones. The younger generation finds it easy, and thus useful, to adopt mobile phones. The older generation could subsequently be helped with systematic training to enable them to experience mobile phones as more user-friendly. This

validated the findings of other researchers (Guo et al., 2015; Maruping et al., 2017; Tavares & Oliveira, 2016; Venkatesh et al., 2003). Hence, developers of technology-based solutions should consider the age of the intended users for its successful adoption.

It is a crucial finding of this study that, for individuals to see the perceived benefit of mobile phones, the healthcare information being shared needs to be in the users' preferred language. High language literacy also influences the perceived ease of use of mobile phone technology, which leads to its adoption. These findings corroborate those from previous studies, in which technology acceptance was high when the language was the one preferred by the user and, conversely, where the language was not one in which the user was conversant, adoption rates were low or non-existent (Aamir et al., 2018; Haldane et al., 2019; Kaunda-Khangamwa et al., 2018). Therefore, the developers of the information need to be considerate of the individuals' preferred language.

In the case of rural Kenya, significant others affected an individual's perception of the usefulness and ease of use of a technology. Previous studies found that social influence affected the decision to adopt or not to adopt a technology (Dewi & Zein, 2017; Esmaeili et al., 2016; Hosseini et al., 2015; Lorenzo-Blanco et al., 2016). It is thus, imperative that the leaders in a community understand the benefits of using a given technology so that they may then positively influence their community members to adopt the same.

This study has contributed to validating the factors identified, namely perceived disease threat, perceived usefulness, social influence of significant peers, the age of the user, and the language employed for the healthcare information, which collectively influence the perceived ease of use of mobile phones, which finally results in the adoption of the given technology.

## 6.3 ASSUMPTIONS AND LIMITATIONS

The study made several assumptions. First, having access to a mobile phone and being a resident of the study area were two assumptions where the respondents' bias could have been possible. The study sample was selected assuming that the individual was considered to be an eligible study participant if the person was above the age of 18 years, was a resident of Nyatoto sub-location, had access to a mobile phone, and

was willing to participate in the study. The willingness to participate was confirmed with a thumbprint or signature on the consent form. The participant's age was determined by the date of birth as indicated on his/her national identification document. Ownership of a mobile phone was not mandatory; thus, not owning a mobile phone or carrying one during the research survey was not evidence of a lack of access to one.

The second assumption was that the study area was a remote and rural area of the country. The properties that determined this quality were the lack of adequate infrastructure to connect it to the power grid, road network, free-flowing water, mobile phone network coverage, and sparsely inhabited villages. Additional factors that could be examined before assuming an area to be rural are poverty level, ageing population, nature of the respondents' occupation, low cost of living, and the like (FAO, 2018), which were then tested and validated through the data collection stage of this research.

Besides the assumptions, the study had some limitations. The first limitation being that it was conducted in one sub-county of one of the 47 counties that make up the entire country. The last population and housing census of 2019 reported that about 70% of Kenyans live in rural areas of the country. Whereas the target sample was calculated according to a well-researched formula, and well represented the study population's attributes, the same might not be the case in other rural regions of the country. There is room for further research to be conducted with the same research objectives to compare and contrast the factors that could be responsible for the sustainable adoption of mobile phones for health literacy on chronic diseases in different rural areas of the country. However, this study's findings would augment further research by providing a model that acts as a foundation to understand the factors that contribute to the adoption or rejection of mHealth in rural Kenya.

The second limitation was that the study assessed the adoption of mobile phones for text messages and not for any other additional features, like audio message, video message, or internet apps. Although the study area was limited to a remote and rural setting, some regions in the county are rural and remote, but have access to broadband internet. Therefore, this study's outcome can be used to test how the influence of the proposed factors change the pattern of adoption of mHealth in other regions, with the availability of internet connectivity.

The third limitation of this study is that some parameters could have changed from the time of data collection to the time of reporting. Through a partnership between the giant multinational technology company, Google, and mobile service provider Telkom Kenya, Project Loon was launched in July 2020. This project uses internet-enabled giant balloons that float in the air, carrying a lightweight mobile phone tower. The giant balloons can provide internet connectivity where the rest of the infrastructure deems a region as a rural and remote area with no or limited internet connectivity. Although many factors would lead to this project's success, it seems appropriate to state that there was a possibility that the study area would have received internet connectivity after the data collection stage. However, this was not the case as the project was dismissed in 2021 for lack of financial sustainability.

The fourth limitation of this study worth highlighting is that the factors that influence the adoption of mobile phones were only assessed for providing health literacy on the five chronic diseases, namely cancers, cardiovascular disease, hypertension, diabetes, and obesity. It is acknowledged that the results could be different for other health conditions in the same study population. This allows for further research on the same study population to assess the influencing factors for health conditions other than the five chronic diseases covered by this study.

Lastly, this study assessed the individual, social, health, and technology-related factors that influenced mobile phone adoption for healthcare education. It would be worthwhile to note that behaviour could also be influenced by economic, cultural, and political environments. This study did not cover these factors and this therefore provides a platform for further research based on these additional factors.

## 6.4 RECOMMENDATIONS

The researcher made several recommendations based on the study. These are grouped under academic and policy proposals.

### 6.4.1 Academic Recommendations

As a result of the data analysis for this study, the direct effect of social influence on the adoption of mobile phones for health literacy on chronic diseases was excluded; for successful adoption, the users had to believe that the technology was easy to use. The reasons could be that the responses did not show a significant impact; and the

study population could be of strong character, one that is firm and cannot easily be swayed by the opinion of their significant others. Therefore, the research would propose that further studies be conducted on another sample population to understand if social influence is indeed a significant factor in adopting mHealth. Here, mHealth refers to the use of mobile phone technology for primary healthcare.

Secondly, it is recommended that this study could be extended horizontally to other sub-locations and counties in the region that face similar limited healthcare and infrastructure settings. The study can also be extended vertically for other disease conditions in the same study population.

### 6.4.2 Policy Recommendations

A review of literature for this study had garnered that although there was a rapid increase in the use of mobile phones for healthcare, there was paucity in empirical evidence to inform the use of mhealth in Kenya. The few initiatives that had been started in the past were either donor funded or led by individuals. Therefore, the findings were not accessible by the policy makers. The recommendation of this study is that the government should spearhead mHealth projects, especially in the rural regions of the country since that is where the poor population, with limited healthcare infrastructure lives. The data from these projects should be utilized by the policy makers and the technology stakeholders in the country.

Measures need to be taken for the population to adopt mHealth for health literacy on chronic diseases. The WHO suggests that, by educating the population on the risk factors associated with chronic diseases, it could lower their debilitating impact, which currently accounts for 27% of the total deaths and over 50% of total hospital admissions in the whole of Kenya every year. Against the backdrop of most of the study population being off the electricity grid, and mobile coverage being limited to the GSM/GPRS network in most of Nyatoto sub-location at the time of collecting the data for this study, the use of feature phones seems to be the most appropriate solution in such conditions. Feature phones also have long battery hours, low network needs, and are easy to use by most of the population. Steps should be taken to ensure that the majority of the population in the region has access to a feature phone.

Secondly, it was noticed that Nyatoto sub-location experiences all-year-round sunshine. Projects like pumping water using solar energy have already been deployed

successfully in the area. It is thus, proposed that access to solar panels as an alternate form of energy should be provided to the population for regular charging of their mobile phones through a project that may be referred to as Kiosk-for-Health (K4H). The Government of Kenya, the Ministry of Health, non-governmental agencies, inter-governmental agencies like the WHO, mobile phone service providers, and other interested stakeholders should jointly seek to fund such a project. The people of Nyatoto sub-location generally visit community centres to procure products for their daily sustenance. Several micro-entrepreneurs could be supported with a small kiosk setup (retail store) that would also provide free solar power to charge mobile phones under the project K4H. Similarly, survivors of chronic diseases could be funded and trained to be the micro-entrepreneurs to motivate the rest of the population to take up healthy behaviour.

Well-trained community health extension workers and community health volunteers should be stationed at the same K4H kiosks. They could then obtain permission from the people visiting the kiosks to register their phone numbers in a database held at the county-level health services. A bulk-text message system needs to be developed with the related healthcare information in efficiently tailored mobile phone text messages. Using the database of registered mobile phone users, the text messages could be disseminated on a daily or weekly basis. The same database may be filtered for end users with existing conditions. Personalised and targeted messages may be sent to them for appointment reminders, drug-adherence reminders, and lifestyle changes. The registered mobile phone users' database would also help set up registries, which are currently non-existent in certain regions.

As a third recommendation, it is noted that the findings of most of the research conducted in developing countries are generally not made available to the local government and national health authorities. Thus, the effect of the findings is not felt at the community level. This study's findings will be available to all stakeholders interested in making a positive health behaviour change among the population in Nyatoto sub-location.

## 6.5 EVALUATION OF STUDY

This research was evaluated according to the following seven criteria: i) contribution to current thinking; ii) change in the practice of Information Systems implementation in

mHealth; iii) underlying logic and supporting evidence; iv) completeness and thoroughness; v) writing and logical flow; vi) interest for researchers and practitioners; and vii) interest for health managers and decision-makers.

### 6.5.1 Contribution to Current Thinking

By combining theories and models from social behaviour, health behaviour and technology adoption behaviour, an integrated model has been developed that looks at individual, health, and technological factors that would influence the adoption of mobile phones for health literacy by individuals in a rural setting. Unlike previous mHealth initiatives introduced by technology organisations, this study developed a consumer-facing model and took into account more than technology-based factors for mHealth adoption. Past mHealth adoption studies were lacking in chronic diseases education and awareness; therefore, this study has contributed to the knowledge pool by filling the gap.

### 6.5.2 Change the Practice of Information Systems Implementation in Mhealth

This study will change the practice of mobile phone use for health as it provides empirical evidence of what influences its successful adoption in rural settings. Findings have revealed that the users need to find it easy to use the technology to adopt it efficaciously. The results also show that social influence is not always a critical factor for the successful adoption or rejection of mHealth. The resulting model would also help organisations implement sustainable and long-term future mHealth initiatives in the study area.

### 6.5.3 Underlying Logic and Supporting Evidence

Both the logic and evidence are compelling. Data was analysed rigorously using the statistical tools of SEM, which is considered a higher-order regression analysis software. This method offers several advantages over the simple regression technique, as it explicitly assesses measurement error, it aids in the estimation of latent (unobserved) variables via observed variables, and it produces both measurement and structural models that display both the direction and the magnitude of interactions among the latent variables while resulting in an appropriate fit of the data. During the process of component analysis, it was revealed that some indicators represented more than one component (variable). Therefore, the actual use of mobile phones was merged with the perceived ease of use of mobile phones.

The final stage of data analysis and hypothesis testing revealed that some of the hypotheses were rejected, as those interactions did not produce a significant score in the analysis. Subsequently, the interactions presented in the final model for mobile phone use by rural Kenyans are the result of empirical data analysis.

The evidence also revealed that the language employed for the health literacy at community level needs to be one preferred by the population. It is necessary to investigate the language of preference before deploying a technologically based solution.

### 6.5.4 Completeness and Thoroughness

As has been summarised in this chapter, each stage of the research was followed and reported meticulously. In Chapter two, the literature on different aspects was thoroughly reviewed. The areas included country's cumulative disease burden of communicable as well as non-communicable (chronic) diseases, the inadequacies of the healthcare system in Kenya, the status of mHealth in Kenya, opportunities and challenges of mHealth, and building the case for the proposed use of mobile phone SMS for mHealth. Chapter three examined nine selected theories and models from the areas of social behaviour, health behaviour, and technology adoption behaviour change. After studying all nine theories and models, the theoretical framework was developed that was tested in the field with the research participants. An appropriate research methodology and research methods were selected and reported on. The development of the survey questionnaire followed the systematic procedure of formulating questions on each of the observed variables hypothesised to influence the uptake of mobile phones. After methodically gathering data from the field, a thorough procedure was followed to analyse the data, test the hypotheses, and develop the final integrated model for mHealth adoption in a rural setting. The assumptions and limitations of the study were highlighted clearly. Recommendations for further study have also been deliberated upon.

### 6.5.5 Writing and Logical Flow

Before beginning to write, an outline of the thesis was developed. Each section was carefully developed in its own chapter. The thesis has six chapters. Chapter one presents the background to why the topic of research is significant for the scientific community. It presents the problem statement, the gap in the literature, and the aims

and objectives of the study. Chapter two covers the existing literature from both primary as well as secondary sources, where the primary literature includes studies by other authors on related topics, and secondary literature was obtained from reports from the WHO, the Kenyan MoH, the Communications Authority of Kenya, and other recommended health and technology organisations. Chapter three presented an analysis of the nine theories and models on behaviour change from the social, health, and technological arenas.

After analysing the shortlisted assumptions and constructs from each of these nine theories and models that would inform the adoption of mobile phones to fulfil this study's objectives, the resultant theoretical framework was thus developed from the thirteen hypotheses. Chapter four discussed the research methodology as well as the research methods that were used in the study. The study population was carefully selected, and the study sample was meticulously calculated to test the questionnaire based on the extracted factors of the theoretical framework developed in Chapter three. Chapter five presented a detailed, step-by-step record of the entire quantitative data analysis procedure, complete with the formation of the model and the testing of the hypotheses. The current Chapter six is a summary of the overall process of thesis writing.

### 6.5.6 Interest for Researchers and Practitioners

This study's topic is very timely and appropriate due to the ever-rising number of cases of chronic disease in Kenya, which is hampered by an inadequate health infrastructure. The integrated model developed by this study is very important to understand a sustainable adoption of mHealth in rural settings.

As reported earlier, about 70% of Kenyans live in the country’s rural areas, and most of these rural regions are off the electricity grid and lack internet access. Close to 130% mobile phone penetration has been reported in Kenya. In the rural areas of Kenya, the population uses feature phones that allow voice calls and text messages (SMS) and have an extended battery life. Therefore, to reach them, mobile phone SMS would be an appropriate avenue.

### 6.5.7 Interest for Health Managers and Decision Makers

This study is significant for managers and decision-makers within the healthcare provision sectors. The Kenyan MoH would benefit from reading this report, which

demonstrates the value addition to human life by educating the population through SMS. Technology-oriented organisations would find this report appealing, as it indicates which factors would influence the adoption or rejection of technology, in this case mobile phones, as a planning step before implementing their projects. Students and academics in behavioural sciences, public health, and technology would find it invaluable to read this report to understand how individuals decide to adopt or reject technology in a rural setting.

## 6.6 CONCLUSION

This chapter successfully expounded on the contribution made through this study to the greater pool of knowledge. The theoretical research contribution was presented in section 6.2.1 and the practical contribution in section 6.2.2 of this chapter, respectively. Section 6.3 discussed the various assumptions and limitations of this study. Both academic and policy recommendations were asserted in section 6.4. Finally, section 6.5 of the chapter appraised the contribution of the study towards current knowledge, it's applicability in the field of information systems, fulfilling the logic and presenting empirical evidence to justify the research objectives. It further assessed the completeness and thoroughness of the study while assessing the written as well as the logical flow of the document. The chapter concluded by highlighting the significance that this study would add to the researchers and practitioners of mHealth as well as the health managers and the decision makers in the field of health-related technology.

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# APPENDIX I: LETTER OF ETHICAL CLEARANCE

UNIVERSITY of the WESTERN CAPE

OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

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10 May 2017

Ms A Khoda
Information Systems
**Faculty of Economic and Management Science**

**Ethics Reference Number:** HS16/4/16

**Project Title:** Mobile phone use in chronic disease education and awareness in rural Kenya.

**Approval Period:** 09 May 2017 – 09 May 2018

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval. Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

*Ms Patricia Josias*
*Research Ethics Committee Officer*
*University of the Western Cape*

***PROVISIONAL REC NUMBER - 130416-049***

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

# APPENDIX II: QUESTIONNAIRE


**UNIVERSITY *of the* WESTERN CAPE**
***Faculty of Economic and Management Services***

***School of Information Systems***

**Survey Questionnaire**

**PERCEIVED USE OF MOBILE PHONE FOR HEALTHCARE EDUCATION AND AWARENESS ON CHRONIC DISEASES**

**Date: ……..** **Serial No: ……**

**INTRODUCTION TO STUDY**

I, Anuradha Khoda, am a researcher pursuing PhD. Information Systems at the University of Western Cape. I am conducting this survey to facilitate my research, which endeavours to assess the population's perception on using mobile phones for healthcare education and awareness on chronic diseases in Rural Kenya. Hypertension, Obesity, Heart Disease, Diabetes, and Cancer constitute the five chronic diseases for my study. This research is purely academic, and will solely be used for that purpose. Your details or data provided will not be passed onto a third party without your knowledge. This research will result in an integrated model that will inform current and future stakeholders about the factors that determine the perceived use of mobile phones for healthcare education and awareness on chronic diseases by the population of rural Kenya.

---

**CONSENT FORM FOR RESEARCH PARTICIPATION**

I, ……., have had the opportunity to ask questions related to this study and obtained satisfactory answers to my questions.

I have also received any additional information that I may have requested about this research.
I agree to participate in this research.

I confirm that at the time of this research, I am above the age of 18 years. I am a resident of Nyatoto sub-location. I have access to a mobile phone.

I understand that my participation in this study is voluntary and that no remuneration will be provided in return for my contribution. I am free not to participate and have the right to withdraw from the study at any time without the need to provide any reason for such withdrawal.

I am aware that the research outcomes will be published and shared with the public, but my identity will not be revealed. It is my understanding that the researcher will ensure my anonymity throughout the research process.

I retain the right of refusal to answer any question which I do not feel comfortable or able to respond to.

**If you have any questions concerning this research, feel free to contact me:**

**Anuradha Khoda e-mail: 3523368@myuwc.ac.za or**

**Supervisor Dr James Kariuki Njenga, e-mail: jkariuki@uwc.ac.za**

**Respondent's consent:** I Agree to participate in this research ☐
I Do Not Agree to participate in this research ☐

**Respondent's/Witness's Signature/Thumb Print:** ……

**Survey Questions**

**Instructions:**

Please tick the appropriate box (es) for each question below. Write in the given spaces where necessary.

**A. Demographics**

**Age Bracket:**

18 - 20☐ 21 - 30☐ 31 - 40☐ 41 - 50☐ 51 - 60☐ 61 - 70☐ 71 - 80☐

**Gender:** Male☐ Female☐

**Marital status:** Married☐ Divorced☐ Widowed☐ Never Married☐ Single☐ Separated☐

**Occupation:**

……

**Monthly Income (KSH):** <3,000☐ 3,001-10,000☐ 10,001-20,000☐
20,001-30,000☐ 30,001-40,000☐ 40,001- 50,000☐ >50, 000☐

**Education Level**

No Formal Schooling☐ Primary School☐ Secondary School☐
Certificate Level☐ Diploma Level☐ Degree Level☐

**B. Language Literacy**

1. I am fluent at reading English.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
2. I am fluent at writing English.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
3. I am fluent at speaking English.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
4. I am fluent at listening to English.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
5. I am fluent at reading Kiswahili.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
6. I am fluent at writing Kiswahili.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
7. I am fluent at speaking Kiswahili.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
8. I am fluent at listening to Kiswahili.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
9. I am fluent at reading Dholuo.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
10. I am fluent at writing Dholuo.
    Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
11. I am fluent at speaking Dholuo.
    Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
12. I am fluent at listening to Dholuo.
    Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐

**C. Perceived Susceptibility**

1. I feel at risk of getting Hypertension.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
2. I feel at risk of becoming Obese.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
3. I feel at risk of getting Heart Disease.
   Strongly agree☐ Agree☐ Neutral☐ Disagree☐ Strongly disagree☐
4. I feel at risk of getting Diabetes.

Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

5. I feel at risk of getting Cancer.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
6. I feel my family at risk of getting chronic diseases due to irregular visits by healthcare providers.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
7. I feel my family at risk of getting chronic diseases due to limited number of healthcare facilities.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

**D. Perceived Severity**

1. I believe chronic diseases are incapacitating to individual's health.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
2. I believe chronic diseases reduce individual's life expectancy.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
3. I believe chronic diseases affect an individual's quality of life.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
4. I believe chronic diseases increase economic burden on an individual and the family.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
5. I believe chronic diseases increase psychological strain on the family.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
6. I believe chronic diseases bring about loss of an individual's earning capacity.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
7. I believe chronic diseases cause strained family relationships.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

**E. Perceived Usefulness**

1. I believe receiving healthcare education on chronic diseases through a mobile phone is cheaper than other sources.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
2. I believe receiving healthcare education on chronic diseases through mobile phone is faster than other sources.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
3. I believe receiving healthcare education on chronic diseases through mobile phone is personalized.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
4. I believe receiving healthcare education on chronic diseases through mobile phone is not time bound.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
5. I believe receiving healthcare education on chronic diseases through mobile phone can save me travelling cost.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
6. I believe receiving healthcare education on chronic diseases through mobile phone text messages can be forwarded to my family and friends.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
7. I believe receiving healthcare education on chronic diseases through mobile phone text messages can be saved for my future reference.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

**F. Perceived Ease of Use**

1. I can easily use the voice call feature on a mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
2. I can easily use the text messaging feature on a mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

3. I can easily use the apps on a mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
4. I can easily use the voice messaging feature on a mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
5. I can easily use the video messaging feature on a mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
6. I can easily use the Internet on a mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
7. I can easily use a mobile phone without additional assistance.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

**G. Social Influence**

1. If my family/friends approved the use of a mobile phone to receive healthcare education on chronic diseases, I would also use it.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
2. If my family/friends used a mobile phone to receive healthcare education on chronic diseases, I would also use it.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
3. If other members of my community approved the use of a mobile phone to receive healthcare education on chronic diseases, I would also use it.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
4. If other members of my community used a mobile phone to receive healthcare education on chronic diseases, I would also use it.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
5. If my religious leaders approved the use of a mobile phone to receive healthcare education on chronic diseases, I would also use it.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
6. If my religious leaders used a mobile phone to receive healthcare education on chronic diseases, I would also use it.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
7. If my cultural beliefs and practices allowed me to use a mobile phone to receive healthcare education on chronic diseases, I would also use it.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

**H. Intention to Use Mobile Phone**

1. I intend to use a mobile phone to receive healthcare education and awareness on the types of chronic diseases.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
2. I intend to use a mobile phone to receive healthcare education and awareness on signs and symptoms of chronic diseases.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
3. I intend to use a mobile phone to receive healthcare education and awareness on risk factors of chronic diseases.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
4. I intend to use a mobile phone to receive healthcare education and awareness on healthy diet.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
5. I intend to use a mobile phone to receive healthcare education and awareness on healthy lifestyle.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
6. I intend to use a mobile phone to receive healthcare education and awareness on prevention of chronic diseases.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
7. I intend to use a mobile phone to receive healthcare education and awareness on management of chronic diseases.

Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

**I. Mobile Phone Use**

1. I currently use a mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
2. I currently use text message on a mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
3. I currently use an app on the mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
4. I currently use a voice message on the mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
5. I currently use a video message on the mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
6. I currently use the Internet on the mobile phone.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐
7. I would recommend family and friends to use a mobile phone for receiving healthcare education on chronic diseases.
   Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree ☐

**XXXXXXXX----------XXXXXXXX----------XXXXXXXX----------XXXXXXXX**

**Administered by: …….**

**Signed:……..……. Date……..…...**

**Location of Respondent:**

**……..……**

**Setting of Administering Questionnaire:**

**……..……**

**Any other Comments:……..……**

**……..……**

**……..……**

**……..……**

## APPENDIX III: QUESTIONNAIRE TRANSLATED IN DHOLUO

**UNIVERSITY *of the* WESTERN CAPE**
***Faculty of Economic and Management Services***
***School of Information Systems***

# Survey Questionnaire

**Duoko mar oganda mayudo thieth, e ber tiyo koda ka ong'we yamo e lando kendo keyo milome e wi tuoche mag achiedh-nadi**

**Tarik:……..** **Namba mar otas:……**

**Wi Wach**
Aduoko erokamano kuom miya thuolo mar penjoi weche mag ngima dhano kaluwore kod tuoche mag achiedh-nadi. Nyinga en Anuradha Khoda, kendo an japuonjre matimo "PHD Information System" e mbalarieny mar Western Cape ma South Africa. Wi Wach ma asomo en: Kaka oganda nyalo tiyo koda ka ong'we yamo mondo ging'e matut/gipuonjore e wi tuoche mag midekre kata achiedh nadi e gwenge. Penjo mantie e otas ni endi biro konya nwang'o adiera kuom oganda e wach mar tiyo koda ka ong'we yamo e yor keyo milome kendo miyo oganda ong'e matut chalre mag tuoche achiedh nadi. Tuoche gi gin kaka Hypertension, Chwe aruya, Tuo Chuny, Tuo Sukar, Koda Kansa. Risach ni en mar tiegruok mae skul kende. Duoko moro-amora ma igolo ok bi nyisi e lela ma ok onyisi. Emomiyo duoko duto maratiro ma ibiro ndiki e otasni inyalo ti kodo e puonjo tienge mabiro ewi wach mar tiyo koda ka ong'we yamo e yore ma-owinjore kuom oganda ma wuok e gwenge mag Kenya.

**<u>Singruok mar oganda moyie duoko penjo</u>**

An……., asebedo koda thuolo mar penjo ratiro mondiki e otasni kaluwore koda somo ma idwaro, amor kendo ayie koda ka dwoko ma osemiya.

Kaluwore koda duoko ma osemiya kokalo kuom penjo mane rik chando pacha aseyie golo pacha e chanro mag tuoche mag achiedh nadi kaka openji e nonro ni.

Da her mar lero ni hika osekalo apar koda boro (18 years), kendo an Jasuba modak e gweng' miluongo ni Nyatoto. An koda ka ong'we yamo.

Da her mar lero ni duoko duto ma abiro miyo japuonjre e nonro ni ok bi chula omwom mora amora. Kendo an gi thuolo mar tamruok golo pacha e nonro ni kendo wuok sa asaya ma ok awacho ni ja-taa nyasi.

Angeyo chutho ni duoko duto ma wamiyo japuonjre ibiro goyo e apapla mag weche manyien kendo dhano duto biro bedo kod nafas mar somo nonro ma osetim kuom tuoche mag achiedh nade. Jogo duto ma ogolo pachgi e nonro ibiro pand nyingegi.

An gi thuolo mar tamruok chiwo duoko e penjo ma ok a lony kodo.

**Ka in kod penjo moro amora kaluwore koda ka nonro ni, in thuolo mar tudri koda: Anuradha Khoda e-mail: 3523368@myuwc.ac.az**
**kata Japuonj Ngire James Kariuki Njenga, e-mail: jkariuki@uwc.ac.za**

**Ratiro mar Jaduoko Penjo:**

Ayie duoko penjo mantie e apapla kaendi ☐
Ooyo ok ayie ng'ang mar duoko penjo ☐

Seyi /Lwedo ma Thuon:…….

**PENJO MAR NONRO**

**Gima onego tim:**

Akwayo mar mondo iketie alama e box ma owinjore e penjo ka penjo. Bende inyalo ndiko duokoni kaka owinjore e thuolo ma nitie e bwo penjo

**A: Chalre mar Jaduok penjo**

**Hiki**

18-20 ☐ 21-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 61-70 ☐ 71-80 ☐

**Miyo Kose Dichwo:** Dichwo ☐ Miyo ☐

**Chal Keny Mari:** In E Keny ☐ Uweru ☐ Chi Liel ☐ Ok idonjo e Keny ☐

Rawera ☐ Upogo Keny ☐

**Tich Ma itiyo ……**

**Yuto Mari mar Misodwe (KSHS):** <3,000 ☐ 3,001-10,000 ☐ 10,001-20,000 ☐

20,001 - 30,000 ☐ 30,001-40,000 ☐ 40,001-50,000 ☐ >50,000 ☐

**Sombi**

Podi Okineneno Dhood Skul ☐ Primary ☐ Secondary ☐ Mbalarieny Degree ☐

Diploma ☐ Certificate ☐

**B: Lony mari e dhumo kata ndiko Dhok mopogore (Language Literacy)**

1. Ingeyo Dhumo Odiero

   Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

2. Ilony e ndiko odiero

   Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

3. Iwacho odiero maliw

   Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

4. Iwinjo Odiero Maliw

   Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

5. Ilony e somo Oswayo

   Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

6. Ilony e ndiko Oswayo

   Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

7. Be ilony e wacho Oswayo

   Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

8. Bende Ilony e winjo Oswayo maliw

   Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

9. Alony e somo dholuo maliw

   Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

10. Alony e ndiko Dholuo

    Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

11. A lony e wacho dholuo

    Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

12. A lony e winjo dholuo maliw

    Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

**C. Perceived Susceptibility**

1. Awinjo ka achich koda ka wach mar nwang'o tuo mar Hypertension, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

2. Awinjo ka achich koda ka wach mar nwang'o tuo mar chwe-aruya, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

3. Awinjo ka achich koda ka wach mar nwang'o tuo mar chuny, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

4. Awinjo ka achich koda ka wach mar nwang'o tuo mar sukar, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

5. Awinjo ka achich koda ka wach mar nwang'o tuo mar Cancer, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

6. Jo dhieth kaloga ka-dichiel emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

7. kuonde mag thieth ok thoth, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

**D. Perceived Severity**

1. Ang'eyo ni tuoche mag achieth nadi kelo masira, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

2. Ang'eyo ni tuoche mag achieth nadi kelo thoye mapiyo enigma dhano, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

3. Ang'eyo ni tuoche mag achieth nadi kelo ng'ol eng'ima dhano, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

4. Ang'eyo ni tuoche mag achieth nadi kelo dhier, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

5. Ang'eyo ni tuoche mag achieth nadi kelo kuyo, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

6. Ang'eyo ni tuoche mag achieth nadi kelo chandruok mag yuto, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

7. Ang'eyo ni tuoche mag achieth nadi kelo thoye mag joot, emomiyo daher mar bedo koda ka ong'we-yamo manyalo konya yudo puonjruok matut ewi touchegi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

**E. Perceived Usefulness**

1. Nwang'o puonjruok/tiegruok mag thieth kokalo kuom on'gwe-yamo nenre ni yoot kipimo koda ka yore mamoko

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

2. Nwang'o puonjruok/tiegruok mag thieth kokalo kuom on'gwe-yamo nenre ni kelo duoko mapiyo kipimo koda ka yore mamoko

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

3. Nwang'o puonjruok/tiegruok mag thieth kokalo kuom on'gwe-yamo nenre ni miyo ng'ato chir nikech ok oriw koda ji mang'eny

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

4. An gi geno ni puonjruok mag thieth ma ikelo kokalo kuom ong'we yamo ok odewo saa

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

5. An gi yie ni ok ochuno ni nyaka atii gi pesa dhi adhi mabor mondo ayud puonjruok mag thieth ka an gi ong'we yamo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

6. Nwang'o puonjruok/tiegruok mag thieth kokalo kuom mbui mag on'gwe-yamo inyalo oor ni jo-oot koda ka osiepe

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

7. Nwang'o puonjruok/tiegruok mag thieth kokalo kuom mbui mag on'gwe-yamo inyalo kan kendo tiyogo ndalo mabiro

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

**F. Perceived Ease of Use**

1. Ok anwang' pek moro-amora wuoyo kokalo kuom ong'we yamo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

2. Onge pek e somo koda ka ndiko mbui

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

3. Onge pek moro-amora e nwang'o tiegruok kokalo kuom applications mantie e ong'we yamo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

4. Mbui mawuoyo kelo tich mayoot e nwan'go puonj mag thieth kokalo ong'we-yamo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

5. Ok anwang' pek moro-amora e yudo tiegruok mag thieth kokalo kuom video mag ong'we yamo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

6. Puonj mag internet kokalo kuom ong'we yamo yot moloyo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

7. Puonj mikelo kokalo internet messenger yot tiyogo nyowuoyo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

**G. Social Influence**

1. Gimoro amora ma jo-dhoot/osiepe owinjore kendo oyie kodo kuom tiegruok mar ngima dhano ka okalo ong'we yamo abiro kawo gi ng'wono

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

2. Abiro luwo chenro koda ka gigo duto ma jo-dhoot/osiepe oketee seyi kuom tiegruok mar tuoche masando gnima dhano kokalo kuom ong'we yamo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

3. Gimoro amora ma anyuola biro winjoree kendo ketoe seyi kuom tiyo koda ka ong'we yamo e-tigruok mar ngima kendo tuoche masando dhano abiro luwo rabithi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

4. Abiro luwo rabithi weche tiegruok duto te mag ngima kod tuoche/midekre ma anyuola biro winjoree mondo ginwang' ko-kalo ong'we yamo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

5. Abiro luwo rabithi winjruok mar jo-tich Nyasaye kuom wach tiyo koda ka ong'we yamo e wach tiegruok mar ngima dhano koda midekre

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

6. Abiro tiyo koda ka ong'we yamo mak man aka jo-tich Nyasaye odagi tiyo kode e yor nwang'o puonjruok mag ngima dhano kod midekre

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

7. Kit Luo, chike koda ka timbegi nyalo kelo rageng' ewach tiyo koda ka ong'we yamo e wach puonjruok mar ngima dhano koda ka midekre

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

**H. Intention to Use Mobile Phone**

1. A biro tiyo koda Ong'we yamo e yudo puonjruok mag thieth mag achiedh nadi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

2. A biro tiyo koda Ong'we yamo e yudo puonjruok mag thieth e ranyisi mag tuoche achiedh nadi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

3. A biro tiyo koda Ong'we yamo e yudo puonjruok duto kaluwore kod hinyruok ma tuoche mag achiedh nadi kelo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

4. A biro tiyo koda Ong'we yamo e yudo puonjruok duto mag chiemo mowinjore

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

5. A biro tiyo koda Ong'we yamo e yudo puonjruok duto mag dak e ngima mowinjore

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

6. A biro tiyo koda Ong'we yamo e yudo puonjruok duto kaka inyalo geng' tuoche mag achedh nadi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

7. A biro tiyo koda Ong'we yamo e yudo puonjruok duto kaka onego wadag gi thieth mag touche mag achiedh nadi

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

**I. Mobile Phone Use**

1. Ang'eyo tiyo koda ka duond-milome mantie e ong'we-yamo ma ok okonya koda ng'ato ang'ata

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

2. Aonge gi pek moro-amoro tiyo koda ka mbui mantie e ong'we yamo

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

3. Anyalo tiyo koda ka "applications" mantie ong'we-yamo maonge kony

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

4. Ang'eyo tiyo koda ka mbui mar wach mantie ong'we-yamo ma ok okonya

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

5. Anyalo tiyo koda ka “video” mantie ong’we-yamo ma ok okonya

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

6. Angeyo tiyo koda ka “internet” mantie ong’we-yamo ma ok okonya

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

7. Anyalo chiwo kwayo makende ni jo-dhoot koda ka osiepe mar mondo gi tii koda ka ong’we yamo yudo weche manyien kuom tuoche mag achiedh nade

Ayie Chutho ☐ Ayie ☐ Ok Alony Kodo ☐ Ooyo Adagi ☐ Adagi chutho ☐

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**Administered by:……**

**Signed:……..……** **Date……..…….....**

**Location of Respondent: ……..……..……..**

**Setting of Administering Questionnaire: ……..……**

**Any other Comment:……**

**……..……..**

**……..……**

**……..……**