Screens to solutions: the role of digital health communication in preventing chronic kidney disease in Ghana

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Abstract

This thesis investigates the role of digital health communication in shaping awareness, information-seeking behaviors, and preventive health actions related to chronic kidney disease (CKD) among Ghanaians. With the increasing use of digital platforms for health-related purposes, this study explores how digital media influence CKD knowledge and behavior in a population facing rising rates of chronic illness and limited early detection.

Grounded in the Health Belief Model (HBM) (Rosenstock, 1974) and Technology Acceptance Model (TAM) (Davis, 1985), the research examines the effects of perceived susceptibility, severity, benefits, barriers, cues to action, self-efficacy, and technology acceptance (perceived ease of use and usefulness) on CKD-related behaviors. Additional variables include digital media use, gender differences, and cultural influences on health behavior.

A quantitative approach was employed, with data collected through an online survey (n=298). The sample was composed of 128 men, 134 women, and 15 who preferred not to identify. Descriptive statistics were calculated, including percentages, means, and standard deviations. Correlation and regression analyses were conducted to test the hypotheses and answer the research questions.

Findings show that perceived benefits (β = .256, t = 2.77, p = .006) and cues to action were significant predictors of CKD knowledge and preventive behavior, while perceived susceptibility (β = –.200, t = –3.24, p = .001) was negatively associated with knowledge. Perceived ease of use (β = .211, t = 2.89, p = .004) and usefulness (β = .202, t = 2.72, p = .007) of digital platforms significantly predicted CKD awareness, supporting TAM's premise. Notably, gender differences were found in perceived barriers, with women reporting significantly more obstacles to preventive behavior (p = .002).

Regression analyses revealed that health beliefs, digital platform acceptance, and subjective norms explained a significant proportion of variance in preventive and information-seeking behavior. These findings underscore the complex interplay between technological access, belief systems, and cultural context in health communication.

This study highlights the potential of digital health communication to improve CKD awareness to promote preventive action in Ghana. It emphasizes the need for culturally relevant, user-friendly digital interventions that consider gender, literacy, and social support systems to effectively bridge gaps in health knowledge and behavior.

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Dedication

This thesis is dedicated to the many hearts and hands that have supported me throughout this transformative journey. To my loving family, whose prayers, sacrifices, and unwavering belief in me have been my constant source of strength. To my husband, thank you for your patience, love, and encouragement that carried me through every challenge. To my students, mentors, and research participants, your thoughts and voices have shaped this work in meaningful ways. Above all, I give thanks God, the Most Gracious, the Most Merciful, for granting me the strength, clarity, and purpose to complete this journey. I am grateful.

Chapter 1- Introduction

Background

In the twentieth century, the world experienced an "epidemiologic transition" (McKeown, 2009), marked by a shift in disease patterns. Noncommunicable diseases (NCDs), including chronic illnesses, emerged alongside infectious diseases as prominent health challenges and have now become the primary causes of death globally (WHO, 2024). The WHO defines chronic diseases as those diseases that tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behavioral factors' (WHO, 2023). They include respiratory conditions like chronic obstructive pulmonary disease (COPD), musculoskeletal disorders like osteoarthritis, cardiovascular diseases like hypertension, metabolic diseases like diabetes mellitus (DM) and kidney diseases like chronic kidney disease. Statistics from the world health organization show that chronic diseases kill 41 million people annually representing 74% of all deaths worldwide (WHO, 2023).

Annually, 17 million individuals succumb to chronic diseases prior to reaching 70 years of age, with 86% of these premature fatalities occurring in low- and middle-income nations. Of all chronic disease deaths, 77% are in low- and middle-income countries and in the United States of America, about half of Americans live with at least one chronic illness, making it a way of life for many (DeHaven et al., 2020).

Additionally, chronic diseases account for 90% of yearly health care spending and about $4.1 trillion in medical expenses (Hardman et al., 2020; Raghupathi & Raghupathi, 2018; Tharani et al., 2021). Patients with chronic illnesses have health and quality of life issues. The health care system and these patients are burdened since they frequently utilize more medical services and spend more time and money on medical care (Buttorff et al., 2017; Raghupathi &

Raghupathi, 2018). According to the National Institute of Diabetes and Digestive and Kidney Disease (NIDDK), chronic illnesses such as hypertension and diabetes are among the leading causes of death and disability as well as the top two causes of chronic kidney disease globally (NIDDK, 2016).

Chronic kidney disease (CKD) is a degenerative illness in which the kidneys lose their capacity to filter blood, concentrate urine, eliminate wastes, and maintain electrolyte balance. As CKD progresses over the years, kidney function declines to the point that it is no longer sufficient to sustain life. This condition is often known as end-stage renal disease (ESRD) (Hallan et al., 2006). The disease is often asymptomatic in its early stages (NIDDK 2016; US Preventive Services Task Force 2012), which makes it difficult for early detection, resulting in many patients unaware of the disease until there has been a significant decline in kidney functions (Okolie, 2024). To survive at this advanced stage of chronic kidney disease, patients need renal replacement therapy, such as dialysis or a kidney transplant (Mayo Clinic, 2013). According to research by Yang et al. (2020), CKD is a common and growing problem worldwide. Globally, more than 850 million people have CKD (ISN, 2024) and in Africa 15.8% of the 1.5 billion people have CKD (Kaze et al., 2018). CKD is responsible for about 1.3 million deaths annually, with an additional 1.4 million deaths from cardiovascular disease that are attributed to impaired kidney function (NCD Alliance, 2023).

Furthermore, the Center for Disease Control (CDC) reports that CKD is more common in Black adults than in any other race (CDC, 2023) and it disproportionately affects people in low- and middle-income nations, especially sub-Saharan Africa, where diabetes and hypertension are the main risk factors (Haroun et al., 2003). In Ghana, CKD is fast becoming a public health issue, with a prevalence of 13.3% among the adult population (Adjei, 2018). According to

research by Tannor et al., (2018), late-stage diagnosis of CKD is very common in Ghana, with many patients going to hospitals in severe stages of the disease, which complicates treatment options. Notably, the use of herbal drugs, exposure to environmental contaminants, lifestyle choices like smoking and drinking, and non-communicable diseases like diabetes and hypertension are some of the factors that are causing an increase in cases of CKD (Bagnis et al., 2004; Mirrakhimov, 2012). It is also widely acknowledged that CKD is a prevalent ailment that increases the risk of cardiovascular disease, kidney failure, and other health problems (Cailhol et al., 2011).

Notwithstanding the high prevalence and substantial expenses of CKD worldwide, 90% of people who have the condition and 40% of individuals with advanced CKD are unaware of their status (Bello & Johnson, 2022). Diagnosis of CKD is at times hindered by low rates of patient CKD awareness and a patient's inability to fully understand the meaning of CKD and its relevance to health (Stolpe et al., 2021; Szczech et al., 2014). Knowledge gaps, according to Agudelo-Botero et al. (2020), are obstacles to the successful prevention and management of renal diseases. Research has shown that adult CKD patients had minimal to average awareness of the disease's etiology, risk factors, drugs, signs and symptoms, consequences, therapy, and prevention (Agudelo-Botero et al., 2020; Ku et al., 2019; Pugh et al., 2019). For instance, 137 patients with CKD were found to have low awareness and understanding of kidney disease in a survey conducted at Vanderbilt University Hospital in the United States of America (Siew et al., 2019). According to the study, the majority of participants did not know what their ailment was, nor did they comprehend risk factors or how to manage it (Siew et al., 2019).

A low socioeconomic status, a low literacy level, and symptoms including restlessness and delirium are some of the factors that lead to people with CKD having little understanding of

the condition (Siew et al., 2019). People with CKD find it challenging to accept, comprehend, and remember information about the condition because of these variables (Siew et al., 2019). Additionally, it has been discovered that religious beliefs and cultural customs play a role in the poor health-seeking behaviors of Ghanaians with CKD (Tannor et al., 2019).

Statement of Problem

Despite its high prevalence, there is also little awareness and knowledge of CKD among the general population in Ghana (Danzima et al., 2023) as well as scarcity of literature regarding knowledge of CKD in Ghana. Nonetheless, two Ghanaian studies found that the majority of those with CKD are unaware of the disease's causes, symptoms, prevention, and treatment (Amoako et al., 2014; Tannor et al., 2019). According to these two studies, people with CKD were also unaware of lifestyle changes that could help them control and manage their condition, such as adhering to prescription regimens, limiting sodium intake, and engaging in manageable exercise (Amoako et al., 2014; Tannor & Sarfo, et al., 2019).

Among other avenues for obtaining knowledge on CKD, the advent of digital health communication offers a great chance to manage and prevent chronic conditions like chronic kidney disease. According to research by Wang et al. (2018) digital health information tools, such as e-health, telemedicine, social media, and mobile health apps, offer easily accessible and reasonably priced means of raising public awareness and sharing health information (Wang et al., 2018). However, a primary concern is understanding the current level of CKD awareness among Ghanaians who use digital health platforms. By exploring this, we can better comprehend how digital literacy influences health knowledge and risk awareness among diverse demographic groups. Additionally, it is crucial to investigate the motivating factors that drive individuals to adopt CKD preventive behaviors and seek information on CKD through digital health channels.

Guided by the Health Belief Model (HBM) and Technology Acceptance Model (TAM), this research aims to assess the level of CKD awareness among Ghanaians who actively use digital health platforms. Through this, the study identifies the motivating factors that drive individuals toward preventive behaviors and the factors that encourage them to seek information on CKD through online platforms. Specifically, the study hypothesizes that individuals' likelihood to seek information about CKD will be positively influenced by their perceptions of ease of use and usefulness of online health information resources, suggesting that user-friendly and valuable digital health content plays a critical role in supporting informed health decisions.

Studies on digital health communication in CKD prevention often employ the health belief model to explain health behavior (Champion & Skinner, 2008; Janz & Becker, 1984). The HBM is useful in understanding how people perceive their susceptibility to CKD, the severity of the condition, the advantages of taking preventative measures, and potential obstacles is made easier with the help of the HBM (Rosenstock et al., 1988). Even though HBM offers valuable information on personal health choices, it ignores the technological aspects that affect the adoption of digital health information.

This study fills this knowledge gap by combining the Technology Acceptance Model (TAM) with the HBM, providing a more thorough framework for comprehending CKD awareness and prevention. Davis (1989) developed the Technology Acceptance Model (TAM), which highlights two important elements that affect people's propensity to adopt digital communication tools, including digital health platforms: perceived usefulness and perceived ease of use. TAM makes it possible to investigate how people's attitudes toward technology affect their use of CKD-related digital tools in Ghana, where levels of familiarity with digital technologies may differ (Kaklamanou et al., 2024); AlQudah et al., 2021).

According to TAM, individuals' perceptions of ease of use and usefulness of online resources directly impact their likelihood of engaging in information-seeking behavior (Davis, 1989). It is therefore important to examine how ease of use and perceived usefulness correlate with social media use in a CKD context providing insights into tailoring digital health information for better engagement in Ghana.

The Health Belief Model (HBM) further suggests that self-efficacy, belief in one's capacity to perform health-promoting actions, plays a pivotal role in influencing preventive behaviors (Rosenstock et al., 1988). The question therefore is whether higher self-efficacy among Ghanaians could positively influence their CKD preventive and information-seeking behaviors, leading to enhanced health outcomes. Moreover, given that health perceptions and behaviors can vary by demographic factors, such as gender, this study aims to identify potential gender differences in HBM and TAM factors that impact CKD-related attitudes and actions (Ek, 2015; Mansfield et al., 2003; Rothman and Salovey, 1997; Wellstead, 2011). Examining these gender-specific factors may enable more tailored and equitable health interventions.

Again, this study explores the influence of media use on health perceptions and behaviors. Previous research has shown that media exposure can shape health beliefs, susceptibility perceptions, perceived benefits, and barriers related to disease prevention (Kim et al., 2021). Understanding the association between media use and CKD health beliefs, susceptibility, benefits, barriers and will allow for a more nuanced approach to leveraging media for effective CKD communication and education in Ghana.

Ultimately, this study addresses these issues by examining (1) the current level of CKD awareness among Ghanaians utilizing digital health platforms, (2) the motivating factors driving preventive behaviors and information-seeking actions, and (3) the influence of self-efficacy, ease

of use, and perceived usefulness on these behaviors. It will further assess gender differences in these factors and analyze how media use is associated with perceptions of susceptibility, benefits, and barriers in relation to CKD. By addressing these gaps, this research aims to provide a comprehensive analysis that can guide the design of more effective digital health strategies to enhance knowledge on CKD prevention in Ghana.

Significance of the Study

Extensive literature has shown that CKD poses a significant global health burden, contributing to increased morbidity and mortality rates worldwide (ISN, 2024; Kaze et al., 2018 Yang et al., 2020) and WHO has predicted that by 2040, CKD will rank as the fifth most common cause of death worldwide, underscoring the need to address this public health emergency (WHO, 2020). While a lot of research has been done in high income nations on how to reduce CKD using digital health communication in public health interventions (Luyckx et al., 2018) there is still little research on how digital health communication can raise awareness and prevent CKD in Africa, especially Ghana (Okpechi et al., 2020). This study, therefore, fills a significant gap by exploring how digital health communication can enhance knowledge and preventive measures for CKD in Ghana, contributing to the global efforts to lower the CKD prevalence.

In Ghana, digital communication technologies are rapidly expanding, providing a valuable avenue for educating the public about CKD prevention and early detection strategies (Demuyakor, 2015). Despite the potential of digital tools, little research has been conducted on how effectively they are being leveraged to prevent CKD in Ghana. This study ultimately explores the role of digital health communication in raising awareness and preventing CKD in

Ghana, focusing on how digital platforms can be used to educate the population and encourage early detection of the disease.

Additionally, by analyzing key variables such as perceived ease of use and usefulness of digital platforms, and the role of media in shaping health beliefs, this research can offer valuable information into how digital health interventions may influence health behaviors. Exploring these elements provides a foundation for developing targeted, accessible digital health solutions that promote CKD prevention and early detection. This is particularly important as it can support more efficient public health campaigns, reaching a broader audience with accurate, actionable health information.

The study's focus on gender-based differences in CKD information-seeking behavior is significant for understanding the disparity in CKD incidence, progression, and outcomes between men and women. Globally, the prevalence of CKD is estimated to be 11.8% in women and 10.4% in men (ISN, 2024), underscoring the importance of understanding how men and women approach CKD information and management differently. Examining these differences through the lens of the Health Belief Model (HBM) and the Technology Acceptance Model (TAM) provides valuable insights into gender-specific motivations and barriers. For instance, men and women may perceive their susceptibility to CKD and its severity differently, influencing their motivation to seek health information and engage in preventive actions.

Additionally, gender-specific evaluations of the benefits of prevention and the barriers to accessing information are crucial, as these factors may affect engagement with digital health resources. Differences in self-efficacy, that is the belief in one's ability to take preventive measures could further drive distinct behaviors in seeking CKD-related information and preventive practices. From a TAM perspective, comfort with accessing online information may

vary between genders, affecting the likelihood of seeking CKD information. By considering how each gender perceives the ease of use and usefulness of digital resources, this study aims to uncover factors influencing CKD awareness and prevention efforts, ultimately contributing to strategies that better address gender-specific health disparities.

By examining how psychological and technological factors influence CKD-related health behaviors, this study contributes to a body of knowledge that supports not only the Ghanaian public health landscape but also global efforts to leverage digital tools for chronic disease prevention in diverse populations.

Chapter 2- Literature Review

Defining Chronic Kidney Disease

Chronic Kidney Disease is characterized by structural or functional abnormalities of the kidneys that have persisted for longer than three months and have an impact on health (Stevens & Levin, 2013). This aspect of the disease explains why people frequently don't realize there is an imminent danger until there has been a significant decline in kidney function (Okolie, 2024). According to the US Preventive Services Task Force (2012) and the National Institute of Diabetes, Digestive and Kidney Diseases (2016), the disease is normally asymptomatic in its early stages and starts to show symptoms around Stage 3, which indicates a significant loss of kidney function before discovery. According Hallan et al., (2006) CKD is characterized by a reduced glomerular filtration rate (GFR)- which is a measure of how well kidneys are filtering waste and excess fluid from the blood, and it increases the risk of cardiovascular morbidity and mortality as well as the development of end-stage renal disease (ESRD).

Even though it is widely agreed upon that the continuous presence of abnormal albuminuria (excessive protein) is indicative of CKD, there is disagreement over whether a single measurement should be used to diagnose CKD independent of albuminuria (Glassock, 2015; Glassock, 2020; Levey, 2015; 2020). Research by Denic et al., (2016) found that the function of the kidney to filter waste and excess fluid in the blood naturally decreases with age. Therefore, setting a fixed measurement to diagnose kidney issues could lead to overdiagnosis in older adults, whose kidneys naturally become weak and underdiagnosis in younger people (Delanaye et al., 2019).

A fixed-threshold definition could lead to an overestimation of the burden of chronic kidney disease (CKD) in the aging population, mostly because of individuals who might not be

at higher risk of unfavorable outcomes (Liu, 2021). According to Liu (2021), a proposed definition for CKD that considers age sets measurements at 75 mL/min/1.73 m² for individuals under 40, 60 mL/min/1.73 m² for those aged 40 to 64, and 45 mL/min/1.73 m² for individuals 65 and older.

According to the Diabetes Control and Complications Trial (DCCT) and the UK Prospective Diabetes Study (UKPDS) trials, the commonest cause of kidney disease worldwide is diabetes mellitus and adequate control of blood sugar has been shown to delay diabetic nephropathy. Other studies have also indicated that not only diabetes, but hypertension is also a main cause of kidney disease worldwide (Haroun et al., 2003; Perneger et al., 1994). Apart from non-communicable diseases (NCDs), some communicable diseases such as HIV and bilharzia might be risk factors for CKD development (Danzima et al., 2023). Smoking and excessive alcohol consumption are examples of lifestyle choices that are significant factors for developing kidney diseases (Bleyer et al., 2000; Falodia & Singla, 2012; Mirrakhimov, 2012). Further factors linked to the development of CKD include the use of herbal medications, exposure to environmental pollutants, and recurrent malaria infections (Danzima et al.,2023). In fact, there is evidence from across the world, including Africa, linking the usage of herbal medication to kidney disease (Bagnis et al., 2004; Barnes et al., 2008). According to the National Kidney Foundation (NKF) in 2023, the symptoms of CKD include anemia, altered cognition, hypertension, problems with digestion, breathlessness, foamy urine, nausea, loss of appetite, itching and cramping. In advanced stages, symptoms include trouble concentrating, trouble sleeping and vomiting (NFK, 2023).

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), in a 2016 article, recommends that protecting kidney health involves preventing or managing

conditions such as diabetes and high blood pressure, which are significant contributors to kidney damage. Ghosh-Dastidar et al., (2014) add that, in order to address other factors influencing CKD risk and aid in CKD prevention, upstream factors such as poverty, unhealthy diets, food insecurity, tobacco use, and sedentary lifestyles should be optimized. According to weight loss and hypertension management interventions have been linked to both a lower risk of CKD and better outcomes for people who already have it (Jafer et al., 2016). The NIDDK also recommends that engaging in at least 30 minutes of physical activity on most days as a vital measure to prevent chronic kidney disease (CKD), with guidance from healthcare providers for those currently inactive.

Prevalence of Chronic Kidney Disease Globally

The prevalence of chronic kidney disease and its risk factors is increasing worldwide (Yang et al, 2020). According to the Global Burden of Disease Study, the global prevalence of CKD is steadily rising worldwide, significantly affecting morbidity and mortality rates (Kovesdy, 2022). CKD is a global public health issue that can lead to kidney failure, cardiovascular disease (CVD), as well as premature death (Levey et al., 2005). Globally, more than 10% of people have CKD, and in high-risk subpopulations such as those with diabetes and hypertension, this number rises to 50% (Eckardt, 2013).

In a 2024 collaborative report by ISN, ASN, and ERA-EDTA, it was revealed that over 850 million people globally suffer from some form of kidney disease. This staggering figure is nearly double the number of individuals living with diabetes (422 million) and 20 times higher than the global prevalence of cancer (42 million) or AIDS/HIV (36.7 million). The prevalence of CKD worldwide is 10.4% among men and 11.8% among women (ISN). Between 2017 and 2022, CKD affected 1 in 10 adults worldwide (Sundström et al., 2022) and was the 12th-leading cause

of global mortality (Carney, 2020) accounting for 35 million disability-adjusted life-years (Bikbov, 2020). According to Webster (2017), only HIV-related complications-related fatalities have risen more quickly than CKD-related deaths since 1990.

In 2015, Mills and colleagues combined data from 33 global studies to assess the prevalence of CKD in various demographics. The study revealed that CKD affected 10.4% of men and 11.8% of women over the age of 20 worldwide (Mills et al., 2015). The study also highlighted significant regional differences in CKD prevalence based on income levels. In high-income countries, the age-standardized prevalence of CKD was 8.6% in men and 9.6% in women. In contrast, in low- and middle-income countries, the prevalence was notably higher, at 10.6% in men and 12.5% in women (Mills et al., 2015). Among people aged 20 years or older, the worldwide prevalence of CKD stages 3-5 was 5.8% for women and 4.7% for men in the research. In other studies that looked at 100 papers with 6,908,440 patients were thoroughly reviewed and meta-analyzed. The results showed that the global prevalence of CKD stages 1–5 was 13.4%, and for stages 3–5, it was 10.6% (Hill et al., 2016). In fact, CKD is predicted to rise to the fifth most common cause of death worldwide by 2040, which is one of the highest anticipated rises of any major cause of death (Foreman et al., 2018).

Prevalence of Chronic Kidney Disease in Africa and Ghana

With a population of over 1.5 billion, Africa is the second-largest continent in the world (UN, 2024). Sub-Saharan Africa is home to 1.2 billion people, while Northern Africa is home to almost 250 million (UN, 2024). Unfortunately, the absence of epidemiological data from many African nations means that the problem of CKD is still under-appreciated throughout the continent (Abd ElHafeez, 2018; George et al., 2021). Although the prevalence of CKD has been

studied in more detail in developed countries, the disease burden is considerably higher in developing nations (Hill et al., 2016).

CKD is a major public health concern in Africa (Afolabi et al., 2009) and based on a meta-analysis of data from the International Society of Nephrology (ISN), Kaze and colleagues estimated that the prevalence of CKD stages 1–5 in the general adult population across Africa is approximately 15.8%. Additionally, the study revealed that 4.6% of adults in Africa have moderate to severe decreases in kidney function, corresponding to CKD stages 3 to 5. The study also revealed that CKD prevalence was greater in sub-Saharan Africa than in North Africa and nearly doubled in high-risk populations compared to the general population. In fact, CKD is notably high among hypertensive patients in Africa, with those in urban areas being more affected than those in rural regions (Ajayi et al., 2021). In comparison to the rest of the world, younger Africans have a greater rate of CKD, which raises the risk of morbidity and early death (Okolie, 2024). Ninety percent of individuals with CKD do not make it past ninety days after starting dialysis (Olanrewaju et al., 2020).

In Africa, diabetes mellitus, hypertension, chronic glomerulonephritis, and tubulointerstitial diseases are the most common causes of CKD (ElHafeez et al., 2018). Additionally, Nyirenda (2016), explains that the development of CKD in Africa is accelerated by poverty and a lower socioeconomic position, which are independent risk factors for the disease. According to the ISN and the Global Health Atlas survey, the estimated prevalence of CKD in South Africa is 10.7% (Bello et al., 2019). Conversely, a recent systematic review found that there were regional variations in the prevalence of CKD in Nigeria (Chukwuonye et al., 2018). Research findings from a 2013 study revealed an 18% prevalence of CKD in a rural community in Osun State, South-Western Nigeria (Oluyombo et al., 2013). In contrast, a separate study by

Onodugo and colleagues (2013) reported lower CKD prevalence rates of 11.4% in rural areas and 11.7% in semi-urban populations in Emene-Nike and Mbulu-Ujodo of Enugu State, South-East Nigeria.

A 2019 study by George and colleagues investigated CKD prevalence in four sub-Saharan African countries: Burkina Faso, Ghana, Kenya, and South Africa. The overall CKD prevalence was 10.7%, with South Africa having the highest rate at 12.9%. Women had a higher CKD prevalence (12.0%) compared to men (9.5%). The study also reported high rates of risk factors: 32.6% for hypertension, 5.6% for diabetes, and 15.9% for HIV. Research studies examining the prevalence of CKD in Eastern Africa, specifically in Uganda and Kenya, reported a prevalence rate of 6.8% (Muiru, 2020). These findings align with a previous meta-analysis of 21 studies in low- and middle-income countries (LMICs), which found that 13.9% of the general population had CKD (Stanifer, 2014). Quite notably, prevalence of CKD varied widely, from as low as 2% in Côte d'Ivoire to as high as 30% in Zimbabwe (Stanifer, 2014).

Compared to those of European ancestry, African communities may have a higher prevalence of CKD, which could be due to a genetic susceptibility. Apolipoprotein L1 (APOL1), which is widely common across Africa (Ulasi et al., 2013), is primarily responsible for the increased genetic risk of CKD in people with African heritage (Freedman et al., 2013; Limou et al., 2014; Parsa et al., 2013). Moreover, the high prevalence of CKD in Africa can be attributed to change in lifestyle through urbanization and globalization (Mills et al., 2015).

In Ghana, the prevalence of CKD has been estimated to be 13.3% among the adult population (Adjei, 2018) and over half of the patients with hypertension have been found to have CKD (Osafo et al., 2011). According to Amoako (2014), more males 64.5% are affected by the disease compared to females 35.5% in Ghana. Similarly, Eghan and colleagues (2009) also

report a male preponderance, with 55% of CKD cases occurring in men compared to 45% in women. Based on data by the Ghana renal registry published in 2022, the average age of patients undergoing Kidney Transplant (KRT) is 45.5 years (Boima et al., 2022). Kidney failure (KF) affects people in Ghana at a comparatively younger age; in over 75% of cases, patients present late with serious conditions (Tannor et al., 2018).

Additionally, researchers have found that the disease is also an independent risk factor for the development of other non-communicable diseases (NCD) such as stroke, ischemic heart diseases, and hypertension (Mann et al., 2001). While Type II diabetes mellitus (DM) is known to be the most common cause of CKD worldwide Coresh (2007), it is the second most common cause in Ghana (Amoako, 2014). In Ghana, CKD has been reported to account for 5% of medical admissions (Plange-Rhule, 1999). Furthermore, Osafo et al. (2011) found a CKD prevalence of 47% among Ghanaian patients, primarily in the Greater Accra region. However, despite these findings, there is a notable lack of literature on knowledge related to the prevention and early detection of CKD in Ghana (Danzima et al.,2023).

Public Awareness and Knowledge About Chronic Kidney Disease

It is estimated that 96% of the people with reduced kidney functions are not aware they have CKD, which is attributed to their little knowledge about the risk factors, symptoms, progression as well as other characteristics of the disease (Anupama and Uma, 2014). While early diagnosis and treatment can halt the progression of kidney diseases, the CDC estimates that about 30 million people with impaired kidney function or kidney damage are unaware that they have these conditions.

Also, findings from studies conducted in Tanzania, India, Australia, Hong Kong, Iran and Nigeria, revealed that most participants had little to no knowledge of CKD (Chow et al., 2012;

Roomizadeh et al., 2014; Gheewala et al., 2018; Hussain et al., 2019; Oluyombo et al., 2016; Stanifer et al., 2016). As a result, chronic kidney disease is often under-recognized and under-diagnosed, leading to the misconception that patients with end-stage kidney failure represent only a small fraction of the total population actually living with the disease (Ige, 2021). While Boulware et al. (2009) argue that the most crucial initial step in treating CKD is early detection; Clarke et al. (2016) believe that increasing awareness is the most crucial strategy because a major contributing factor to the incidence of CKD is a lack of knowledge about the disease.

Researchers believe that the public perceptions of risk and susceptibility to kidney diseases have declined as a result of inadequate knowledge and low public awareness of kidney disorders (Hu et al., 2018; Yamamoto, 2010). Additionally, this lack of general knowledge of the disease has been associated with governments failing to raise clinical awareness and not providing adequate and visible data on the prevalence of the disease (Patel et al., 2016). In support of this, Muhammad and Sen (2014), argue that many individuals diagnosed with the disease lack the means or platforms to spread awareness due to the absence of appropriate frameworks or platforms for awareness campaigns. This lack of awareness is further compounded by limited knowledge of CKD risk factors and preventive measures, which hinder prevention and control efforts, including effective treatment plans and early detection (Danzima et al., 2023).

Furthermore, linking cultural factors to CKD has been found to be another significant hindrance to preventing the disease. For instance, a study conducted among the Efik, Ibibio, and Annang ethnic groups in southeast Nigeria revealed that symptoms of kidney failure, particularly body swelling, are often attributed to evil spirits, personal transgressions, or theft. This lack of knowledge and awareness about the medical causes of CKD has led to practices such as

mutilating the corpse before burial to placate local deities and prevent further tragedy within the family (Akpan & Ekripko, 2015). This highlights the critical need for increasing public awareness and education about CKD to dispel harmful misconceptions and promote early diagnosis and treatment.

Increasing public awareness of the seriousness of CKD and its risk factors through health education, taking advantage of chances for early screening and detection, focusing on the prevention of obesity, diabetes, and hypertension, and providing appropriate treatment are some strategies to lessen the burden of the disease (Gheewala et al., 2018). Nevertheless, there is still a lack of epidemiological information about the illness burden and risk factors, and there is a low level of community awareness of this disease even in spite of a potentially high incidence (Danzima et al., 2023).

Research on the general public's and victims' knowledge of CKD appears to be scarce in Africa as according to a 2012 study, only 44.7% of non-medical university students in their third and fourth year in Benin City, Nigeria, knew that diabetes mellitus and hypertension were risk factors. Again, 48% of respondents thought that herbal therapy, urine therapy, and spiritual healing were forms of treatment. 25.1% of respondents had strong knowledge, 35.2% had some knowledge, and 39% had inadequate knowledge, according to the survey (Damtie et al., 2018). Despite these known adverse effects of CKD, most of the people are still unaware of the disease (Danzima et al.,2023). High prevalence and low awareness were the main obstacles to the prevention and treatment of CKD (Provenzano M, et al., 2019; Wen CP, et al., 2008; Zhang L, et al., 2012).

The Role of the Media in Chronic Kidney Disease Prevention

According to the U.S. Department of Health and Human Services' Office of Disease Prevention and Health Promotion, health communication is the study and practice of disseminating health-promoting information, such as in public health campaigns, health education, and doctor-patient interactions. Early studies on the topic of mass media's role in health campaigns, such as those conducted by Rimal and Lapinski (2009), demonstrated how well radio and television work to increase public awareness of health issues.

As the internet grew in popularity, health communication transitioned to online platforms, giving people instant access to resources and health information (Bennett & Glasgow, 2009). Digital communication tools, such as telemedicine, online health information resources, and mobile health apps, have become quite popular and are being incorporated into healthcare delivery systems more and more (Fitzpatrick, 2023). These resources present exceptional chances to connect with a broad spectrum of people, irrespective of their location, socioeconomic standing, or level of education. Digital communication technologies have the potential to increase patient-provider communication, raise health literacy, and ultimately improve health outcomes by utilizing technology (Fitzpatrick, 2023). The Internet, particularly social media platforms like TikTok, have strong dissemination and acceptance characteristics (Yao et al., 2022). As a result, they have steadily emerged as one of the main platforms for the dissemination of health information (Goobie et al., 2019; Van der Keylen et al., 2020), and they are becoming more and more significant in populations that are sub-healthy or may be at risk for disease (Diaz et al., 2002; Grosberg, 2017).

Importantly, there is overwhelming proof that social media can play a crucial role in the process of formation (Basch et al., 2020) given the fact that more people are turning to these

platforms as their main sources of news and information in general (Mitchell, 2016). As Slavik et al., (2021) put it, using social media applications has been one of the ways that the public has kept up with important details and updates on COVID-19. During the shutdown, social networking platforms were crucial for spreading information (Castro-Martinez et al., 2021). According to Yuksel et al. (2020), people started looking for different ways to access trustworthy information about how to protect themselves from this disaster after the pandemic caused the closing of borders, social isolation, and the overload of health systems.

Digital Health Communication in Chronic Kidney Prevention

The first generally accepted definition of e-health was published in 2001 by Gunther Eysenbach, who defined *"e-health as a medical and public health field, referring to health services and information delivered or enhanced through the Internet and related technologies"* (p.1). Eysenbach's definition is regularly cited and is still regarded as valid. He emphasized that the word "e-health" refers to more than merely using the internet but *"a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology"* (p.1). Eysenbach's description of e-health suggests that it represents a revolutionary shift in the way people perceive and communicate about health care on a local and global scale (Andersson, 2024).

Alongside terms like e-mail, e-solutions, and e-commerce, the term "e-health" was originally employed in the fields of industry and marketing (Andersson, 2024). The "e" then stood for "electronic," but Eysenbach said that it could also represent other concepts, such as efficiency, empowerment, enabling, and equity, thereby encompassing the concept's potential (Eysenbach, 2001). The functions of e-health have been categorized into three roles; 1)

Information, tracking, and monitoring of health parameters; 2) Interaction and communication amongst health care providers; and 3) Data utilization to enhance health and health services (Shaw et al., 2017; van der Kleij et al., 2019).

Thus, e-health encompasses everything from implanted electronic devices to big data and electronic health records (Singhal & Cowie, 2020). Mobile health, or m-health, is the branch of e-health that deals with the use of wearables, including smartwatches, and applications on mobile phones for healthcare (Alessa et al., 2019). The term "digital health" is frequently used as an umbrella term covering the field of e-health (Andersson, 2024). The WHO describes digital *health as the field of knowledge and practice associated with the development and use of digital technologies to improve health.* According to Andersson (2024), there is no clear distinction between digital health and e-health since the terms are used interchangeably in scientific literature.

An estimated 300,000 mobile-enabled digital health applications are utilized globally, indicating the growing use of digital health technologies for health information and services (Lancet Digital Health, 2019). Some scholars have noted that the current integration of technologies into healthcare is an essential component of modern healthcare practice and human life (Mather et al., 2018). Others have suggested that humans and digital technology may collaborate to address societal issues and threats to healthcare delivery (Fombu, 2017). The WHO (2011) has conducted extensive observations of the subject and has confirmed that more than 114 member nations are either fast expanding initiatives to integrate mobile health into current electronic health services or are actively employing digital health services. The rising use of mobile devices is the driving force behind the rapid expansion of digital health, especially in low- and middle-income nations (Chowdhury & Pick, 2019).

In recent years, new communication technologies have almost saturated every area of the healthcare system (Abroms, 2012). As a result, there is a growing body of study in the field of health communication that focuses on the use of technology in disease prevention messaging, including advancements in medical technology within the healthcare system and the use of information technology in this context (Ahmed, 2009). By offering easily available, customized, and easy-to-use health information, digital communication platforms have been recognized as important enablers of enhanced health literacy (Nutbeam, 2008). Health disparities have decreased because of e-health platforms, such as websites, blogs, and online forums, which have increased access to health information for a variety of groups (Norman & Skinner, 2006).

Furthermore, mobile health technology has revolutionized the way people access and engage with health information, making it a potent instrument in the healthcare sector in this age of digital innovation and connection (Egharevba, 2023). Through encouraging behavior change and optimizing the dissemination of health information, communication technology has played a critical role in better health outcomes. Research indicates that mobile health (mhealth) strategies, such text messaging and mobile applications, have proven to be successful in assisting with the treatment of chronic illnesses, especially in environments with limited resources (Free et al., 2013). For example, among patients with chronic diseases including diabetes and hypertension, mHealth treatments have been linked to better disease self-management and improved medication adherence (Hamine et al., 2015). In a 2013 study conducted by Goldstein and colleagues to understand the use of digital media in promoting kidney disease education, they found that both health professionals and the public are actively discussing kidney disease on social media platforms. Twitter (X), in particular, is a key channel where various health

professionals share breaking news, research updates, events, CKD-related advice, and research findings.

Additionally, the study found that when providers discuss CKD on social media, they typically focus on new studies related to treatment or emphasize the importance of prevention, often linking it to other diseases that can be prevented through a healthy lifestyle. The tone of health professionals' posts is authoritative and educational, with providers not using social media to seek advice on diagnoses or to directly educate patients about CKD (Goldstein, 2013). To enhance public awareness of CKD, early screening, early diagnosis, and prevention strategies, professional popularization of kidney disease should be promoted and appropriately guided on social media to distribute high-quality health information on kidney disease in this new context (Chen et al.,2014; Chen et al., 2015; Wei et al., 2010;).

Online Health Information Seeking for Chronic Kidney Disease Prevention

The Internet is one area that has a significant impact on the accessibility of healthcare resources and the usage of health information by the general population as well as caregivers (Hesse et al., 2005; 2010; Statistics Canada, 2005; 2007; 2010). Online health information seeking and usage can boost participation in health decision-making while also enhancing knowledge and competence (Kim & Kim, 2009; Murray et al., 2003; Ziebland & Wyke, 2012). In the comfort and privacy of their own homes, people can now look up health-related topics and investigate sensitive or awkward subjects.

When presented in a legitimate, credible, and evidence-based environment, online health information can be a useful and affordable tool for support and education (Griffiths et al., 2006; Kim & Kim, 2009; Murray et al., 2003). Although there is potential for the Internet to improve people's health and well-being by increasing knowledge about healthcare and health (Cutler &

Lleras-Muney, 2006; Lewis, 1999; Wantland et al., 2004), there are still concerns about how various populations or groups will interact with web-based health information.

Given that the availability of health information is one of the main reasons people use the Internet (Fox & Duggan, 2013) and that Internet usage rates are rising quickly each year (Statistics Canada, 2009), health services researchers are working to learn more about how people use and search for online health information. Many people use the internet to access content that is easy to understand, relevant to their health condition or question, and relatable (Sillence et al., 2007; van Uden-Kraan, 2008; Ziebland et al., 2004).

By enabling peer support, health education, and public health initiatives, the internet, particularly social media platforms, have also been significant in health communication. Health organizations can interact with the public, provide correct health information, and refute false information by using social media sites like Facebook and X (Chou et al., 2009). Social media's interactive features have made it possible for users to discuss their individual health experiences, which has strengthened the sense of community and promoted healthy habits (Moorhead et al., 2013). The majority of young people primarily communicate digitally in their daily lives, and older people are quickly catching up (Ofcom, 2015)

Online support groups are growing in popularity in addition to in-person support sessions as more people get familiar with e-health technologies (White & Dorman, 2001). Facebook, for example, has several disease-specific platforms and groups that facilitate patient interaction, information sharing, and support (Zhang et al., 2013). Facebook groups with a health focus that are open to all users have the potential to serve as an online "gathering space" where users can get support and information (Ahmed et al., 2017).Several studies have examined the content of

Facebook groups focused on various chronic diseases, including diabetes, breast cancer and colorectal cancer (Bender et al., 2011; De la Torre-Díez et al., 2012; Greene et al., 2011).

Burckhardt & Padman (2015) analyzed the content of two closed online kidney forums, Kidney Space and DaVita renal Care, using semantic ontologies. Over 60,000 posts were collected between the two sites for the study in order to determine patient experiences and treatment choice preferences. The study found that a significant portion of the content covered topics such as kidney transplant recipient food requirements, dialysis methods, and home dialysis preferences. Additionally, it was shown that a greater proportion of women than males were utilizing the online forum and that entries mentioned male companions far more frequently than those mentioned female partners.

In a later study, Ahmed et al. (2017) used qualitative thematic analysis to examine a Facebook kidney dialysis discussion. Exchanging knowledge, seeking and offering emotional support, and exchanging experiences with others were the main topics that emerged from the forum (Ahmed et al., 2017). With its growing potential to assist people interact with the community despite distance and transportation obstacles, online social support (OSS) is accessible, affordable, and flexible enough to let users respond at their own convenience (Ahmed et al., 2017; Bennett et al., 2015; Pinsk & Nicholas, 2017).

Digital Health Communication in Ghana

Two-thirds of the global population use mobile phones and in Ghana, where there are 39 million mobile subscriptions (Statista.com, 2024). 1989 saw the establishment of Ghana's first internet connection when the nation joined the world's first submerged fiber-optic cable system, which connects Africa to Europe and Asia (Achampong, 2012). Since then, Ghana has emerged as a regional leader in the Information and Communication Technology (ICT) sector in West

Africa (Ghana eHealth Policy, 2010). Over the last few decades, Ghana has maintained its leadership in ICT for Accelerated Development (ICT4AD) thanks to investments from both the public and commercial sectors (Achampong, 2012). According to Oxford Business Group (2016), there were an estimated 5 million internet users in Ghana in 2014, representing a 19.6% penetration rate. In 2021, that figure, according to the Digital Ghana report, climbed to 15.7 million users with a penetration rate of 50.0%. In other words, of the 30 million population, 50% use the internet (Kemp, 2021). The Ghana Ministry of Communications (MoC), which oversees overall policy and state-sponsored initiatives, and the private sector—of which there are roughly 180 internet service providers (ISPs), have collaborated to increase internet penetration (Ghana eHealth Policy, 2010).

Ghana's increased use of mobile devices and mobile internet connectivity has increased demand for online services such as banking, mobile money, e-government, and mobile online health information and services (Oxford Business Group, 2016). The number of active internet users in Ghana, which is half of the country's population at 15.70 million according to published statistics, reflects the demand for these online activities including digital health communication (Kemp, 2021).

Similar to other developing nations, Ghana's health system is characterized by inadequate infrastructure, a lack of human and material resources, and severely restricted access to healthcare for remote populations (Afarikumah, 2014). Similar to other LLMICs, these health system issues continue to stand in the way of the UN Sustainable Development Goals' 2030 deadline for attaining universal health coverage (Chowdhury & Pick, 2019). Amidst these obstacles, the Ghanaian government introduced the national e-health strategy in July 2010 with the aim of leveraging technology to enhance the efficiency of health systems, broaden healthcare

accessibility, and elevate the well-being of Ghanaians (Achampong, 2012). The fundamental idea is that healthcare quality will increase, service costs will decrease, and access to health information will not be restricted by location when technology is integrated with health systems and digital applications are used to deliver information, services, data collection, and health management (Ahmed et al., 2020).

The Health Management Information System (HMIS), which was expanded and taken on by the Ghana health service, is one of the many digital health pilot projects that have been started since the e-health policy was introduced in 2010 (Achampong, 2012). According to studies by Afarikumah (2014), as of 2014, there were a total of 22 digital health pilot projects in Ghana that were centered on activities like supplying and sharing health information, gathering health data, offering telemedicine education, and putting patients in touch with medical professionals.

Since 2015, the number of new digital health startup companies has increased beyond the pilot project. Data from Startup Facility (2020) indicates a growing trend in digital health systems that link patients with medical professionals such as pharmacists, nurses, and counselors. As per the Startup Facility research, these digital health platforms employ mobile-enabled health forums for online booking of pharmaceutical services, healthcare consulting, and health education and information, hence bridging communication and access gaps.

These digital health services are assisting Ghana in overcoming its health system's obstacles and providing the country's citizens with accessible and reasonably priced medical treatment (Demuyakor, 2020). For instance, a patient can obtain care without having to go far since they can use mobile applications to request a consultation (Startup Facility, 2020). By directly linking community health workers with medical specialists, telemedicine has also decreased needless referrals (Ghana telemedicine, 2020). MedTrack software takes the place of

the burdensome paper-based health records, and patients can quickly locate their medical folders online (Vota, 2019).

The developers of the aforementioned digital health applications have presented a comprehensive narrative that aims to empower Ghanaian healthcare providers and patients, enhance their quality of life, lower costs associated with services and facility transportation, increase accessibility, and, in the case of telemedicine, the developers claim that the technology has proven to be a life-saving measure amidst the coronavirus pandemic (Ghana telemedicine, 2020). Applications in digital health close the health disparity, enhance health care for marginalized populations, and result in impact-driven medical interventions (Startup Facility, 2020). Ghana is currently one of several African countries with an increasing trend in digital health platforms (Startup Facility, 2020). Healthcare professionals in remote regions have embraced mobile interventions like the Technology for Maternal and child health (T4MCH) which offers educational videos on how to manage emergency births, increasing their ability to provide essential maternal healthcare on an app called the SGS collect (Nuhu et Al., 2023). These digital technologies are especially crucial in isolated and rural areas, where it is frequently difficult to reach medical facilities.

Ghana is seeing a rise in the usage of social media sites like Facebook, WhatsApp, and Twitter for the purpose of interacting with the public and sharing health-related information. Social media has been utilized by the Ghana Health Service (GHS) to support public health initiatives like immunization drives and sickness prevention programs. The Ghana Health Service (GHS) employed social media during the COVID-19 pandemic to inform the public about preventive measures, dispel false information, and offer updates (Vincent, 2020).

Theoretical Framework

This study is guided by the Health Belief Model (HBM) and the Technology Acceptance Model (TAM). The HBM explains health behaviors by examining individuals' perceptions of susceptibility, severity, benefits, barriers, and self-efficacy related to health issues. Meanwhile, TAM focuses on users' adoption of technology based on perceived usefulness and ease of use. Together, these models provide a framework for understanding both health behavior and technology adoption in the context of health interventions.

Health Belief Model

The Health Belief Model (HBM) has been one of the most popular conceptual frameworks in health behavior research since the early 1950s. The Health Belief Model, developed in the 1950s by social psychologists Irwin Rosenstock, Godfrey Hochbaum, Stephen Kegels, and Howard Leventhal at the U.S. Public Health Service, was created to better understand why screening programs were often unsuccessful in preventing and detecting diseases. The model was further developed by Becker et al., (1977) to guide health behavior treatments as well as explain how changes in and maintenance of health-related behaviors occur. Additionally, the HBM has been extended, compared to other frameworks, and utilized to support interventions aimed at altering health behavior in the last two decades Champion, & Skinner, 2008). Originally developed to model the adoption of preventive health behaviors in the United States (Rosenstock, 1974), the Health Belief Model (HBM) has been effectively modified to suit many cultural and contemporary situations (Griffin, 2012; Scarinci et al., 2012). The HBM was one of the first models that examined adherence to medical recommendations (Rosenstock, 2005; 1988) which identifies attitudes and beliefs as factors influencing changing behavior (Jones et al., 2015).

According to the HBM, patients are more likely to adhere to a specific health behavior if they perceive that they are vulnerable to the disease and believe that the target behavior will decrease the likelihood of health problems and disease-related costs (Becker et al., 1977; Becker,1974; Jones et al., 2015; Rosenstock, 2005; Rosenstock, 1974; 1988). Thus, modifying factors (e.g., age, socioeconomic status, knowledge about the disease and its treatments), cues to action (e.g., symptoms, reminders associated with the disease and its demands), and individual beliefs all play a role in a person's decision and motivation to adopt a health behavior (Becker,1974; Janz et al., 2002).

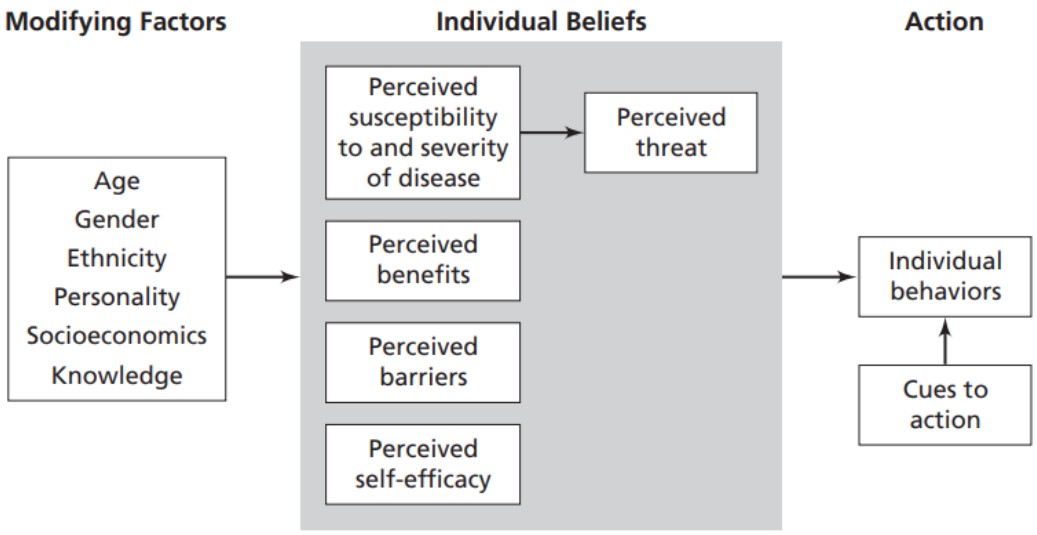
Regarding individual beliefs, five main constructs predict motivation for behavioral change: (i) perceived severity (the beliefs about the seriousness of the disease and its consequences); (ii) perceived susceptibility (the extent to which the individual feels at risk of being exposed/suffer from the condition); (iii) perceived benefits (the perception that certain actions have the potential to minimize risk and/or disease severity); (iv) perceived barriers (the perception that physical, psychological, financial, or other costs associated with a certain health behavior or action are low), and (v) self-efficacy (the belief that the individual can overcome the disease requirements and barriers) (Peikani et al., 2018; Sulat, 2018). The model has been repeatedly and effectively replicated due to its capacity to explain and predict a wide range of behaviors linked to better health outcomes (Janz & Becker, 1984).

HBM has also been utilized in developing many successful health communication interventions by targeting messages around the HBM variables to change health behaviors (Sohl & Moyer, 2007). In the research conducted by Sohl and Moyer (2007), it was found that tailored interventions, especially those that utilize the Health Belief Model and incorporate a physician's recommendation, are effective in promoting mammography screening. Faramarzi et al. (2022),

explored how different elements of the health belief model were utilized to predict kidney care behaviors in patients with type 2 diabetes. Abraham et al. (2023) applied the Health Belief Model to explore the health-seeking behaviors of adults living with chronic diseases during the COVID-19 pandemic.

Previous studies that looked at applying the HBM concepts to ESRD demands suggested that adherence to fluid control (Ghaddar et al., 2009), dietary restrictions (Nooriani et al., 2019), physical exercise (Sutherland, 2021), immunosuppressive medication in renal transplant patients (Kung et al.,2017) , and prevention of peritonitis in patients receiving peritoneal dialysis (Peikani et al., 2018) are all predicted by perceived barriers, self-efficacy, and perceived severity of the illness. The study found that the Health Belief Model was an effective framework for understanding how individuals with chronic conditions approached their health care during the pandemic.

Figure 2. 1. Health Belief Model (source: Champion & Skinner, 2008)



Perceived susceptibility: This concept contends that if people perceive they are vulnerable to a specific adverse health effect, they will be more inclined to act in a healthy

manner (Rosenstock, 1966). According to the model, people won't take action to stop a negative health outcome from happening to them if it is unlikely to happen. Therefore, an individual who perceives himself or herself as susceptible will take preventive actions towards preventing chronic kidney disease (Champion & Skinner, 2008).

Perceived severity: According to this concept, people will be more driven to take action to prevent a negative health consequence if they believe it to be more severe than they now believe (Rosenstock, 1966). Also, people are more inclined to take actions to stop or lessen the severity of a health issue if they believe it to be significant (Champion & Skinner, 2008). To be more precise, an individual who perceives the severity of chronic kidney disease will take preventive measures on chronic kidney disease.

Perceived benefits: This concept argues that an individual must believe that engaging in the target behavior will have significant positive effects. The intended conduct needs to specifically have the potential to avert the unfavorable health consequence (Hallal, 1982). Regardless of objective facts about the action's efficacy, the HBM suggests that people are more likely to engage in a behavior if they believe it will have more benefits in relation to a perceived threat (Champion & Skinner, 2008). Even if an individual identifies personal susceptibility to chronic kidney disease, whether this perception leads to behavior change will be influenced by the individual's beliefs concerning perceived benefits of the several existing and accessible actions for reducing chronic kidney disease.

Perceived barriers: According to the concept, people are reluctant to adopt preventative behavior if they believe there are significant barriers in their way (Rosenstock, 1966). Champion and Skinner (2008), add that perceived barriers are potential complications involved with a particular health action. These are elements that make it difficult to carry out

recommended actions. The actions could be seen as excessively costly, uncomfortable and difficult. According to HBM, for behavior to change, the perceived benefits must be greater than the perceived barriers (Champion & Skinner, 2008). The perceived barriers act as obstructions or hindrances to undertaking the recommended behaviors to prevent chronic kidney disease.

Self-efficacy: This concept describes a person's belief in their own ability to carry out an action successfully. The HBM acknowledges that changing health behavior requires having faith in a person's capacity to influence results (Champion & Skinner, 2008). This refers to a person's capacity to successfully adopt preventive measures against chronic kidney diseases. Someone who can follow these instructions and perform breast self-examination correctly would be motivated to do so on a regular basis.

Cues to action: This concept describes the internal or external motivations behind an action. The HBM postulates that in order to encourage participation in actions that promote health, a cue, or trigger, is required. In contrast to external signals, which can include events or billboard signs, internal cues can be physiological, such as pain (Champion & Skinner, 2008). An individual is motivated to take preventive action by a variety of events, experiences, interpersonal variables, and environmental factors like health campaigns (Janz & Becker, 1984). A person who knows when to take preventative measures against chronic kidney disease will avoid the condition. An individual with cues to action takes preventive steps on chronic kidney disease will prevent chronic kidney disease.

Modifying Factors: According to Janz and Becker (1984), a variety of demographic, sociopsychological, and structural factors may, in any given situation, impact the person's perspective and hence indirectly influence behavior connected to health. These are the unique

characteristics of each person that affect how they perceive their health, such as age, gender, occupation, degree of education, knowledge and eating habits.

Health Belief Model and Chronic Kidney Disease

According to the health belief model the perceived seriousness and perceived susceptibility of a disease, like chronic kidney disease (CKD), determine the perceived threats associated with it (Green & Murphy, 2014). The perceived benefits and barriers of every health behavior impact its effectiveness (Becker, 1979). It appears that self-efficacy is a major component of the Health Belief Model and that it is impacted by mediating variables such social, structural, and demographic factors (Skinner et al., 2015). Elliot et al., (2015) conducted a descriptive study to determine whether there are any connections between modifying factors, personal health attitudes, and the adherence to a low-phosphorus diet by haemodialysis patients. Individual health beliefs, such as self-efficacy to carry out healthier habits and the perceived benefits thereof, were also found to be associated with dietary adherence (Chironda et al.,2019).

Modifying factors, such as age, education level, and knowledge of the disease, were found to be associated with dietary adherence (Elliot et al., 2015). Consequently, positive dietary adherence is achieved among haemodialysis patients through an understanding of moderating factors and personal health values (Elliot et al., 2015). Cues to action, as described by Becker et al. (2008), are elements that compel a person to make informed decisions on certain health-related issues. In other words, they are strategies that encourage preparedness to adopt the recommended health behavior.

Based on this perspective, adherence in the CKD population is greatly aided by cues to action such as family support, peer support, and knowledge of the consequences of non-adherence Chironda & Bhengu (2019). According to Anuar et al., (2020) the HBM is a means to

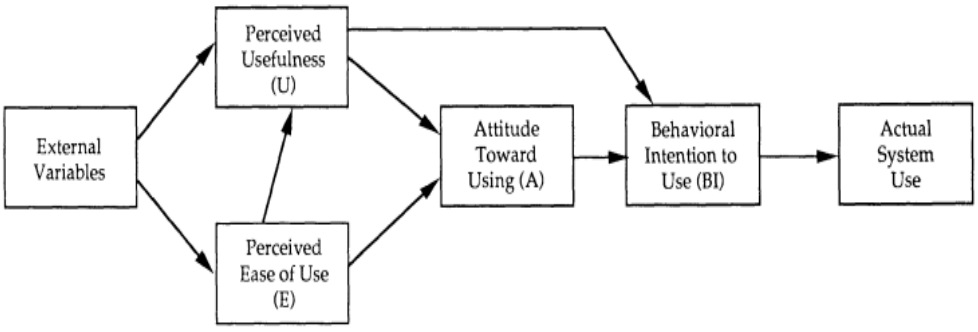
uncover potential perceptions of seriousness, susceptibility, benefits and barriers that can explain the need to engage in particular behaviors to prevent the CKD and provide cues to action by modifying the factors that influence health behavior.

Technology Acceptance Model

The Technology Acceptance Model (TAM), developed by Davis, Bagozzi, and Warshaw in 1989, has been extensively studied in research literature due to its influential role in understanding user acceptance and adoption of new technologies. The purpose of TAM is to offer a general, theoretically justified, and parsimonious explanation of the factors influencing computer acceptance that can also explain user behavior across a wide range of end-user computing technologies and user populations (Davis et al., 1989).

Perceived usefulness and perceived ease of use are two specific beliefs that TAM suggests are primarily relevant to computer acceptance behaviors (Davis et al., 1989). The model centers on the theory of reasoned action (TRA), which argues that societal norms and an individual's attitude determine behavioral intention, which in turn determines actual behavior (Shimp & Kavas, 1984). TRA was a good choice for the model as it has been helpful in explaining different human-behaviors (Manstead, Proffitt, & Smart, 1983; Shimp & Kavas, 1984).

Figure 2. 2. Technology Acceptance Model (Davis, Bagozzi & Warshaw, 1989)



As shown in figure 2, TAM suggests that "Perceived Usefulness" and "Perceived Ease of Use" are the primary determinants of human decision-making about the adoption of a given technology (Davis et al., 2008).

Perceived usefulness describes how much a person understands that using a specific technology or system will improve their overall performance at work, while *perceived ease of use* describes how much a person thinks using the technology or system they are using will be as simple as possible (i.e., not requiring complicated operating procedures) (Davis et al., 2008; Gong et al., 2004; Mathieson et al., 2001).

These two components work together to show the attitude of the individual to use a specific technology/system, which leads to the Behavioral Intention to use a particular technology system. A person's interest in using a technology or system is determined by their behavioral intention, and the model operates under the premise that if a person expresses a behavioral intention to use a system, they will in fact utilize it (Gong et al., 2004).

According to Lee et al., (2003) and Holden and Karsh (2009), TAM's popularity stems mostly from its ability to predict and explain consumers' reactions to information technology, as well as its accessibility. In the context of this study, technology refers to using mobile phones and the internet to seek health information, whereas task refers to CKD prevention. With dozens of studies testing TAM in healthcare and numerous empirical and theoretical health IT papers referencing the theory, TAM is increasingly portrayed as a fitting framework for understanding technology adoption in the healthcare context (Holden & Karsh, 2010).

Furthermore, TAM was utilized by Lim et al. (2011) to investigate if Singaporean women were open to using their mobile phones to look for health information. The report emphasizes how, rather than being used for interactive or patient-educational objectives, electronic platforms

are increasingly being used for the authoritative broadcast of health information. In their research, Zhang et al. (2014) used TAM to explore how personalization and privacy concerns affect mHealth adoption. The study found that both factors significantly influence adoption intentions through perceived usefulness and user attitudes, and how TAM provides valuable understanding into how these factors interact to shape mHealth adoption decisions.

Also, Tsai (2014) used an integrated framework combining the Extended Technology Acceptance Model (Extended TAM) and the Health Belief Model (HBM) to explore telehealth adoption in underserved areas. The study found that trust factors positively influence technological factors (perceived ease of use and usefulness), which affect usage intention. While TAM has often been a well-researched model for predicting user acceptance of an invention (Lim et al., 2011), Holden and Karsh raised concerns that TAM "is not a model developed specifically in or for the healthcare context (Holden & Karsh, 2010). There is also very little research done using TAM as a model in understanding health communication of CKD through digital communication.

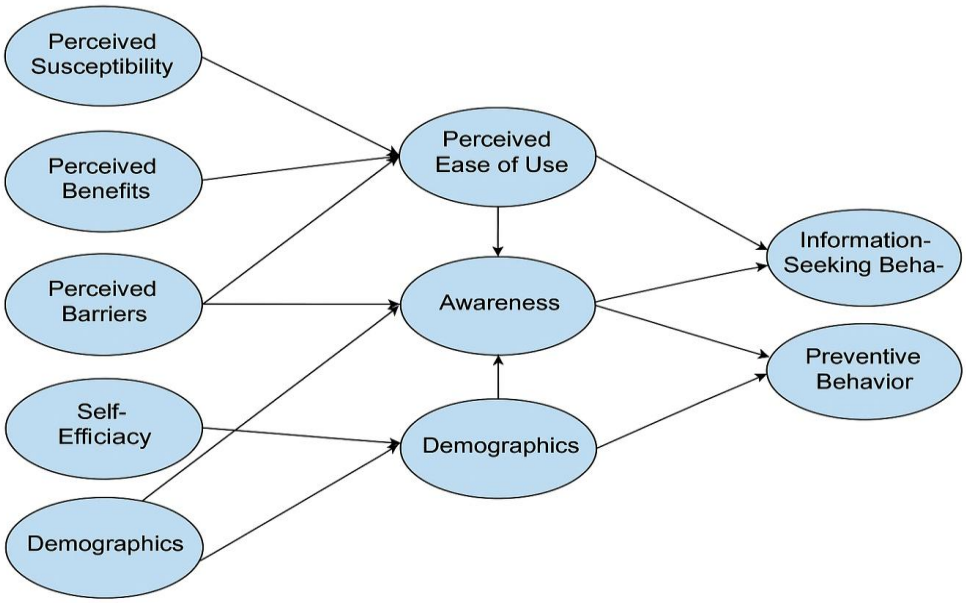
The concept has been criticized due to its narrow perspective on user acceptance. Mathieson et al., (2001), for example, claimed that the model does not account for the barriers that keep someone from utilizing a technology even after they have realized how useful it is and have encountered no problems using it. Mathieson et al. (2001) highlighted several significant obstacles, such as insufficient funds, time, expertise, or resources.

According to Taylor and Todd (1995), the model is the best at predicting behavior, but it falls short of other models when it comes to forecasting the intention of behavior since it ignores crucial elements like perceived behavioral control and subjective norm. Self-efficacy and resource constraints are important elements that have a considerable indirect influence on

behavioral intention (Taylor & Todd, 1995). Accordingly, these elements should be included in the TAM to improve comprehension of behavioral intention (Mathieson et al., 2001).

Conceptual Framework

Figure 2. 3. Conceptual framework for this research.



Hypothesis and Research Questions

Based on a review of the literature and the conceptual framework, the hypothesis and research questions addressed in this study are as follows:

H1: TAM variables (perceived ease of use and usefulness) will positively correlate with social media use

H2: There is an association between social media use and susceptibility, severity, benefit and barriers.

H3: There is a gender difference in all the HBM factors (susceptibility, severity, benefit and barriers) and TAM factors (perceived ease of use and usefulness).

RQ1: What is the current level of knowledge of CKD among Ghanaians who use digital health platforms?

RQ2: What factors within the Health Belief Model (HBM) significantly influence knowledge about chronic kidney disease (CKD) among Ghanaians?

RQ3: What Technology Acceptance Model (TAM) variables significantly predict knowledge acquisition related to CKD through digital health platforms?

Chapter 3- Methodology

This chapter provides an overview of the research methods employed in this study, including research design, sample selection, data collecting, data analysis, measurements of variables as well as the detailed ethical considerations for this study were offered. To address the research questions and hypothesis, this study adopts a relevant study design specifying the important methodologies applied (Polit & Beck, 2010) as espoused by Parahoo (2006), selecting the best design is essential to achieving the study's objectives. The research design section thoroughly explains the survey method chosen for data collection and provides a detailed overview of the study's underlying design. Additionally, this section addresses ethical and legal considerations and highlights the limitations associated with the chosen research methodology.

Research Design

This study uses a quantitative research design to investigate how Ghanaians' awareness of chronic kidney disease (CKD) and preventative health practices are impacted through digital health communication. Quantitative research involves the empirical examination and analysis of numerical data to ascertain the link between the independent and dependent variables (Schoonenboom & Johnson, 2017). Quantitative research is based on deductive reasoning and employs a variety of quantitative analysis techniques, from describing the variables in simple terms to using complex statistical modeling to establish statistical relationships among the variables (Schoonenboom & Johnson, 2017). As such, online survey makes it possible to measure variables like perceived benefits, perceived barriers, information-seeking behavior, awareness levels, and ease of technology use as determinants of CKD preventive behaviors as conceptualized in this study. In keeping with the study's goals to generalize findings and spot any

trends, this design also makes it easier to gather data over a large sample in a predetermined amount of time (Creswell, 2017).

According to Polit and Beck (2014), a survey can be conducted quickly and flexibly when information on current events in a surveyed location is required (Polit & Beck, 2014). The study employed an online survey to examine the predictors of kidney disease awareness among individuals in Ghana. The study also explores online health information-seeking behaviors related to chronic kidney disease (CKD) and identify perceived benefits and barriers associated with the use of digital health information. By analyzing participants' perceptions, the study aims to understand factors that influence awareness, as well as the motivational predictors driving engagement with online CKD information and the potential challenges individuals face in accessing and utilizing digital health resources for disease management.

The target population for this study includes Ghanaians aged 18 years and above. A combination of convenience and purposive sampling techniques was employed to select a sample of 298 participants.

Sample

The target population for this study includes Ghanaians aged 18 years and above. A combination of convenience and purposive sampling techniques was employed to select a sample of 298 participants. Participants were recruited primarily through digital platforms, including social media and messaging applications, where the survey link was shared among online communities and contacts who met the inclusion criteria. This sample size aligns with the minimum recommendation for quantitative research as suggested by Guadagnoli and Velicer (1988) and is considered adequate for achieving sufficient statistical power to analyze the relationships among the variables of interest (Boateng et al., 2018).

Instrument Development

Data was collected using a structured online questionnaire administered through the Qualtrics survey system. Informed by the health belief model and the technology acceptance model, this online survey was designed to measure key variables which include; knowledge of chronic kidney disease, perceived severity, susceptibility of CKD, perceived barriers, benefits, self-efficacy, perceived usefulness and ease of use, media use and online health information seeking behavior. The questionnaire was divided into six sections aligning with the variables that need to be measured. Data on the general socio demographic information relating to age, gender, level of education, occupation, and marital status was also gathered.

Knowledge and Awareness of Chronic Kidney Disease

The knowledge section was adapted from the CKD Screening Index developed by Khalil et al. (2014). Khalil et al. (2014) created the Chronic Kidney Screening Index, which is divided into three subscales: knowledge, attitudes, and practices. Each subscale includes items that are assessed separately from the others. In the current study, the Knowledge Subscale was the only tool utilized to assess the individuals' knowledge of CKD. The Knowledge Subscale has 24 items intended to evaluate the respondent's understanding of the definition, risk factors, symptoms, and complications of CKD (Khalil et al., 2014). Each of the 24 questions has three possible answers: true, false and don't know. For the purposes of this study, each participant completed 10 items which are appropriate for the study population. Higher knowledge of CKD is indicated with a higher score. Again, all "don't know" responses were combined with incorrect responses.

The items include: “The kidneys regulate body water and chemicals in my blood, such as sodium, potassium, phosphorus, and calcium, “The kidneys remove drugs and toxins introduced into my body”, “The kidneys release hormones into the blood to regulate blood pressure, produce

red blood cells, and promote strong bones", "Chronic kidney disease (CKD) is a serious illness", "Becoming an old person will decrease the function of my kidneys", "Having increased blood pressure makes me more likely to get CKD", "Having diabetes mellitus makes me more likely to get CKD", "Having a family member with CKD will increase my chances of getting CKD", "Being a smoker increases my chances of getting CKD" and "Having CKD gives me swollen feet and ankles, and a puffy face in the morning" (M = 6.30, SD = 2.83).

Two studies utilizing an English version of the Chronic Kidney Screening Index tool have since determined Cronbach's alpha values of .80 and .87, following its development in Jordan in the Arabic language (Khalil et al., 2014; Sa'adeh et al., 2018). Also, the tool has been used in low and middle-income countries like Ethiopia, Palestine and Ghana (Khalil et al., 2014; Sa'adeh et al., 2018; Tegegne et al., 2020).

Variables Related to the Health Belief Model

To measure perceptions, the measurement scale was adapted from a scale developed by Lee (2019) which has a reliable internal consistency (Cronbach alpha – .88) and utilizes the Health Belief Model (HBM) to assess participants' health beliefs. The survey used a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree," to measure the following key HBM constructs. The scale adapted from Lee (2019) had 33 items and a reliable internal consistency ($\alpha = .88$). The items included: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action.

Perceived susceptibility to CKD construct measures participants' perceived risk of developing CKD. Higher scores indicate a greater perceived vulnerability to CKD. The scale measuring this construct had 4 items with a reliable internal consistency (M = 2.05, SD = 1.08, $\alpha = .80$). The items include: "I think I can develop kidney disease", "I have a chance of developing

kidney disease within the next 10 years", "I have many risk factors for kidney disease", "I have a higher chance of developing kidney disease compared to others".

Perceived severity of CKD construct evaluates participants' beliefs about the seriousness of CKD and its potential consequences. Higher scores reflect greater concern about the impacts of CKD. The scale measuring this construct had 7 items with a reliable internal consistency (M = 3.99, SD = 1.04, α = .82). The items include: "I am afraid of developing kidney disease", " Kidney disease will cause long-lasting health problems", "Kidney disease will negatively impact my relationships with family and others", "Kidney disease will completely change my life", "Once diagnosed with kidney disease, the quality of life significantly declines", "Kidney disease is serious, even in its early stages", "It is expensive to treat kidney disease".

The perceived benefits of CKD prevention construct assess participants' belief in the effectiveness of preventive measures, such as lifestyle changes and regular health check-ups, in reducing the risks associated with CKD. Higher scores indicate a stronger belief in the benefits of prevention. The scale measuring this construct had 5 items with a reliable internal consistency (M = 3.99, SD = 1.13, α = .87). The items include; "Early detection of CKD can save lives", "Regular health checkups will help detect CKD early", "If I detect CKD early, treatment is manageable", "Early detection of CKD reduces concerns about the disease", "Early detection reduces the probability of CKD-related death".

Perceived barriers to CKD prevention construct measures participants' perceptions of obstacles that might prevent them from engaging in preventive behaviors, such as financial, social, or logistical barriers. Higher scores indicate greater perceived barriers. The scale measuring this construct had 11 items with a reliable internal consistency (M = 3.47, SD = 0.91, α = .85). The items include: "I am afraid of undergoing medical tests in case of abnormal

findings", "Health checkups for CKD are embarrassing", "I have no time to undergo regular health checkups", "I cannot afford the cost of CKD health checkups", "I do not need CKD health checkups because I have no symptoms", "I am afraid of CKD checkups because I do not understand the procedures", "CKD health tests are painful", "Preparing for health checkups is too challenging", "I am afraid of complications associated with CKD testing". "I cannot undergo CKD testing due to transportation problems", "I do not trust health checkups for CKD".

Cues to action for CKD prevention construct evaluate internal and external triggers that motivate participants to take preventive measures against CKD. Higher scores indicate greater readiness to engage in preventive actions. The scale measuring this construct had 6 items with a reliable internal consistency ($M = 3.78$, $SD = 0.82$; $\alpha = .74$). The items include: "If a doctor recommends a CKD health checkup, I will undergo it", "If my friends or family recommend a CKD health checkup, I will undergo it", "If mass media (Radio or TV) promotes CKD health checkups, I will consider it", "If I experience symptoms of CKD, I will seek a health checkup", "I will undergo a CKD checkup as I am concerned about my health", "If I know someone diagnosed with CKD, I will consider regular checkups".

Variables Related to the Technology Acceptance Model

The variables of TAM would be measured by adapting from a scale developed by Davis (1989) which has a reliable internal consistency ($\alpha = .94$) and utilizes the Technology Acceptance Model (TAM) to assess participants' perceptions online health information. The scale uses a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree," to measure key TAM variables. Originally, the scale had 12 items and a reliable internal consistency ($\alpha = .94$). However, in this study each participant completed 7 items which are

appropriate for the study population. The items include perceived usefulness and perceived ease of use of online information.

Perceived usefulness to CKD prevention measures participants' perceptions of the benefits and value of engaging in preventive behaviors. It assesses the extent to which participants believe that digital health platforms can effectively enhance their knowledge and facilitate the prevention of CKD. The variable was measured using 4 items adapted from Davis (1989), which demonstrated a reliable internal consistency (M= 3.7, SD = 0.92, α = .73). The items include: “Using online information helps me better understand how to prevent CKD”, “Online information improves my ability to make informed decisions about my CKD prevention and management”, “Online information makes it easier for me to adopt healthy behaviors related to CKD prevention”, I find online information valuable for improving my overall health management”.

Perceived ease of use measures participants' perceptions of the effort required to effectively use digital health platforms for CKD prevention. It evaluates how intuitive and user-friendly the platforms are perceived to be. This variable was measured using 3 items also adapted from Davis (1989), with a strong internal consistency (M = 3.70, SD = 0.83, α = .82). The items include: “It is easy for me to find reliable online information about CKD prevention and management”, “Online information platforms are simple to navigate when seeking CKD related health advice”, “Accessing online information about CKD fits well into my daily routines”.

Online Health Information Seeking Behavior

Online health information-seeking behavior was assessed using four items adapted from Kelly et al., (2015). These items were scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The items include: “Social media can be useful to help people

decide if their symptoms are important enough to go to see a doctor," "The internet is a reliable resource to help me understand what a doctor tells me," "Online health information encourages me to play a more active role in my healthcare," and "I have learned something new from electronic health information." Cronbach's alpha for this scale was estimated to be ($\alpha = .82$), indicating good reliability, and it was adapted to assess CKD-related health information-seeking behavior in the current study.

Again, the source Ghanaians often use to obtain health information was assessed using one item adapted from Wong and Sam (2010). The item was specifically focused on the use of social media platforms (e.g., Facebook, Twitter, Instagram, TikTok, WhatsApp) to access health-related information. Participants indicated how frequently they use these platforms to seek health information on a 5-point Likert scale: 1 (Never), 2 (Rarely: 1–2 times), 3 (Sometimes: 3–4 times), 4 (Often: 5–6 times), and 5 (Always: More than 7 times). This measure helped to determine the preferred social media platforms used by Ghanaians for accessing CKD-related health information.

Demographics

According to previous studies, socio-demographic factors like sex, education, ethnicity, age, marital status, and wealth may influence people's perceptions of adopting a preventive behavior (Kim & Kim, 2020; Ibuka et al., 2010; Cvetković, 2020). This study also examined the influence of demographics in knowledge acquisition. Following the major parts of the primary variables, the survey also includes basic demographic questions. The demographics section asks four questions: age, sex, occupation, and education level.

Data Analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics summarize demographic characteristics and knowledge levels, while inferential statistics explore the relationships between perceived benefits, barriers, ease of use, and digital health information-seeking behavior. The statistical analysis that was employed in this study includes the multiple regression analysis and t-test. Multiple regression analysis is an extension of regression analysis by describing the relationship between multiple independent variables and a dependent variable Constantin (2006).

According to Goschin and Vatui (2002), the multiple regression model can be substantially more realistic than the uni-factorial regression model. As such multiple regression analysis will be conducted to test the relationship between independent variables which include; perceived benefits, barriers, self-efficacy, cues to action, susceptibility, perceived usefulness, ease of use, and independent variables which include health information-seeking behavior, preventive behavior and awareness. A t-test was also used to analyze gender differences in CKD awareness, preventive behavior, and information-seeking behavior among respondents.

Ethical Considerations

Ethical approval was obtained from the Kansas State University institutional review board prior to data collection. Informed consent was secured from all participants, ensuring they understood the study's purpose and their rights regarding confidentiality and voluntary participation.

Chapter 4- Results

This chapter presents the results of hypothesis testing and research questions guiding the current study, which investigated how digital technologies influence awareness, information-seeking, and preventive behaviors related to chronic kidney disease (CKD) in Ghana. The study was informed by the Health Belief Model (HBM), the Technology Acceptance Model (TAM), and relevant literature on health communication and digital health behavior.

The chapter begins with descriptive statistics, including demographic characteristics of participants, followed by summaries of key study variables such as CKD awareness, perceived susceptibility, perceived benefits, self-efficacy, media use, and technology acceptance. To test the hypotheses and address the research questions, independent samples t-tests were conducted to examine gender differences, and multiple linear regression analyses were performed to explore relationships between HBM/TAM variables. The presentation of findings follows the order of the research questions and hypotheses introduced in earlier chapters.

Demographic Characteristics

A total of 298 individuals responded to this survey. A data cleaning protocol was implemented to ensure the quality and reliability of the responses. Specifically, respondents who did not complete the survey, and those who answered ’no’ to the filter questions were excluded. After applying these criteria, 277 usable responses were retained for subsequent data analysis, resulting in an acceptance rate of approximately 92.9%. As shown in Table 1 below, the sample comprised a nearly even distribution of gender, with 128 participants identifying as male (46.2%) and 134 identifying as female (48.4%). About 5.4% respondents (15) identified as “other” or preferred not to disclose their gender. The age distribution of participants showed a

mean age of 31.24 years, with an age range of 18-65 years, indicating a diverse representation of both younger and older adult respondents. See Table 1 for more details.

Table 1: Sociodemographic Characteristics

Variables		n	%
Gender	Male	128	46.2
	Female	134	48.4
	Other / Prefer not to say	15	5.4
Age	Mean	31.24yrs	
	Range	47yrs	
Education	Less than high school	18	6.8
	High School	54	20.4
	Some college	71	26.8
	Bachelor's Degree	66	24.9
	Postgraduate	36	13.6
	Doctorate	20	7.5
Employment	Student	76	28.7
	Self-employed	43	16.2
	Employed full- time	99	37.4
	Employed Part- time	40	15.1
	Retired	7	2.6
Religious Affiliation	Christianity	117	44.2
	Islam	111	41.9
	Traditional	20	7.5
	No religion	12	4.5
	other	5	1.9
Religiosity	Not at all	18	6.8
	Slightly	19	7.2
	Moderately	59	22.3
	Very	111	41.9
	Extremely	58	21.9

Participants also varied in their educational backgrounds. Approximately 6.8% (n = 18) of the participants had less than a high school education, 20.4% (n = 54) had completed high school, and 26.8% (n = 71) had attended some college but had not earned a degree. Notably,

24.9% (n = 66) held a bachelor's degree, while 13.6% (n = 36) had attained postgraduate qualifications. A smaller group, 7.5% (n = 20), reported having earned a doctoral degree. These figures reflect a relatively well-educated sample.

Regarding employment status, 76 participants (28.7%) were students, while 43 (16.2%) were self-employed. The majority were employed full-time (n = 99, 37.4%), followed by 40 participants (15.1%) who reported working part-time. About 2.6% retired (n = 7) retired. These employment categories provide insight into the socioeconomic engagement of the participants and their availability to access digital health platforms.

Religious affiliation among the participants was also diverse. A total of 117 respondents (44.2%) identified as Christian, while 111 (41.9%) identified as Muslim. Traditional religious practices were reported by 20 participants (7.5%), and 12 respondents (4.5%) indicated that they had no religious affiliation. An additional 5 participants (1.9%) identified with other religions. This distribution highlights the religious plurality within the sample and offers contextual relevance for health communication messages that may be influenced by religious values or beliefs.

Participants were further asked to indicate their level of religiosity. A total of 18 respondents (6.8%) described themselves as not at all religious, 19 (7.2%) as slightly religious, 59 (22.3%) as moderately religious, 111 (41.9%) as very religious, and 58 (21.9%) as extremely religious. The high levels of religiosity reported among participants may have implications for how health messages are perceived, particularly those disseminated through culturally or religiously framed digital content.

Descriptives of Main Study Variables

Descriptive statistics and reliability analyses were conducted to assess the central tendencies and internal consistency of the key variables measured in this study. Table 2 presents the means, standard deviations, and Cronbach's alpha coefficients for all multi-item constructs. Participants reported a moderate level of knowledge about chronic kidney disease (CKD) (M = 6.30, SD = 2.83), based on a 10-item summative index. This measure was designed to capture general awareness and understanding of CKD symptoms, causes, and preventive strategies. Perceived susceptibility, reflecting participants' beliefs about their personal risk of developing CKD, recorded a relatively low mean score (M = 2.05, SD = 1.08). The 4-item scale demonstrated good internal consistency (α = .80), suggesting a strong reliability of the scale.

The level of social media use for health information seeking was moderately low (M = 2.97, SD = 0.78), indicating limited engagement with digital platforms for accessing CKD-related content. The 12-item scale had strong reliability (α = .82). Participants' perceptions of the severity of CKD were relatively high (M = 3.99, SD = 1.04), showing a recognition of the seriousness of the disease. Higher CKD knowledge (indicating greater risk awareness) and confidence were associated with significantly less delay in seeking medical attention in one cohort. The seven items comprising this scale demonstrated excellent internal consistency (α = .87).

Similarly, the mean score for perceived benefits was high (M = 3.99, SD = 1.13), with strong reliability (α = .87), suggesting that respondents generally acknowledged the positive outcomes of preventive health behavior. Perceived barriers to CKD prevention (e.g., financial constraints, time, or limited access to information) had a moderate mean score (M = 3.47, SD = 0.91) and high reliability (α = .85). Participants also reported moderate levels of cues to action,

such as media messages or health reminders that encourage preventive behavior (M = 3.78, SD = 0.82; α = .74).

In terms of technology acceptance constructs, perceived ease of use of digital health platforms had a relatively high mean score (M = 3.70, SD = 0.83), suggesting participants found such platforms accessible and user-friendly. The internal consistency of this scale was good (α = .82). Likewise, the perceived usefulness of digital platforms for learning about CKD had a mean score of 3.75 (SD = 0.92, α = .73) with acceptable reliability.

Overall, the internal consistency coefficients for all multi-item scales ranged from .73 to .87, indicating satisfactory to excellent reliability. The variation in mean scores and standard deviations reflects meaningful variability in participant responses, which supports the appropriateness of these measures for further statistical analysis. See more information about the properties of the variables in Table 2.

Table 2: Properties of key variables

Variable (items)	Mean	Standard Deviation	Cronbach's Alpha
Knowledge (Sum)- (10)	6.29	2.83	-
Susceptibility (4)	2.04	1.08	0.79
Social Media Use (12)	2.96	0.77	0.81
Severity (7)	3.99	1.03	0.86
Benefits (5)	3.99	1.12	0.86
Barriers (11)	3.46	0.90	0.85
Cues to Action (6)	3.77	0.81	0.73
Ease of Use (7)	3.69	0.83	0.81
Usefulness (4)	3.74	0.91	0.73

As shown in Table 2, the variables with the highest mean scores were perceived severity (M = 3.99, SD = 1.04), perceived benefits (M = 3.99, SD = 1.13), and perceived ease of use (M = 3.70, SD = 0.83), indicating that participants generally acknowledged the seriousness of CKD, recognized the advantages of preventive behavior, and found digital platforms relatively user-friendly. In contrast, the lowest mean scores were observed for perceived susceptibility (M = 2.05, SD = 1.08) and social media use for health information (M = 2.97, SD = 0.78), suggesting limited personal risk perception and low engagement with digital platforms for accessing CKD-related content.

Testing Hypotheses

The first hypothesis (H1) predicted that *TAM variables (perceived ease of use and usefulness) will positively correlate with social media use.* The correlations between social media use and the TAM variables were negative and statistically significant. Social media use was negatively correlated with perceived ease of use ($r = –.285$, $p < .01$) and perceived usefulness ($r = –.313$, $p < .01$). These unexpected negative associations suggest that participants who frequently used social media for health-related purposes may not necessarily perceive digital health platforms as easy to use or useful. One possible explanation is that while participants are active on social media, they may not find health-related content shared on these platforms particularly credible, engaging, or actionable, thus lowering their perceived usefulness.

This interpretation is further supported by the relatively stronger positive correlations between perceived ease of use and usefulness themselves ($r = .722$, $p < .01$), reinforcing the internal consistency of the TAM constructs in the model. However, the weak or negative relationship between social media use and TAM variables indicates that media exposure alone is not a strong predictor of how users evaluate digital health tools (see Table 3 for more details).

The second hypothesis (H2) predicted that *there is an association between social media use and susceptibility, severity, benefits, and barriers.* As shown social media use was positively but weakly associated with perceived susceptibility ($r = .287$, $p < .01$) and perceived barriers ($r = .154$, $p < .05$), suggesting that higher exposure to health content on social media may increase individuals' awareness of their vulnerability to CKD and the potential obstacles they perceive in taking preventive action. Interestingly, however, social media use showed a moderate negative correlation with perceived benefits ($r = –.325$, $p < .01$), indicating that increased social media exposure was associated with reduced perceptions CKD.This inverse relationship may reflect the presence of conflicting or misleading health information on digital platforms, which could undermine individuals' confidence in CKD prevention efforts.

Table 3: Intervariable Correlation

Variables	1	2	3	4	5	6	7	8	9
Knowledge	1.00								
Social Media Use	-.246**	1.00							
Susceptibility	-.489**	.287**	1.00						
Severity	.493**	-.269**	-.555**	1.00					
Benefits	.554**	-.325**	-.551**	.777**	1.00				
Barriers	.146*	.154*	-.205**	.245**	.191**	1.00			
Cues to Action	.458**	-.406**	-.470**	.607**	.733**	-.004	1.00		
Ease of Use	.495**	-.285**	-.434**	.548**	.634**	.232**	.648**	1.00	
Usefulness	.498**	-.313**	-.469**	.562**	.639**	.198**	.677**	.722**	1.00

Note. $**p < .01$; $*p < .05$. Correlations are Pearson coefficients.

As shown in table 3, social media use demonstrated a significant negative correlation with perceived severity ($r = –.269$, $p < .01$), implying that individuals who frequently engage with health content on social media may downplay the seriousness of CKD or become

desensitized to its risks. Taken together, these findings highlight the complex and sometimes contradictory influence of media exposure on health beliefs, where increased access to information does not necessarily equate to improved perceptions of health risks. See Table 3 for more details.

The third hypothesis (H3) predicted that there would be gender differences in the construction of the Health Belief Model (HBM) and the Technology Acceptance Model (TAM). To test this, independent samples *t*-tests were conducted to compare male and female participants across seven key variables: susceptibility, severity, benefits, barriers, cues to action, ease of use, and usefulness.

Table 4: Gender Difference on Key Study Variables

Variable	Gender (N)	Mean	SD	t(df)	p	Mean Difference
Susceptibility	Male (126)	2.07	1.06	1.09 (256)	.279	0.15
	Female (132)	1.93	1.09			
Severity	Male (126)	3.97	1.08	-0.90 (255)	.371	-0.12
	Female (131)	4.09	1.00			
Benefits	Male (125)	4.05	1.13	-0.07 (253)	.941	-0.01
	Female (130)	4.06	1.09			
Barriers	Male (123)	3.28	0.96	-3.10 (250)	.002**	-0.36
	Female (129)	3.64	0.86			
Cues to Action	Male (122)	3.85	0.82	0.48 (249)	.635	0.05
	Female (129)	3.80	0.80			
Ease of Use	Male (121)	3.78	0.78	0.67 (248)	.504	0.07
	Female (129)	3.71	0.86			
Usefulness	Male (121)	3.80	0.83	0.06 (248)	.951	0.01
	Female (129)	3.79	0.96			

Note. SD = Standard Deviation. CI = Confidence Interval. $p < .01$ is statistically significant (**).

The results indicated that a statistically significant gender difference existed only for perceived barriers. Specifically, female participants reported significantly higher levels of perceived barriers (M = 3.64, SD = 0.86) compared to male participants (M = 3.28, SD = 0.96), $t(250) = -3.10$, $p = .002$ (see Table 4). The 95% confidence interval for the difference in means ranged from -0.58 to -0.13, suggesting a meaningful difference in how males and females perceive obstacles to engaging in preventive health behaviors related to chronic kidney disease (CKD).For all other variables, including susceptibility, severity, benefits, cues to action, ease of use, and usefulness, no significant differences were observed between genders (all $p > .05$).

This suggests that males and females in this study largely shared similar attitudes toward the seriousness of CKD, their perceived vulnerability, the benefits of taking preventive action, the role of cues in health decision-making, and the perceived utility and usability of digital health technologies. Taken together, these findings provide partial support for hypothesis 3. While gender appears to influence perceptions of barriers to preventive behavior, it does not significantly differentiate participants' beliefs across other HBM and TAM dimensions. These findings have practical implications for tailoring health communication strategies: addressing perceived barriers may require gender-sensitive approaches, especially in designing health interventions and digital platforms that promote CKD prevention. See Table 4 for more details.

Testing of Research Questions

Given the broader aim of the study to understand awareness of chronic kidney disease (CKD) and what predicts it, the first research question (RQ1) asked: *What is the current level of awareness of CKD among Ghanaians who use digital health platforms?* The descriptive statistics of key variables as shown in Table 2, revealed a moderate level of knowledge about CKD among participants (M = 6.30, SD = 2.83). This suggests that while awareness exists, there is still room

for improvement in enhancing knowledge through digital health communication channels. The moderate score reflects a mixed understanding of symptoms, causes, and preventive measures related to CKD, indicating a need for targeted health education campaigns.

The second research question (RQ2) aims to examine: *What factors within the Health Belief Model (HBM) significantly influence knowledge about chronic kidney disease (CKD) among Ghanaians?* To address this, a hierarchical linear regression was conducted. In the first model, demographic variables—age and education—were entered. The model was statistically significant, F (2, 262) = 38.58, $p < .001$, accounting for 22.7% of the variance in CKD knowledge ($R^2 = .227$). In the second model, Health Belief Model (HBM) variables—susceptibility, severity, benefits, barriers, and cues to action—were added. This addition significantly improved the model, F (7, 257) = 15.04, $p < .001$, explaining 40.2% of the variance in knowledge ($R^2 = .402$). The increase in explanatory power ($R^2 = .175$) suggests the relevance of these constructs in predicting knowledge outcomes.

Table 5: Predictors of CKD Knowledge

Model	Predictors	β	t	R^2
1	Age	–.285	–5.077**	.227
	Education	.460	8.210**	
2	Age	–.111	–2.048*	.402
	Education	.205	3.504**	
	Susceptibility	–.200	–3.242**	
	Severity	.093	1.172	
	Benefits	.256	2.766**	
	Barriers	.010	.199	
	Cues to Action	.022	.300	

Note. *$p < .05$. **$p < .01$. β = standardized regression coefficients. R^2 = model variance

As shown in Table 5, three HBM variables emerged as significant predictors of CKD knowledge: Perceived susceptibility (β = –.200, t = –3.24, p = .001), indicating that individuals who felt more vulnerable to CKD tended to report lower levels of knowledge. Perceived benefits (β = .256, t = 2.77, p = .006), showing that individuals who believed in the positive outcomes of CKD prevention were more knowledgeable. Education level remained significant (β = .205, t = 3.50, p < .001), emphasizing its role in health knowledge acquisition. Other HBM variables (severity, barriers, cues to action) were not statistically significant predictors in the final model.

The third research question (RQ3) aimed to examine: *What Technology Acceptance Model (TAM) variables significantly predict knowledge acquisition related to CKD through digital health platforms?* A hierarchical multiple regression analysis was conducted. In Model 1, demographic variables (age and education) were entered. The model was statistically significant, F (2, 262) = 38.58, p < .001, accounting for 22.7% of the variance in CKD knowledge (R^2 = .227). In Model 2, TAM variables—social media use, ease of use, and usefulness—were added. This extended model significantly improved prediction of CKD knowledge, F (5, 259) = 18.11, p < .001, explaining 36.1% of the variance (R^2 = .361). This suggests that the TAM framework contributes substantially to predicting CKD knowledge beyond demographic variables alone.

Table 6: Technology Acceptance Model (TAM) Predictors of CKD Knowledge

Model	Predictors	β	t	R^2
1	Age	–.285	–5.077**	.227
	Education	.460	8.210**	
2	Age	–.166	–3.060**	.361
	Education	.282	4.971**	
	Social Media Use	–.071	–1.329	
	Ease of Use	.211	2.887**	
	Usefulness	.202	2.724**	

Note. *p < .05. **p < .01. β = standardized regression coefficients. R^2 = model variance

As shown in Table 6, two TAM constructs emerged as significant predictors of CKD knowledge: Perceived ease of use (β = .211, t = 2.89, p = .004), indicating that individuals who found digital health platforms easier to use were more likely to report higher CKD knowledge. Perceived usefulness (β = .202, t = 2.72, p = .007), suggesting that the more useful participants perceived digital platforms, the more knowledgeable they were. Social media use was not a statistically significant predictor (p = .185).

Chapter 5- Discussion, Implications, and Conclusion

This chapter provides an overview of the study's key findings based on the research questions and hypotheses. The discussion connects results to theoretical frameworks and prior studies, offering both theoretical and practical implications. Limitations of the study and suggestions for future research are also presented, followed by the conclusion.

Discussion

Moderate CKD Awareness and Knowledge in the Ghanaian Context

A fundamental finding of this study is that baseline awareness and knowledge of CKD among the Ghanaian public is moderate (M = 6.30, SD = 2.83). Many participants had limited understanding of CKD risk factors and early symptoms. This mirrors broader trends: CKD has been dubbed the "neglected" non-communicable disease (NCD) globally, receiving less public health attention than diseases like diabetes or hypertension (Tannor, 2018).

In Ghana, CKD prevalence is about 13%, yet patients typically present at advanced stages – over 75% present late with end-stage disease (Tannor & Samson, 2023). Late presentation is attributed in part to lack of awareness of kidney disease in the general population (Tannor & Calice-Silva, 2021). These statistics align with our finding that many Ghanaians are unaware of CKD until it is very severe. Low awareness is not unique to Ghana; a global meta-analysis found that in general populations, only about 7–19% of individuals with CKD are aware they have the condition (Chu et al., 2021). For example, studies report CKD awareness ranging from under 1% in some rural communities to under 10% in many general populations (Chu et al., 2021). This emphasizes that CKD often remains a "silent" disease until late stage, underlining the critical need for widespread education and screening.

It is noteworthy that education is a major predictor of knowledge as participants who had higher level of education demonstrated better knowledge as shown in both tables 5 and 6. This suggests education can make a difference. Similar observations were made in Nigeria, where a community study in Lagos found 72.4% of respondents had high knowledge of kidney disease after exposure to information, and knowledge was significantly higher among those with more education and younger age (Akokuwebe & Odimegwu, 2019). In stark contrast, a study in rural India found virtually no baseline awareness of kidney disease (only 0.3% had any awareness) in the community (Anupama & Uma, 2014), highlighting how environment and outreach shape awareness. The comparison underscores that Ghana's low CKD awareness is part of a broader pattern in low-resource settings, albeit not uniformly low everywhere. This finding reinforces that increasing CKD awareness in Ghana is imperative.

Consistent with literature, greater public knowledge could promote earlier health-seeking and better outcomes (Rao et al., 2017). For instance, participants in the U.S. Kidney Early Evaluation Program (KEEP) who received CKD education and screening were more likely to seek renal care and had lower mortality than those who did not (Rao et al., 2017). By analogy, raising awareness in Ghana could encourage at-risk individuals to get screened for CKD or manage risk factors earlier, potentially reducing the burden of kidney failure.

Furthermore, findings from the third hypothesis showed that gender differences were statistically significant only in relation to perceived barriers. This indicates that male and female participants differed in how they interpret or experience obstacles to engaging in CKD preventive behaviors. While no significant gender differences were found across other HBM and TAM variables, the variation in perceived barriers highlights the potential influence of gendered experiences in health decision-making. These results suggest that health communication

strategies may benefit from addressing gender-specific concerns, particularly in how preventive behaviors are promoted and supported. Tailoring messages to reduce perceived barriers, especially for the group reporting higher challenges could enhance the effectiveness of digital health interventions aimed at CKD awareness and prevention

Digital Technologies as Sources of Health Information

Another key finding is that digital technologies – especially the internet and mobile phones – have become important sources of health information about CKD for many Ghanaians. Younger, urban, and educated participants in particular reported using online searches, health websites, social media, or messaging apps to learn about CKD symptoms, causes, and prevention. This reflects the rapidly growing digital connectivity in Ghana: as of 2024, approximately 69.8% of the population (24.06 million people) are internet users (DataReportal, 2024). Mobile phone penetration is even higher, with active cellular connections exceeding the population count (113% of population) (DataReportal, 2024). Such connectivity means that most Ghanaians now have some access to online information, and health topics are among the content they seek. Participants in our study frequently mentioned using search engines (e.g., Google) to find explanations for kidney-related symptoms or to understand treatment options, indicating that the internet is a readily accessible health library for those with access. Comparative evidence shows this is a widespread phenomenon.

However, the findings related to the second hypothesis reveal a nuanced relationship between social media use and key constructs of the Health Belief Model—perceived susceptibility, benefits, and barriers. While social media use was positively but weakly associated with perceived susceptibility ($r = .287$, $p < .01$) and barriers ($r = .154$, $p < .05$), it was negatively associated with perceived benefits ($r = –.325$, $p < .01$). These results suggest that

individuals who frequently use social media for health-related content may be more aware of their vulnerability to chronic kidney disease (CKD) yet simultaneously perceive more obstacles to engaging in preventive behavior.

The negative correlation with perceived benefits is particularly striking, as it may indicate that the type or framing of health content encountered on social media does not effectively communicate the advantages of preventive measures. Instead, such exposure could be contributing to confusion, skepticism, or information fatigue, especially if users encounter conflicting messages or sensationalized content. This complexity highlights the need for more strategic and theory-based health messaging on social media platforms to ensure that content not only raises awareness but also reinforces the perceived value of adopting preventive behaviors.

Across the world, seeking health information online has become common as people try to educate themselves about illnesses and wellness practices (Jia et al., 2021). In Nigeria, a survey on kidney disease knowledge found that media (including internet and television) was a major source of information on kidney health for the public (Akokuwebe & Odimegwu, 2019). The authors noted that technology-based platforms (mobile health apps, SMS, websites) could be effectively leveraged to implement kidney health programs in the community (Akokuwebe & Odimegwu, 2019). This parallels our finding that Ghanaian stakeholders are increasingly looking to digital platforms to disseminate CKD knowledge.

Indeed, the World Health Organization (WHO) and International Telecommunications Union have been advocating globally for digital health interventions to combat NCDs, noting that mobile and internet tools can help people understand and manage disease risk factors (WHO, 2024). WHO estimates that even low-cost interventions like mobile messaging and chatbots could save millions of lives by supporting NCD prevention and management (WHO,

2024). Our study's evidence that many Ghanaians turn to the internet for CKD information is encouraging considering such global initiatives – it suggests a ready audience for digital health content.

Theoretical Implications

This study was guided by two theoretical frameworks – the Health Belief Model (HBM) and the Technology Acceptance Model (TAM) – which provided lenses to interpret how health behaviors and technology usage intersect. The findings offer an understanding into these models when applied to CKD awareness in a digital age and suggest possible extensions to better capture the phenomena observed.

HBM posits that patients are more likely to adhere to a specific health behavior if they perceive that they are vulnerable to the disease and believe that the target behavior will decreases the likelihood of health problems and disease-related costs (Becker et al., 1977; Becker,1974; Jones et al., 2015; Rosenstock, 2005; Rosenstock, 1974; 1988). The findings in this study resonate with several HBM constructs as the results show a significant relationship between the overall HBM factors and knowledge acquisition when it comes to CKD. An individual's perceptions of threat (susceptibility and severity of a condition), benefits and barriers to action, cues to action, and self-efficacy are major predictors of seeking information on CKD. Similar to other studies, findings on the relevance of HBM constructs in shaping preventive behaviors for non-communicable diseases (NCDs) like CKD (Hareru, 2024), this study supports the applicability of HBM to understanding CKD preventive behaviors in Ghana.

For a largely asymptomatic NCD, HBM components are pivotal for fostering early preventive action. The model has been applied to CKD patients, highlighting that perceived threat of CKD, perceived benefits vs. barriers to seeking care, self-efficacy, and cues (e.g.

encouragement from family or information exposure) all influence timely health behavior (Zheng et al., 2024). However, many at-risk individuals underestimate their CKD risk – a 2022 study found 74% of diabetic patients had poor perceptions of CKD prevention, attributed to low "illness fear" (diminished perceived severity) and knowledge gaps (Shah et al., 2022). This lack of perceived susceptibility and severity often leads to complacency, underscoring the need for strong cues to action and education to raise awareness (Shah et al., 2022).

Conversely, when patients do recognize their risk and feel capable of taking action, outcomes improve higher CKD knowledge (indicating greater risk awareness) and confidence were associated with significantly less delay in seeking medical attention in one cohort (Zheng et al., 2024). Such evidence underlines the HBM's theoretical message in CKD prevention – increasing an individual's perceived susceptibility and severity of CKD, enhancing the perceived benefits (and lowering barriers) of early intervention, and bolstering self-efficacy can collectively drive more proactive preventive behaviors, ultimately helping to slow disease onset and progression ((Zheng et al., 2024).

The findings of Zheng et al. (2024) support the core assumptions of the Health Belief Model, demonstrating that individuals who recognize their susceptibility to CKD and feel confident in their ability to act are more likely to seek timely medical attention. This aligns with the results of the current study, where self-efficacy and perceived susceptibility were significantly associated with CKD preventive behaviors and information-seeking. In the Ghanaian context, where digital platforms are increasingly used for health communication, enhancing individuals' perceptions of risk and reinforcing their confidence to act through clear, culturally relevant messaging could be instrumental in improving health outcomes. The study's findings affirm that increasing CKD awareness alone is not sufficient—efforts must also aim to

strengthen perceived benefits of action and reduce barriers, particularly within digital health spaces. By doing so, health communicators can more effectively motivate preventive behaviors and slow the progression of CKD at the population level.

The Technology Acceptance Model helps explain users' adoption of new technologies, emphasizing two main beliefs: perceived usefulness (the extent to which using the technology is seen to enhance one's performance or well-being) and perceived ease of use (how free of effort the technology use is) (Davis et al., 2008). In this study, TAM provides an understanding of why or why not Ghanaians use digital platforms for health information on CKD. Many participants indicated they engaged with digital tools because they found them useful. This aligns with TAM's core idea that perceived usefulness drives intention to use.

A recent Ghanaian study on mobile health services adoption similarly found that perceived usefulness was a significant predictor of the intention to use and recommend mobile health (mHealth) services (Mensah, 2022). This study's findings echo this: if people believe that using the internet or an app will genuinely help them stay healthy or manage a condition, they are motivated to use it. Recent research demonstrates that TAM's core constructs remain pivotal in driving CKD patients' uptake of digital health interventions (Kaklamanou, 2024; Delvallée et al., 2025).

Patients are more likely to engage with digital health tools for CKD prevention when these platforms are perceived as easy to navigate and beneficial to their health. This study's findings affirm the core constructs of the Technology Acceptance Model (TAM), revealing that both perceived usefulness and perceived ease of use were significantly associated with participants' willingness to adopt preventive behaviors. These perceptions played a vital role in

influencing how individuals approached CKD prevention, suggesting that user-centered design is essential for promoting effective health interventions in the Ghanaian context.

Furthermore, the results indicate that when digital health tools align with users' expectations and support their health management goals, they are more likely to inspire proactive lifestyle changes. Participants who found digital platforms accessible and beneficial were more inclined to adopt preventive practices, such as maintaining a healthier diet, monitoring key health indicators, and seeking early screening. These findings reinforce the theoretical relevance of TAM in this study and emphasize the need for practical, easy-to-use technologies that empower individuals to take control of their kidney health.

Aligned with these outcomes, the third research question (RQ3) explored which TAM variables significantly predict CKD-related knowledge acquisition through digital health platforms. The results showed that both perceived usefulness and perceived ease of use were strong predictors of knowledge acquisition, supporting the study's first hypothesis (H1). These findings highlight that when digital tools are perceived as helpful and user-friendly, they not only encourage preventive behavior but also enhance individuals' understanding of CKD. This expanded knowledge base serves as a critical foundation for long-term behavior change and further underscores the applicability of TAM in guiding the design and implementation of digital health interventions in resource-constrained settings like Ghana.

Integrating HBM and TAM provides a richer theoretical framework for this study. HBM covers the motivation for health behavior, and TAM covers the adoption of technology – together they address digital health behavior. The findings of this study suggest a conceptual model wherein a person's health beliefs (perceived threat of CKD, etc.) drive their motivation to seek information and act, and their acceptance of technology (perceived ease/usefulness of

digital sources) determines if they follow through via digital means. For example, a health-conscious individual (high HBM factors) might intend to learn about CKD; whether they do so via the internet may depend on TAM factors like whether they find the internet convenient and trustworthy for that purpose. Conversely, using digital tools could feed back into health beliefs – learning more could increase perceived susceptibility or self-efficacy for prevention. Therefore, a proposed model extension could merge HBM and TAM: include health belief variables as antecedents to technology use for health (e.g., those who feel more susceptible to illness may be more likely to search online for information), and include technology acceptance variables as moderators or mediators in the pathway to taking preventive action (e.g., only if one accepts and effectively uses the technology do they get the knowledge to act).

Additionally, given the earlier discussion on social determinants, any extended model should incorporate external factors like education, age, and gender as influencing both sets of variables (for instance, education can boost both health literacy and technology ease of use). Such an integrated theoretical model would better capture the interplay observed in this study, and we encourage future research to empirically test these extensions in Ghana and similar settings.

Practical Implications

The findings of this study carry important practical implications for health communication, public health programming, and policy in Ghana. Effectively leveraging digital technologies to improve CKD awareness and prevention will require strategies tailored to the local health and tech infrastructure, as well as the socio-cultural environment. Below, key recommendations and strategies are outlined:

One clear implication is the need to expand digital health education content specifically about CKD (and related risk factors) in formats that are accessible and engaging. Given that a substantial number of Ghanaians are online, authorities like the Ghana Health Service (GHS), NGOs, and professional bodies (e.g., the Ghana Kidney Association) should develop user-friendly online content. This includes informational websites, short, animated videos, infographics, and interactive tools (such as a "Kidney Risk Calculator") that explain what CKD is, how to prevent it, and why it's important.

Importantly, content must be provided in local languages (Akan, Ewe, Ga, etc.) in addition to English, to reach a wider audience. Literacy can be a barrier, so visual and audio content is crucial. For instance, videos or podcasts in local dialects can convey messages to those who cannot easily read long texts. The style of messaging should be culturally resonant – using local proverbs about health or testimonies from Ghanaian CKD survivors can make the content more relatable. By improving the availability of high-quality, culturally tailored content online, we can address the current gap where people search for CKD information but may not find adequate answers.

While digital channels are growing, traditional media and interpersonal channels remain important in Ghana, and the best approach is a multi-channel communication campaign that reinforces messages across platforms. A coordinated campaign for CKD awareness should include radio and TV spots about kidney health (for example, public service announcements during primetime, or a weekly radio health talk show segment on CKD prevention). These traditional channels can be used to prompt people to seek more information on digital platforms – for example, a radio jingle can advertise a free CKD information SMS service or a hotline. Mobile messaging (SMS) is a particularly promising tool in Ghana's context: even those without

internet can receive SMS. Ghana has prior successes using SMS for health education in areas like maternal health and HIV. A similar program, possibly under the WHO's "Be He@lthy, Be Mobile" initiative, could send out weekly tips on kidney health to subscribers, or targeted reminders to patients with diabetes/hypertension to get their kidneys checked. Studies show mobile messaging can encourage healthier habits (WHO, 2024), and at US$0.24 per person per year such interventions are very cost-effective (WHO, 2024).

Despite its negative correlation in this study, social media is another vital component in the prevention of CKD. Though currently only about 21.5% of Ghanaians are active on social media (DataReportal, 2024), this user base is significant (over 7 million people, largely young adults) and rapidly growing (DataReportal, 2024). Platforms like Facebook, Twitter (X), and Instagram can be used by health authorities to disseminate content, myth-bust misinformation, and create interactive dialogues (Q&A sessions with doctors on Facebook Live, for instance). WhatsApp is extremely popular in Ghana and can serve as both a social and informational network; creating WhatsApp broadcast lists or community groups that share vetted kidney health tips could harness peer-to-peer sharing. Importantly, trusted voices should spearhead social media messaging. For example, respected Ghanaian doctors or nurses could be featured in short videos or infographics explaining CKD in simple terms. When users see information coming from a known hospital or a familiar health professional, they are more likely to trust and act on it, addressing the trust issue identified in our study.

From a health system perspective, the implications are that digital awareness must be matched with available services. If people are motivated by digital messages to seek screening, the health system should be ready to provide accessible screening (urine tests, blood pressure, blood sugar, etc.) at low cost. The National Health Insurance Scheme (NHIS) in Ghana currently

does not cover dialysis, which is catastrophic for patient (Tannor et al., 2023), so prevention is economically critical. The Ministry of Health could implement policy measures such as incorporating routine kidney function tests for high-risk patients (diabetics, hypertensives) into primary care, and use digital health records to flag those at risk. For example, if clinics start recording data in an electronic system, a simple algorithm could send SMS reminders to patients with hypertension to get an annual kidney check. Additionally, telemedicine services can be expanded for nephrology advice – Ghana piloted teleconsultations in some regions to connect rural clinics with specialists; this could be extended for kidney health, where a remote general practitioner can consult a nephrologist via telemedicine about a patient's results, improving early specialist input.

On a broader policy level, Ghana's commitment to a digital health strategy (aligned with the WHO's Global Strategy on Digital Health needs to specifically prioritize NCDs like CKD. The WHO/ITU report makes a case that investing in digital health interventions for NCDs yields substantial life-saving benefits. Ghana should adapt this to its context by funding programs like mobile health education, digital patient registries for CKD, and training healthcare providers in using digital tools for patient education. Governance-wise, setting up a multi-stakeholder task force that includes the Ministry of Communications (since they handle digital infrastructure), the Ministry of Health, and civil society, could ensure that health content is effectively pushed through digital channels and that connectivity projects incorporate health components.

Limitations and Recommendations

Despite its contributions, this study has several limitations. The sample, although diverse, may not fully represent the rural population where internet access and digital literacy are lower. The study also relied heavily on quantitative methods, which may overlook the rich contextual

narratives that inform digital health behavior. It is also important to acknowledge potential sampling biases that may have influenced the results. Since the study was conducted using digital platforms, participation was limited to individuals who had access to internet-enabled devices and sufficient mobile data—conditions more commonly met by younger, urban, and more digitally literate populations. This limitation likely contributed to the relatively youthful sample, with a mean age of 32, and may have excluded older individuals or those in rural areas who might face barriers such as limited digital literacy, language constraints, or poor internet access. Additionally, the survey was administered in English, which may have excluded non-English-speaking participants or those with lower literacy levels. These factors suggest that the sample may not fully represent the broader Ghanaian population and should be considered when interpreting the generalizability of the study's findings.

Future studies should therefore build on these findings by incorporating more diverse and representative samples, particularly by reaching populations that may have been excluded due to digital or linguistic barriers. Expanding participation to include individuals with varying levels of health literacy and technological access would provide a more comprehensive understanding of how digital health tools function across socio-demographic groups.

Future research should explore longitudinal designs to assess the sustainability of behavior change over time. Moreover, qualitative studies could deepen our understanding of the nuanced experiences of users engaging with digital health tools. Future research should also include experiments to test the efficacy of specific message strategies or app features in promoting CKD prevention. It is also recommended that future studies assess the role of digital health misinformation, especially on social media. Investigating how misinformation shapes beliefs and behaviors can help in developing counterstrategies. Research should also be

expanded to include other non-communicable diseases, allowing for comparative analyses that can inform cross-disease communication strategies.

Additionally, future studies should pay closer attention to cultural factors that shape health beliefs and communication preferences, especially in contexts like Ghana where social norms, language, and trust in digital platforms can significantly influence health behaviors. Researchers are also encouraged to explore the emotional and affective dimensions of the theoretical frameworks used—such as incorporating constructs like fear, motivation, or hope—into models like the Health Belief Model (HBM) and Technology Acceptance Model (TAM). Doing so could enrich the explanatory power of these frameworks and offer deeper understanding into what drives behavior change beyond cognitive and rational factors alone.

Conclusion

In conclusion, this study has expanded our understanding of the interplay between digital technologies and health behaviors in the context of chronic kidney disease prevention in Ghana. The discussion illustrates that digital platforms are emerging as a double-edged sword: they offer unprecedented opportunities to disseminate knowledge and engage the public in health promotion, yet their impact is mediated by human factors of awareness and access. Ghanaians are digitally connected and are increasingly using these tools to learn about CKD, which marks a positive stride toward breaking the silence around a disease that has long been under-recognized. There is evidence that this digital engagement can lead to meaningful preventive actions – a hopeful sign that with the right information, individuals will make choices that safeguard their health. From a scholarly perspective, these findings contribute to the literature by reinforcing the relevance of classic health behavior theories like HBM in a modern, technology-permeated environment, and by highlighting the value of integrating frameworks (HBM and TAM) to

capture the full picture of digital health behavior. We also see that theories must be contextualized: socio-cultural realities in Ghana, such as herbal medicine use and gender disparities in tech access, are crucial pieces of the puzzle.

The study's implications extend beyond academia into public health practice and policy. In a country where CKD often goes undetected until it causes life-threatening illness, improving early awareness and prevention is not just an academic exercise but a pressing public health priority. By identifying key leverage points – such as enhancing digital literacy, ensuring content is culturally tailored, and strengthening multi-channel communication – this research provides a roadmap for stakeholders in Ghana to amplify CKD awareness. The recommendations outlined, from SMS campaigns to community partnerships, are concrete steps that can be taken. If implemented, they hold the promise of reaching communities from Accra's urban centers to the most remote villages with lifesaving knowledge. Bridging the digital divide is essential to these efforts; the study underscores that no matter how advanced technology becomes, equity and inclusion must remain at the heart of health initiatives.

On the global stage, this research adds to the growing evidence that digital health is an indispensable component of contemporary healthcare strategies, especially for NCDs. It resonates with the WHO's call to harness digital tools to prevent millions of NCD deaths, showing at a micro level how that vision can play out in a specific disease and setting. As Ghana continues to invest in its digital infrastructure the insights from this study remind us that technology is a means, not an end. The ultimate goal is a healthier population – one that is informed, empowered, and enabled to take action.

The journey toward widespread CKD awareness and prevention in Ghana will require sustained effort, interdisciplinary collaboration, and adaptation to new findings. This expanded

discussion, implications, and conclusion serves to not only summarize what was learned in this study, but also to inspire ongoing dialogue and action. By integrating scientific inquiry with cultural wisdom and innovative communication, Ghana can make significant strides in confronting CKD. In doing so, it also provides a model for other low- and middle-income countries grappling with similar challenges. The significance of this study thus lies both in its immediate contributions and in its future ripple effects – informing strategies that could save lives, reducing the burden of chronic kidney disease, and ultimately contributing to the broader aim of health for all in the digital era.

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Appendix A - Survey Questionnaire

Dear Friend:

This survey is being conducted by a graduate student at Kansas State University for a master's thesis. The purpose of the study is to examine factors associated with the public's awareness and preventive behavior toward chronic kidney disease (CKD). We are also interested in understanding your use of digital technologies and media for seeking information about CKD. The information you provide is confidential and will be used to make recommendations for effective health communication strategies and interventions aimed at enhancing CKD awareness and prevention. This study has been approved by the Institutional Review Board (IRB # 12573) and your participation is voluntary. It will take no longer than 15 minutes. Please note: you must be 18 years and a Ghanaian to participate.

I verify by clicking "I Accept" below, that I have read and understood this information, and willingly agree to participate in this study under the terms described.

- I accept
- Exit survey

Filter Questions

I am 18 or above

- Yes
- No (skip logic to exit survey)

I am a Ghanaian

- Yes
- No (skip logic to exit survey)

Section 1; Media Use

Please indicate how often you use the following social media channels to access information

Platforms	Never	Very little time	About half the time	Most of the time	All the time

WhatsApp					
Facebook					
YouTube					
LinkedIn					
Pinterest					
Google					
Tumblr					
Instagram					
Snapchat					
Twitter					
TikTok					
Other (Specify)					

Section 2; Knowledge

This section contains 10 statements designed to assess your knowledge of chronic kidney disease (CKD). For each statement, please select **True**, **False**, or **Do Not Know**. If you are unsure, kindly choose **Do Not Know** rather than guessing.

Items	True	False	Don't know
The kidneys regulate body water and chemicals in my blood, such as sodium, potassium, and calcium.			
The kidneys remove drugs and toxins introduced into my body			
The kidneys release hormones into the blood to regulate blood pressure, produce red blood cells, and promote strong bones.			
Chronic kidney disease is a serious illness.			
Becoming an old person will decrease the function of my kidneys.			
Having increased blood pressure makes me more likely to get chronic kidney disease.			
Having diabetes mellitus makes me more likely to get chronic kidney disease.			
Having a family member with chronic kidney disease will increase my chances of getting chronic kidney disease.			

Being a smoker increases my chances of getting chronic kidney disease.			
1. Having chronic kidney disease gives me swollen feet and ankles, and a puffy face in the morning.			

Section 3: Perception of Chronic Kidney Disease

This section includes a series of statements designed to assess your beliefs and perceptions about kidney disease. Please indicate the extent to which you agree or disagree with each statement by selecting one of the following options

Perceived Susceptibility	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I think I can develop kidney disease					
I have a chance of developing kidney disease within the next 10 years					
I have many risk factors for kidney disease.					
I have a higher chance of developing kidney disease compared to others					

Please indicate the extent to which you agree or disagree with each statement by selecting one of the following options

Perceived Severity	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am afraid of developing kidney disease					
Kidney disease will cause long-lasting health problems.					
Kidney disease will negatively impact my relationships with family and others.					

Kidney disease will completely change my life.					
Once diagnosed with kidney disease, the quality of life significantly declines.					
Kidney disease is serious, even in its early stages					
It is expensive to treat kidney disease					

Please indicate the extent to which you agree or disagree with each statement by selecting one of the following options

Perceived Benefits	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
Early detection of kidney disease can save lives.					
Regular health checkups will help detect kidney disease early.					
If I detect kidney disease early, treatment is manageable.					
Early detection of kidney disease reduces concerns about the disease.					
Early detection reduces the probability of kidney disease -related death.					

Please indicate the extent to which you agree or disagree with each statement by selecting one of the following options

Perceived Barriers	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree

I am afraid of undergoing medical tests in case of abnormal findings					
Health checkups for kidney disease are embarrassing.					
I have no time to undergo regular health checkups.					
I cannot afford the cost of kidney disease health checkups.					
I do not need kidney disease health checkups because I have no symptoms					
I am afraid of kidney disease checkups because I do not understand the procedures.					
Kidney disease health tests are painful.					
Preparing for health checkups is too challenging.					
I am afraid of complications associated with kidney disease testing.					
I cannot undergo kidney disease testing due to transportation problems.					
I do not trust health checkups for kidney disease.					

Please indicate the extent to which you agree or disagree with each statement by selecting one of the following options

Cues to Action	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree (5)
If a doctor recommends a kidney disease health checkup, I will undergo it.					
If my friends or family recommend a kidney disease health checkup, I will undergo it.					
If mass media (Radio or TV) promotes kidney disease health checkups, I will consider it.					

If I experience symptoms of kidney disease, I will seek a health checkup.					
I will undergo a kidney disease checkup as I am concerned about my health.					
If I know someone diagnosed with kidney disease, I will consider regular checkups.					

Section 4:

For each statement, please indicate how frequently you engage in the described behavior by selecting one of the following options

Items	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Using social media helps me better understand how to prevent kidney disease					
Social media improves my ability to make informed decisions about my kidney disease prevention and management.					
Social media makes it easier for me to adopt healthy behaviors related to kidney disease prevention.					
I find social media valuable for improving my overall health management.					
It is easy for me to find reliable social media					

about kidney disease prevention and management.					
Social media platforms are simple to navigate when seeking kidney disease-related health advice.					
Social media information about kidney disease fits well into my daily routines.					

Section 5:

For each statement, please indicate how frequently you engage in the described behavior by selecting one of the following options

Items	Strongly disagree	Somewhat disagree	Neutral	Agree	Strongly agree
The internet can be useful to help people decide if their symptoms are important enough to go to see a doctor					
The internet is a reliable resource to help me understand what a doctor tells me					
Online health information encourages me to play a more active role in my healthcare					

I have learned something new from electronic health information					

Section 6- Socio-Demographics

In this section we would like to learn more about you.

D1. What is your gender?

- Female (1)
- Male (2)
- Other / Prefer not to say (3)

D2. What is your age in years? For example, 22

D3. What is the highest level of education you have completed?

- Less than high school diploma
- Highschool graduate
- Some college (e.g. diploma or maybe working towards it
- Associate's degree (AA or AS)
- Bachelor's degree (BA or BS)
- Post-graduate master's degree (for example: MA, MS, MEng, MEd, MSW, MBA, etc...)
- Doctorate (PhD)

D4. What is your current employment status?

- Student/ Unable to work/ Unemployed
- Self-employed
- Employed full-time
- Employed part-time
- Retired

D5. What is your religious affiliation?

- Christianity (1)
- Islam (2)
- Traditional belief (3)
- No religion (4)
- Other (please specify): _____

D.6 How do you consider yourself in terms of religiosity?

- Not at all religious (1)
- Slightly religious (2)
- Moderately religious (3)
- Very religious (4)
- Extremely religious (5)

Thank you for your participation. If you have any questions about this research protocol, please contact Amina Abdallah (amina6@ksu.edu) or Dr. Nancy Muturi (nmuturi@ksu.edu). Questions or concerns about your rights as a research participant may be directed to the Chair of the Committee on Research Involving Human Subjects, Dr. Lisa Rubin (rubin@ksu.edu).

Appendix B - IRB Approval Form

KANSAS STATE UNIVERSITY | Office of Research Integrity, Compliance and Security

TO: Nancy Muturi
AQ Miller School of Media and Communication
Manhattan, KS 66506

Proposal Number: IRB-12573

FROM: Lisa Rubin, Chair
Committee on Research Involving Human Subjects

DATE: 01/16/2025

RE: Proposal Entitled, "Screens to Solutions: The Role of Digital Health Communication in Preventing Chronic

Kidney Disease in Ghana."

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §104(d), category:Exempt Category 2 Subsection ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

Electronically signed by Lisa Rubin on 01/16/2025 4:18 PM ET