



AN M-HEALTH INTERVENTION TO IMPROVE CLINIC ATTENDANCE AMONG
GYNAE-ONCOLOGY PATIENTS: A PILOT RANDOMIZED CONTROLLED TRIAL IN
KENYATTA NATIONAL HOSPITAL, KENYA

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By Agneta Kandie Chelimo

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Abstract

AN M-HEALTH INTERVENTION TO IMPROVE CLINIC ATTENDANCE AMONG GYNAE-ONCOLOGY PATIENTS: A PILOT RANDOMIZED CONTROLLED TRIAL IN KENYATTA NATIONAL HOSPITAL, KENYA

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Gynaecological cancers, including cervical, ovarian, and endometrial malignancies, contribute substantially to morbidity and mortality worldwide. Timely clinic attendance is essential for continuity of care, yet patients in developing countries often face barriers such as financial constraints, forgetfulness, and transport difficulties. Mobile health (mHealth) interventions, particularly short message service (SMS) reminders, have shown promise in chronic disease management, but evidence in oncology care remains limited. The effectiveness, feasibility, acceptability, and financial consequences of two-way SMS reminders in improving timely clinic attendance among gynecology patients at Kenyatta National Hospital (KNH), Kenya, were assessed in this pilot randomized controlled trial (RCT).

A two-arm RCT was conducted with 122 gynae-oncology patients randomised 1:1 to either the intervention arm (SMS recipients) or the control arm (received usual care). Attendance data were extracted from hospital attendance records and analysed using chi-square tests and logistic regression. Thematic analysis was used to evaluate the viability and acceptability of four key informant interviews with providers and two recipient focus group discussions. Microcosting was utilized to estimate incremental provider costs.

At baseline, timely clinic attendance was low (31.1%) and comparable between arms (control 29.5% vs intervention 32.8%, $p=0.696$). Financial limitations, forgetfulness, and transport issues were the most common barriers. Following the intervention, timely attendance was significantly higher in the SMS group (67.2%) than controls (26.2%). After adjustment for

sociodemographic and clinical covariates, SMS recipients were 12.8 times more likely to attend on time (95%CI=3.9–42.3, $p<0.001$). There was high acceptability among patients and providers, with SMS reminders perceived as supportive, culturally appropriate, and privacy-respecting. Providers affirmed feasibility, citing infrastructure readiness and low costs, though barriers such as phone access and network reliability were noted. Incremental costs were modest, suggesting sustainability.

KNH gynecological patients' timely clinic attendance was greatly enhanced by two-way SMS reminders. The intervention was feasible, acceptable, and affordable, supporting its potential as a scalable strategy to strengthen oncology care continuity in resource-constrained settings. In addition to supporting the integration of digital health interventions to promote universal health coverage and Sustainable Development Goals 3 and 5, these findings provide evidence to a crucial gap in oncology practice in LMICs.

Key words: Timely Clinic Attendance, M Health, Gynae-Oncology, Cancer, Kenya

Declaration

I affirm that I composed this thesis myself, that the content is my own except where specifically stated, and that, unless specified, this work has not been submitted for any other degree or professional qualification.

AI Acknowledgment

Use of AI:

I acknowledge my use of Grammarly (<https://app.grammarly.com/>) and Quill Bot (<https://quillbot.com/grammar-check>) to proofread all the chapters. This action was completed in 26.05.26.

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Dedication

I dedicate this research to my beloved family and the reproductive health team for their support through this journey.

Acknowledgments

I am thankful to God for providing energy and the ability to understand, learn, and complete this research.

My sincere gratitude also goes to Dr. Hubert Amu who supported and encouraged me throughout the research period. I extend my gratitude to ERC of KNH-UON and UNICAF for giving me the approval to collect data.

My heartfelt appreciation goes to KNH Medical Research and programs for giving me grants to carry out the entire research. I wish to express my gratitude to the participants who completed the questionnaires, without which this research would be incomplete. To conclude, I wish to thank the statistician who gave me support during the report analysis.

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List of Abbreviations

Diffusion of Innovations (DoI)

Ethics Research Committee (ERC)

High-Income Countries (HICs)

Hormonal Emergency Contraception (HEC)

Kenyatta National Hospital (KNH)

Low- and Middle-Income Countries (LMICs)

Randomized Controlled Trial (RCT)

Short Message Service (SMS)

Social Cognitive Theory (SCT)

Sub-Saharan Africa (SSA)

Technology Acceptance Model (TAM)

Theoretical Framework of Acceptability (TFA)

Theory of Planned Behaviour (TPB)

Unicaf University Research Committee (UREC)

Universal Health Coverage (UHC)

University of Nairobi (UON)

World Health Organization (WHO)

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CHAPTER 1: INTRODUCTION

1.1. Background to the Study

1.1.1. Global and Regional Burden of Gynaecological Cancers

Gynaecological malignancies contribute substantially to global female morbidity and mortality. These cancers, primarily cervical, uterine, and ovarian (Medhin et al., 2020), account for approximately 40% of cancer occurrence and more than 30% of all cancer-related deaths among women worldwide, with an estimated annual prevalence exceeding 3.6 million cases and over 1.3 million deaths (Piechocki et al., 2022). Cervical cancer remains one of the most common malignancies affecting women globally. In 2018 alone, an estimated 570,000 new cases were reported, resulting in approximately 311,000 deaths (WHO, 2019). In 2020, cervical cancer ranked fourth globally in both incidence and mortality among women, disproportionately affecting low- and middle-income countries (LMICs), particularly in sub-Saharan Africa (SSA) and Southeast Asia (Adeleke et al., 2023).

Persistent infection with high-risk human papillomavirus (HPV) types is a well-established etiological factor in cervical cancer development. HPV-16 and HPV-18 account for approximately 71% of newly diagnosed cases, while types 31, 33, 45, 52, and 58 contribute an additional 19% (Adeleke et al., 2023). Although HPV infection commonly occurs among sexually active women aged 18–30 years, cervical cancer typically manifests later in life, particularly after age 35, reflecting the slow progression from infection to malignancy (Adeleke et al., 2023). This long latency period underscores the importance of screening, early detection, and sustained follow-up care.

Ovarian cancer, ranked third among gynaecological malignancies (Akhter et al., 2020), accounts for approximately 4% of female cancers globally (Bray et al., 2018). It carries the highest mortality rate among gynaecological cancers, with more than 70% of cases diagnosed at advanced stages (III and IV), contributing to poor prognosis and limited survival outcomes

(Torre et al., 2018). In the United States, approximately 21,750 new ovarian cancer cases and 13,940 fatalities were anticipated in 2020, with a five-year survival rate of 46.2% (Siegel et al., 2020). Approximately 90% of ovarian cancers are epithelial ovarian carcinomas (Huang et al., 2022). Risk factors include advancing age, BRCA gene mutations, family cancer syndromes, nulliparity, and lifestyle-related factors such as obesity and metabolic disorders (Huang et al., 2022). Economic development and lifestyle transitions are expected to sustain these risk trends, particularly in LMICs. Consequently, strict lifestyle changes, such as treating metabolic disorders, stopping alcohol usage, quitting smoking, increasing physical activity, and controlling weight, are necessary, particularly for those in high-risk groups for ovarian cancer (Huang et al., 2022). Beyond mortality, these malignancies impose psychological, social, and economic strain on affected women and their families, affecting quality of life and healthcare systems globally (Gitonga et al., 2020).

1.1.2. Importance of Timely Follow-up and Adherence in Oncology Care

While advances in screening, diagnosis, and treatment have improved survival outcomes in many settings, the effectiveness of oncology care depends heavily on timely clinic attendance and adherence to treatment and follow-up schedules. Early detection and consistent monitoring are critical components of the oncology care continuum, particularly for cancers such as cervical and ovarian malignancies where delayed presentation is common. Follow-up adherence in oncology extends beyond mere appointment keeping; it reflects sustained engagement with structured care pathways necessary for disease monitoring and therapeutic continuity (Stroetmann et al., 2024). Adherence is influenced by both patient-level behavioral factors and system-level communication processes that shape the reliability and predictability of care delivery (Chen et al., 2019; Monestime et al., 2021).

Ovarian cancer, for example, is frequently diagnosed at advanced stages due to vague early symptoms and the absence of reliable, cost-effective screening tools (Cheserem et al.,

2013). More than half of women are diagnosed at late stages, a factor strongly associated with poor prognosis (Cheserem et al., 2013). Similarly, disparities in access to secondary prevention and screening have been shown to significantly influence cervical cancer mortality trends in LMICs such as Nigeria (Lawson et al., 2023). In regions with comprehensive screening systems, cervical cancer deaths have been substantially reduced (Lawson et al., 2023). These findings highlight that access alone is insufficient; continuity of care and adherence to recommended follow-up appointments are equally essential.

Missed appointments in oncology settings have far-reaching consequences. Delayed reviews can postpone treatment initiation, disrupt chemotherapy cycles, compromise monitoring of disease progression, and ultimately affect survival outcomes. Furthermore, non-attendance contributes to inefficiencies within health systems, increases costs due to repeated scheduling and administrative burdens, and exacerbates patient anxiety and dissatisfaction.

Given these challenges, healthcare systems globally have explored various strategies to improve clinic attendance and adherence. Reminder systems, including telephone calls and short message service (SMS) notifications, have demonstrated effectiveness in enhancing appointment adherence in HIV care, maternal health, and child health programs in LMICs (Mayer & Fontelo, 2017; Yunusa et al., 2021). In Chile, despite high mobile phone penetration, more than 40% of eligible women did not adhere to screening and treatment recommendations, prompting exploration of mobile-based strategies (Momany et al., 2017). Similarly, in Tanzania, where mobile phone ownership is widespread, the integration of mobile technologies into healthcare has been identified as a promising avenue to address gaps in cervical cancer care (Linde, 2019). These examples suggest that digital communication tools may offer scalable, cost-effective mechanisms to enhance adherence, particularly in resource-constrained environments.

1.1.3 Digital Health and mHealth in Strengthening Patient Engagement

Digital health technologies have increasingly been recognised as critical tools for improving communication between health systems and patients, particularly in contexts where healthcare infrastructure is stretched and follow-up systems are weak. The World Health Organization (WHO) defines digital health as the use of information and communication technologies to support health services, surveillance, education, and research (WHO, 2021). Within this broad domain, mobile health (mHealth) refers specifically to the use of mobile devices such as phones and tablets to deliver health-related services and information.

Over the past decade, the rapid global expansion of mobile phone ownership has created new opportunities to strengthen patient engagement. According to the International Telecommunication Union (2022), mobile subscriptions now exceed the global population, with particularly rapid growth in LMICs, making mobile phones one of the most accessible platforms for health interventions. Unlike internet-dependent applications, short message service (SMS) operates on basic networks and can be accessed through simple feature phones, making it especially suitable for resource-constrained settings.

Within healthcare delivery, SMS-based communication has been widely applied to improve medication adherence, appointment attendance, and patient education. Systematic reviews confirm that SMS reminders significantly improve adherence behaviours in chronic disease management, including HIV care, tuberculosis treatment, diabetes management, and maternal health services (Free et al., 2013; Mayer & Fontelo, 2017). More recent evidence shows that digital interventions can enhance patient engagement in oncology and hematologic malignancies, though most studies remain concentrated in high-income settings (Werk et al., 2024). In LMICs, scoping reviews highlight the potential of digital technologies to provide social support and improve continuity of cancer care, but also note the limited empirical evidence base (Dau et al., 2025).

Beyond behavioural reinforcement, SMS reminders address structural communication gaps common in LMIC health systems. Appointment scheduling often relies on paper records or patient-held cards, which are vulnerable to loss or miscommunication. Patients may forget dates or misunderstand instructions given during busy clinical encounters. SMS reminders provide a supplementary communication channel that reinforces appointment information after patients leave the clinic.

Importantly, SMS interventions are low-cost and scalable. Compared with telephone calls that require staff time, automated SMS reminders can be deployed at scale with minimal recurrent expenditure (Guy et al., 2012). This cost efficiency has driven interest in SMS strategies as pragmatic tools for strengthening patient retention in overstretched systems.

However, most existing research has focused on communicable diseases and preventive health services. Applications in oncology remain limited, particularly in LMICs where cancer care faces additional challenges of resource constraints and complex referral pathways. Oncology treatment often requires repeated visits over extended periods, making patient engagement essential for favourable outcomes. Furthermore, many reminder interventions rely on one-way messaging, which notifies patients but does not allow them to confirm, reschedule, or seek clarification. Two-way SMS systems offer greater interactivity and may improve communication efficiency, but evidence on their effectiveness and feasibility in oncology follow-up care in sub-Saharan Africa is scarce. Addressing this evidence gap is particularly relevant for tertiary referral hospitals managing large oncology populations. Evaluating whether structured two-way SMS reminders can enhance clinic attendance provides an opportunity to assess how simple digital tools may strengthen continuity of care within routine oncology service delivery.

1.1.4. Gynaecological Cancers in Kenya

In Kenya, the burden of gynaecological cancers mirrors broader regional trends. In 2020, approximately 26,550 new female cancer cases were reported nationally, with cervical cancer ranking second at 12.4% (5,236 cases) and accounting for 3,211 deaths (11.9%) in the same year (Globocan, 2020). The elevated death rate is mostly ascribed to late-stage diagnosis and restricted access to prompt treatment (Ali, 2016; Ministry of Health, 2021). Structural health system challenges, financial constraints, and geographic barriers further compound delays in diagnosis and continuity of care.

Despite growing national attention toward cancer control, including efforts to expand screening and early detection, oncology services in Kenya face limitations in infrastructure, specialist availability, and data systems. The epidemiology of reproductive malignancies, particularly ovarian cancer, remains inadequately characterized due to limited national registries and reliance on institutional data (Cheserem et al., 2023). These systemic gaps hinder comprehensive planning and targeted interventions.

Kenyatta National Hospital (KNH), Kenya's largest national referral and teaching hospital, plays an important role in the handling of complicated oncological cases from all across the country and beyond. The hospital receives referrals from multiple levels of care and provides specialized surgical and chemotherapeutic services. Given its position within the national health system, challenges experienced at KNH, particularly in maintaining continuity of care for oncology patients, have broader implications for cancer service delivery nationally.

1.1.5. Digital Health and Mobile Phone Penetration in Kenya

Kenya has emerged as one of the leading countries in sub-Saharan Africa in the adoption and integration of digital technologies within various sectors, including healthcare. Mobile phone penetration has expanded rapidly over the past two decades, creating an enabling environment for mobile-based health interventions. According to the Communications

Authority of Kenya (2023), mobile phone subscriptions exceeded 66.4 million in 2023, representing a penetration rate of over 130% relative to the national population. This widespread access to mobile communication infrastructure provides a valuable platform for delivering digital health services at scale.

The Kenyan government has increasingly recognised the role of digital innovation in strengthening health system performance. The Kenya National eHealth Strategy emphasises the integration of information and communication technologies to enhance service delivery, improve health information management, and strengthen patient engagement (Ministry of Health Kenya, 2016). Digital health initiatives have been implemented across several areas of the health sector, including disease surveillance systems, electronic medical records, telemedicine services, and mobile-based health communication platforms.

Mobile health interventions have been particularly prominent in Kenya's response to both communicable and non-communicable diseases. Randomised trials in prevention of mother to child transmission programmes have shown that SMS messaging significantly enhances maternal retention and adherence to antiretroviral therapy, thereby reducing transmission risks (Kinuthia et al., 2023). Beyond infectious diseases, SMS based interventions have also been applied in NCD contexts. For example, mobile phone reminders have been used to support diabetes management and medication adherence, demonstrating improvements in patient knowledge and compliance in Kenyan outpatient settings (Kithuka, 2021; Karanja, 2015). In oncology, emerging evidence from Kenya indicates that SMS reminders can improve chemotherapy adherence and follow up attendance, though studies remain limited compared to HIV and maternal health domains. Collectively, these programmes highlight that mobile based communication can play a meaningful role in improving health service utilisation and patient adherence behaviours across diverse conditions in Kenya.

Despite these advances, the application of mobile health technologies within cancer care services in Kenya remains relatively limited. While the national cancer control strategy has prioritised early detection, screening, and treatment infrastructure, comparatively less attention has been directed toward patient retention and follow-up adherence after diagnosis. Yet the effectiveness of oncology treatment depends heavily on sustained engagement with scheduled clinical reviews and treatment cycles. The Ministry of Health's objective was to reduce cancer incidence, morbidity, and mortality while enhancing survival and quality of life through a coordinated national framework (2017). The strategy explicitly emphasised integration of ICT and digital health tools to strengthen referral systems and patient follow-up. This aligns with Kenya's broader Universal Health Coverage (UHC) agenda, which prioritises equitable access to essential services and continuity of care. By focusing on patient retention and adherence, your study directly addresses operational gaps identified in both the NCCS and UHC frameworks.

Despite Kenya's advances in digital health, the application of mobile technologies within cancer care remains limited. National cancer strategies have prioritised screening and treatment infrastructure, but comparatively less attention has been directed toward patient retention and follow-up adherence after diagnosis. In tertiary referral hospitals such as KNH, where patients travel long distances and manage complex treatment schedules, communication challenges contribute to missed appointments and discontinuity of care. Leveraging SMS reminders within this context therefore represents a practical, scalable strategy to strengthen continuity of oncology care. Evaluating their effectiveness, feasibility, acceptability, and cost implications at KNH addresses a critical gap in both national policy and the global evidence base.

1.2. Statement of the Problem

Timely clinic attendance for post-diagnosis follow-up care remains a major challenge in the Kenyatta National Hospital Gynae-oncology Clinic, despite the high number of admissions in obstetrics and gynaecology. Patient complaint summaries compiled quarterly by the Patient Affairs Unit consistently highlight oncology patients as accounting for nearly half of all complaints, with the majority relating to missed or delayed clinic appointments (KNH, 2020). A recent complaints analysis (2021–2022) identified poor communication (38%), poor coordination of care (23%), systemic failures (15%), and poor flow of information as the leading causes of non-adherence to review appointments (KNH, 2022). In practice, these weaknesses often result in patients forgetting their appointment dates or losing patient cards that contain the next scheduled visit. The consequence is skipped appointments, delayed reviews, and subsequent complications in disease management.

Beyond patient-reported complaints, hospital statistics further confirm the magnitude of the problem. The Gynae-oncology Clinic recorded the highest non-attendance rates within the hospital in 2022 and 2023, at 61.1% and 49.9% respectively. During this period, the hospital managed 1,243 gynae-oncology cases, of whom 988 were alive and required ongoing follow-up care. These figures demonstrate a substantial attrition in continuity of care among a clinically vulnerable population. While screening services at KNH operate under established protocols, the breakdown in adherence to scheduled follow-up appointments among already diagnosed patients represents a critical failure in the oncology care continuum.

The implications of poor clinic attendance are significant. Missed appointments not only delay diagnosis and treatment initiation but also increase healthcare costs, frustrate patients, and compromise continuity of care (Alturbag, 2024a). In oncology, where timely follow-up is critical to monitor disease progression and treatment response, such delays can lead to avoidable morbidity and mortality (Hanna et al., 2020; Hemmig et al., 2023). Improving

adherence to scheduled reviews is therefore central to strengthening both curative and preventive services in gynecological oncology.

Globally, studies have demonstrated that reminder systems such as SMS messaging and personal phone calls enhance healthcare appointment adherence across diverse conditions, including cervical cancer screening, maternal health, and chronic disease management (Alturbag, 2024b; Boksmati et al., 2016; Hasvold & Wootton, 2011; Linde et al., 2017; Momany et al., 2017). Mobile health (mHealth) interventions are increasingly recognized as cost-effective, scalable, and adaptable tools for improving patient engagement and health-seeking behavior. However, despite this evidence, limited research has examined the use of SMS reminders among cancer patients in Kenya, and none has specifically focused on the KNH Gynae-oncology Clinic.

Furthermore, while SMS technology has been widely applied in other health contexts, there is little evidence on the effectiveness of two-way SMS reminders, which allow patients to confirm, reschedule, or seek clarification, within oncology services. Equally absent are studies that evaluate the cost implications of integrating SMS reminders into routine oncology care in Kenya. These gaps are critical, given the increasing burden of gynecological cancers and the need for innovative, patient-centered strategies to improve service delivery.

In summary, non-adherence to review appointments among gynae-oncology patients at KNH is a persistent problem driven by communication failures and systemic inefficiencies. Missed appointments compromise timely care and increase costs, yet proven interventions such as SMS reminders remain under-utilized in this setting. Despite high non-attendance rates at KNH, no study has evaluated whether a structured two-way SMS reminder system can improve follow-up adherence among diagnosed gynae-oncology patients within this setting, nor has the feasibility of such integration been examined.

Beyond the immediate operational challenges, persistent clinic non-attendance also reflects broader systemic gaps in patient communication and follow-up management within hospital systems. In many tertiary facilities in LMICs, appointment tracking remains largely manual and dependent on patient-held documentation. While such systems function when patients retain cards and recall dates, they offer limited safeguards against missed visits due to forgetfulness, competing responsibilities, or information loss. Without structured reminder mechanisms, providers have little capacity to proactively re-engage patients who default. Given that oncology care requires long-term monitoring and repeated treatment cycles, strengthening communication pathways between patients and facilities is essential for continuity of care. Exploring digital reminder systems therefore represents a potentially important strategy for addressing these communication gaps. This study was therefore designed to address this gap through a pilot randomised controlled trial of two-way SMS reminders, providing evidence on their effectiveness and feasibility, thereby informing policy and practice in oncology service delivery in Kenya.

1.3. Purpose of the Study, Research Aim, and Objectives

1.3.1. Purpose of the Study

The purpose of this study was to generate context-specific evidence on whether a structured two-way short message service (SMS) reminder system can improve post-diagnosis clinic attendance among women receiving gynae-oncology care at Kenyatta National Hospital. Persistent non-attendance at scheduled review appointments has been identified as a significant barrier to continuity of care within this setting, yet limited empirical evidence exists regarding the effectiveness of digital reminder systems for oncology follow-up in Kenya. Through a pilot parallel-arm randomized controlled trial, complemented by qualitative inquiry and exploratory cost analysis, this study sought to evaluate the effectiveness, feasibility, acceptability, and preliminary cost implications of integrating two-way SMS reminders into routine oncology

services. The findings are intended to inform institutional decision-making and contribute to evidence-based strategies for strengthening continuity of cancer care in resource-constrained settings.

1.3.2. Research Aims

The primary aim of this study was to conduct a pilot randomized controlled trial to evaluate the effectiveness, feasibility, and acceptability of two-way short message service (SMS) reminders in improving post-diagnosis clinic attendance among women receiving care at the KNH Gynae-oncology clinic, and to estimate the incremental cost implications of integrating this intervention into routine practice.

1.3.3. Objectives

- i. Determine the baseline rate of timely clinic attendance among gynae-oncology patients at Kenyatta National Hospital;
- ii. Ascertain the effectiveness of SMS reminders in enhancing clinic attendance among gynae-oncology patients;
- iii. Examine the feasibility of using two-way SMS reminders to improve clinic attendance among gynae-oncology patients;
- iv. Determine the acceptability of using two-way SMS reminders to improve clinic attendance among gynae-oncology patients; and
- v. Estimate the incremental cost of integrating SMS reminders in improving clinic attendance for gynae-oncology patients

1.4. The study's nature and significance

1.4.1. Nature of the Study

This study adopted a pilot experimental design, specifically an individual parallel-arm randomized controlled trial (RCT), conducted within a real-world tertiary oncology setting. Eligible participants were selected and randomized at baseline into either the intervention arm

or the control arm through simultaneous allocation, ensuring comparability between groups prior to implementation of the intervention. This design allowed the study to examine causal relationships between the introduction of two-way SMS reminders and clinic attendance outcomes among gynae-oncology patients.

The study was designed as a pilot trial to determine the feasibility, acceptability, and preliminary effectiveness of the intervention in the operational context of a national referral hospital. Pilot trials play a critical role in testing intervention procedures, recruitment strategies, data collection tools, and implementation logistics before large-scale trials are conducted. In the context of oncology services in LMICs, where resource constraints and system-level inefficiencies may affect trial execution, a pilot RCT provides essential contextual insight into practicality and scalability.

The trial employed a mixed-methods approach to generate both quantitative and qualitative evidence. Quantitative data were collected from 122 female gynae-oncology patients (61 per arm), with sample size determination accounting for anticipated attrition. Clinic attendance outcomes were measured using hospital records, and statistical analyses were performed using SPSS version 26.0. Comparative analyses between intervention and control groups were conducted using Pearson Chi-square test and logistic regression, to determine whether observed differences in attendance rates were statistically significant.

In addition to quantitative assessment, qualitative methods were incorporated to capture experiential and contextual dimensions of the intervention. Two focus group discussions with patients and key informant interviews with healthcare providers were conducted to explore perceptions of the reminder system, communication barriers, and feasibility within routine practice. Qualitative data were analysed using thematic analysis to identify recurring patterns and insights relevant to the experiences of the patients and service providers as well as the implementation of the intervention.

Furthermore, the study included an exploratory cost analysis to estimate the potential financial implications of integrating two-way SMS reminders into routine oncology care. Although not designed as a full economic evaluation, this component provides preliminary insight into affordability and resource considerations within the hospital context.

Overall, the nature of this study is pragmatic, patient-centered, and implementation-oriented. It moves beyond descriptive analysis of attendance challenges by testing an intervention under routine service delivery conditions. The study sought to generate contextually grounded evidence to inform future scale-up decisions within oncology services in Kenya by combining randomised evaluation with qualitative inquiry and exploratory cost assessment.

1.4.2. Significance of the Study

The significance of this study extends across clinical practice, health systems management, digital health innovation, policy development, and academic scholarship. The study addresses a critical yet underexamined gap in the oncology care continuum within low- and middle-income countries by focusing on follow-up adherence among women already diagnosed with gynae-oncological conditions.

1.4.2.1. Clinical Significance

Continuity of care is a foundational principle in oncology management. Unlike acute episodic care, cancer treatment requires structured, repeated clinical engagement for monitoring therapeutic response, managing side effects, adjusting treatment regimens, and detecting recurrence or disease progression. Missed appointments interrupt this clinical trajectory and may lead to delayed clinical decision-making, unmanaged complications, and avoidable deterioration.

While much attention in cancer control discourse is placed on early detection and screening, the outcomes of diagnosed patients depend equally on sustained engagement with

care services. For gynae-oncology patients in particular, who may undergo surgery, chemotherapy, radiotherapy, or multimodal treatment, follow-up visits are not optional but integral to treatment success. Evaluating whether structured two-way SMS reminders improve attendance rates, this study directly addresses an operational factor that influences clinical continuity. The study therefore shifts the discourse from access alone to retention in care, emphasising that diagnosis without sustained engagement may limit the benefits of specialised oncology services.

1.4.2.2. Health System and Service Delivery Significance

At the health system level, missed appointments generate both direct and indirect inefficiencies. Scheduled clinic slots that go unused reduce service productivity, disrupt workflow planning, and increase the administrative burden associated with rescheduling. In high-volume tertiary facilities such as Kenyatta National Hospital, which serves as a national referral centre, clinic non-attendance can compound existing pressures on specialist services.

Improving appointment adherence enhances predictability in service delivery, supports more efficient utilisation of specialist time, and strengthens operational planning. Even modest improvements in attendance rates may translate into measurable gains in resource optimisation within overstretched oncology units.

Moreover, Kenya's high mobile phone penetration provides an existing technological infrastructure that can be leveraged to address system inefficiencies. Although patient contact information is routinely collected, structured digital reminder systems are not consistently embedded within oncology follow-up processes. This study, therefore, examines whether a low-cost communication intervention can enhance system performance without requiring additional physical infrastructure or substantial capital investment. It contributes practical evidence on how digital tools can be integrated into everyday service delivery in resource-constrained settings through its placement of the intervention within routine care conditions.

1.4.2.3. Digital Health and Implementation Significance

Globally, digital health strategies are increasingly promoted as mechanisms for improving adherence, enhancing patient engagement, and strengthening health system responsiveness. However, much of the empirical evidence originates from high-income settings or focuses on communicable diseases. Evidence specific to oncology follow-up adherence in LMIC tertiary settings remains limited.

This study contributes to the emerging field of implementation science by examining not only whether a two-way SMS system works, but also whether it is feasible and acceptable within the structural realities of a public referral hospital. The inclusion of qualitative inquiry allows exploration of contextual factors influencing implementation, including patient perceptions, communication barriers, and provider perspectives.

This study offers a multidimensional understanding of intervention performance through its integration of randomised quantitative evaluation, qualitative assessment, and exploratory cost estimation. This strengthens the translational value of the findings, as policymakers and administrators require evidence that interventions are not only effective but operationally feasible and contextually appropriate.

1.4.2.4. Policy and Programmatic Significance

Kenya's national cancer control efforts emphasise improving access to diagnosis and treatment. However, continuity of care following diagnosis represents a persistent operational challenge. Evidence generated from this study may inform institutional policies regarding structured patient communication systems within oncology services.

If demonstrated to improve attendance rates in a cost-conscious manner, two-way SMS reminders may represent a scalable strategy that can be integrated into broader hospital information systems. Because the intervention utilises existing mobile infrastructure and

patient contact records, it aligns with pragmatic health system strengthening approaches that optimise available resources.

Furthermore, preliminary cost insights generated through the exploratory analysis provide decision-makers with early evidence regarding financial feasibility. In resource-constrained public health environments, affordability and sustainability are critical determinants of policy adoption. Incorporating cost considerations, the study enhances its practical relevance to hospital administrators and health planners.

1.4.2.5. Equity and Access Significance

Barriers to clinic attendance often extend beyond individual forgetfulness. Transportation costs, caregiving responsibilities, competing economic priorities, and limited access to timely information can all influence follow-up adherence. Structured reminder systems may partially mitigate information-related barriers by improving communication clarity and reducing uncertainty around appointment scheduling.

Although the intervention does not eliminate structural barriers, it represents a potentially equitable strategy because it relies on widely accessible mobile technology rather than specialised devices or internet connectivity. In contexts where smartphone access and broadband coverage may be uneven, SMS-based communication offers a comparatively inclusive digital solution. The study contributes to ongoing discussions on reducing inequities in cancer care retention through its focus on women with gynae-oncological conditions, a group often affected by gendered socioeconomic constraints.

1.4.2.6. Academic and Methodological Contribution

From a scholarly perspective, the study contributes to the limited body of randomised evaluations of digital adherence interventions within oncology settings in sub-Saharan Africa. By implementing a parallel-arm randomised controlled design in a real-world tertiary facility,

the research strengthens methodological rigour within a context where experimental designs are less commonly applied.

The pilot nature of the study generates foundational data on recruitment feasibility, intervention fidelity, attrition patterns, and implementation barriers. Such information is essential for designing fully powered trials in the future. The integration of qualitative insights alongside quantitative outcome measurement enhances interpretive depth and aligns with contemporary calls for mixed-methods approaches in health systems research.

Rather than solely describing the prevalence of non-attendance, the study advances the field by testing a solution-oriented intervention. In doing so, it moves beyond problem identification toward evidence-informed service improvement.

1.4.2.7 Global Health Significance

This study helps to advance the global health agenda by directly addressing ongoing disparities in cancer treatment continuity in low- and middle-income nations.

Noncommunicable illnesses, including gynaecological cancers, currently account for more than 74% of worldwide fatalities each year, with LMICs suffering a disproportionate share of the burden due to fragmented health systems, poor diagnostic facilities, and insufficient patient follow-up procedures (WHO, 2022). Improving the continuity of oncology care in these contexts is therefore not merely a clinical priority but a global health imperative.

By focusing on women with gynaecological cancers, the study aligns with Sustainable Development Goal 3 (Good Health and Well-Being), specifically Target 3.4, which calls for a one-third reduction in premature mortality from non-communicable diseases by 2030 and the achievement of universal health coverage. SDG 3.8 further calls for access to quality essential healthcare services and safe, effective medicines for all, aspirations that are undermined when diagnosed oncology patients fail to maintain follow-up. The study also speaks to SDG 5 (Gender Equality), Target 5.6, which emphasises equitable access to sexual and reproductive

health services for women. Gynaecological cancers are exclusively a female burden, and improving attendance at follow-up services for this group constitutes a concrete, measurable contribution to gender-responsive healthcare delivery.

Beyond SDG alignment, the study's transferability across LMIC oncology systems is a key dimension of its global significance. The intervention model, a manually managed two-way SMS reminder system operating on basic mobile phones at a per-patient cost of under USD 7, is deliberately low-resource in design, requiring no bespoke technology platform, internet infrastructure, or specialised digital literacy. This design philosophy makes it directly replicable in analogous tertiary oncology settings across East Africa, West Africa, and South Asia, where mobile penetration is high but digital health resources are constrained. In generating the first rigorous trial evidence for this intervention in a Kenyan gynaecological context, the study contributes foundational evidence that can be adapted and scaled within the WHO's global digital health strategy framework, which prioritises interoperable, scalable, and equity-oriented digital health solutions for strengthening health system performance in LMICs.

1.4.2.8. Institutional Significance

As Kenya's largest national referral hospital, KNH occupies a structurally unique position within the country's oncology care landscape. It receives referrals from all 47 counties, functions as the primary training environment for oncology nurses, physicians, and allied health professionals, and sets de facto clinical standards that cascade through lower-tier facilities. Interventions tested, refined, and institutionalised at KNH therefore carry a multiplier effect: evidence generated in this setting has the potential to influence clinical protocols, staff training curricula, and service delivery norms across County Referral Hospitals, sub-county facilities, and mission hospitals nationwide.

By conducting the trial within the KNH Gynae-oncology Clinic specifically, the study generates evidence at the apex of public oncology care in Kenya, the level at which policy

adoption is most consequential and most visible. If the SMS reminder system is shown to be effective, feasible, and affordable at KNH, this provides a compelling institutional precedent for integration into the hospital's routine digital communication infrastructure, with implications for other oncology sub-specialties beyond gynaecology. Furthermore, the study's findings contribute to KNH's own institutional knowledge base, providing data to support internal quality improvement processes and enabling evidence-informed decision-making by clinical governance teams. In a context where institutional capacity to generate original research evidence within routine service delivery is limited, this study models an approach, embedding a pilot RCT within an existing clinical workflow, that can be replicated across departments and adopted as a framework for continuous quality improvement at national referral level.

1.4.2.9. Implications for Future Research

As a pilot randomised controlled trial, this study is explicitly designed as a foundational step in an incremental programme of research rather than as a definitive trial. Its primary contribution to future research lies in the generation of feasibility data, recruitment rates, attrition patterns, intervention fidelity metrics, and implementation barriers, that are essential inputs for the sample size calculation and protocol design of a fully powered, definitive RCT. Without this foundational evidence, a large-scale trial would risk being underpowered, logistically unprepared, or methodologically unsuited to the realities of routine oncology practice at KNH and in comparable LMIC settings.

Beyond powering a definitive trial, the study opens several specific avenues for future investigation. First, the pilot's positive findings on attendance rates and acceptability create a platform for a multi-site RCT spanning Level 5 and Level 6 oncology facilities across Kenya, enabling assessment of contextual variation in intervention effects and costs. Second, the

exploratory cost data provide the basis for a full cost-effectiveness analysis linked to clinical outcome measures, such as cost per recurrence detected or cost per completed treatment cycle, in a longer follow-up study. Third, the qualitative acceptability findings identify patient subgroups with lower engagement, including older women, patients with shared phone access, and those with lower literacy, who warrant targeted intervention design adaptations in future trials. Fourth, the study creates space for examining integration of SMS reminders with broader patient navigation systems and electronic health records, a natural next step as Kenya's health information infrastructure matures. In each of these directions, the present study provides the empirical and methodological scaffolding without which future work would lack a rigorous local foundation.

1.5. Research Hypothesis and Research Question

1.5.1. Research Question

- Q1.** What is the baseline rate of timely clinic attendance among gynae-oncology patients at Kenyatta National Hospital?
- Q2.** What is the feasibility of implementing two-way SMS reminders to improve clinic attendance among gynae-oncology patients at Kenyatta National Hospital?
- Q3.** What is the acceptability of two-way SMS reminders for improving clinic attendance among gynae-oncology patients at Kenyatta National Hospital?
- Q4.** What is the effect of two-way SMS reminders on timely clinic attendance among gynae-oncology patients at Kenyatta National Hospital?
- Q5.** What is the incremental cost associated with integrating two-way SMS reminders into routine gynae-oncology clinic services at Kenyatta National Hospital?

1.5.2. Research Hypothesis

- H₀ 1.** There is no statistically significant difference in timely clinic attendance between patients receiving two-way SMS reminders and those receiving standard care.

1.6. Definition of Terms

Acceptability: Refers to the extent to which patients and healthcare providers perceive the two-way SMS reminder system as satisfactory, appropriate, and agreeable within the context of gynae-oncology follow-up care at Kenyatta National Hospital.

Baseline Clinic Attendance Rate: The proportion of scheduled post-diagnosis review appointments attended by eligible gynae-oncology patients prior to the implementation of the two-way SMS intervention.

Clinic Attendance (Timely Attendance): Attendance at a scheduled post-diagnosis review appointment on the assigned date or within the allowable review window as defined by the clinic protocol.

Feasibility: The practicality and operational viability of implementing the two-way SMS reminder system within routine gynae-oncology clinic services at Kenyatta National Hospital, including successful message delivery, patient response rates, and integration into existing workflows.

Gynae-oncology Patients: Women diagnosed with gynecological cancers or pre-malignant gynecological conditions who are receiving follow-up care at the Kenyatta National Hospital Gynae-oncology Clinic.

Incremental Cost: The additional financial resources required to design, implement, and maintain the two-way SMS reminder system compared to standard care without SMS reminders.

Non-attendance (Missed Appointment): Failure to attend a scheduled post-diagnosis clinic appointment without prior cancellation or rescheduling within the allowable clinic review window.

Post-diagnosis Follow-up Care: Scheduled clinical reviews conducted after a confirmed diagnosis of a gynecological oncological condition for the purposes of monitoring disease progression, evaluating treatment response, and managing complications.

Standard Care: The routine appointment scheduling and communication procedures practiced at the Kenyatta National Hospital Gynae-oncology Clinic prior to the introduction of the two-way SMS reminder intervention.

Two-way Short Message Service (SMS) Reminder: A structured mobile phone text messaging system that sends appointment reminders to patients and allows recipients to respond to confirm, reschedule, or seek clarification regarding their scheduled clinic visit.

1.7. Contributions to Knowledge

This study adds new information to the field of oncology service delivery research in low- and middle-income countries at the empirical, methodological, implementation, economic, conceptual, and institutional levels. Every contribution directly fills a particular gap that was found in the literature study and expressed in the research questions.

First, the project generates context-specific empirical data on how well two-way SMS reminders work to boost post-diagnosis clinic attendance among Kenyan gynae-oncology patients. To the best of the researcher's knowledge, no previous published study has examined this intervention in a gynecological outpatient context in Kenya or in an East African national referral hospital setting. By conducting a randomised controlled trial within KNH's Gynae-oncology Clinic and demonstrating a statistically significant improvement in timely attendance (67.2% vs. 26.2%), the study provides the first rigorous, locally grounded effect estimate for this intervention in this population, filling a gap that neither extrapolation from HIV or maternal health studies nor inference from high-income country oncology settings could credibly address.

Second, the study contributes methodologically by demonstrating that a parallel-arm individually randomised controlled trial is operationally feasible within the routine workflow of a high-volume tertiary oncology clinic in an LMIC. Experimental designs are infrequently applied in routine oncology service settings in sub-Saharan Africa due to operational, infrastructural, and ethical challenges. By achieving 100% recruitment retention and full intervention fidelity within a six-month pilot period at KNH, the study provides a replicable methodological template, including consent procedures, allocation concealment, and outcome extraction from hospital records, for future implementation-focused RCTs in analogous LMIC oncology contexts.

Third, the study advances implementation science by examining not only whether the intervention works but whether it is feasible and acceptable within the structural realities of a public referral hospital. Prior to this study, no published evidence existed on the operational feasibility of a two-way SMS reminder system in an African gynaecological outpatient setting, nor on the dimensions of patient acceptability specific to this population. The mixed-methods design, combining a Likert-scale acceptability survey with focus group discussions and key informant interviews, produces a multidimensional implementation profile that goes beyond efficacy to generate the contextual intelligence needed for responsible scale-up planning.

Fourth, the exploratory cost analysis provides the first published estimate of the incremental provider costs of a two-way SMS reminder intervention in a gynaecological outpatient context in Kenya. No microcosting study had previously examined this specific cost domain in the Kenyan or East African oncology literature. By disaggregating costs into start-up and recurrent components using a microcosting framework and estimating a cost per additional timely attendee of USD 16.60, the study provides directly actionable economic evidence base for hospital administrators, health system planners, and Ministry of Health policymakers considering digital health investment decisions within oncology services.

Fifth, the study advances the conceptualisation of clinic non-attendance in oncology follow-up care. Rather than framing missed appointments as a patient behavioural failure, the dominant narrative in clinical discourse, the study positions non-attendance as a systemic outcome of communication gaps, structural barriers, and resource constraints that can be partially addressed through system-level digital health investments. This reframing has practical implications: it shifts the locus of intervention from patient education and individual motivation to health system design and communication infrastructure, which are more tractable targets for institutional quality improvement.

Finally, as one of the first studies to conduct a randomised trial of two-way SMS reminders within the KNH Gynae-oncology Clinic, the research generates locally grounded, institutionally situated evidence that is directly actionable by the hospital's clinical governance structures. Unlike evidence extrapolated from other countries or disease contexts, this study's findings reflect the specific patient population, staffing model, mobile telecommunications environment, and clinical workflow of KNH, making them immediately applicable to scale-up decisions within the hospital and transferable, with appropriate contextual adaptation, to other national and county referral facilities managing gynaecological caseloads across Kenya.

1.8. Structure of Thesis

This thesis is organised into five chapters. Chapter One introduces the study by presenting the background to the research, the statement of the problem, research aims and objectives, research questions and hypotheses, the significance of the study, definitions of key terms, contributions to knowledge, and the overall structure of the thesis. This chapter establishes the conceptual and contextual foundation for examining follow-up clinic attendance among gynae-oncology patients at Kenyatta National Hospital.

Chapter Two presents a comprehensive review of relevant literature. It examines global and regional evidence on gynecological cancers and continuity of oncology care, explores

theoretical and conceptual perspectives on adherence and health-seeking behavior, and reviews empirical studies on digital reminder systems and mobile health (mHealth) interventions. The chapter identifies existing gaps in knowledge and develops the conceptual framework guiding the study.

Chapter Three outlines the research methodology adopted for the study. It describes the study design, setting, target population, sampling procedures, intervention development and implementation, data collection methods, and analytical approaches for both quantitative and qualitative data. The chapter also details ethical considerations and procedures undertaken to ensure validity, reliability, and rigor.

Chapter Four presents the findings of the study. Quantitative results from the randomized controlled trial are reported, including baseline clinic attendance rates and comparative analysis between intervention and control groups. Qualitative findings related to feasibility and acceptability are also presented, alongside the exploratory cost analysis. Results are reported objectively without interpretation.

Chapter Five discusses the findings in relation to existing literature and the conceptual framework. The chapter interprets the implications of the results for clinical practice, health systems, and policy, highlights the study's contributions to knowledge, outlines limitations, and provides recommendations for practice, policy, and future research.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter provides a comprehensive and critical review of the published literature directly relevant to the present pilot randomised controlled trial, which investigates the effectiveness, feasibility, acceptability, and incremental cost of a two-way short message service (SMS) reminder intervention to improve clinic attendance among gynaecological patients at Kenyatta National Hospital (KNH), Kenya. The chapter is structured to move from the theoretical foundations underpinning the study's design and conceptual framework through to a thematically organised empirical review of the evidence base, culminating in an integrative synthesis and a statement of the research gaps that justify the present study.

The Technology Acceptance Model, Social Cognitive Theory, Theory of Planned Behaviour, Diffusion of Innovations framework, and WHO Health Systems Building Blocks are five complementary theories and frameworks that together explain how patients adopt mHealth technologies, how behaviour change is facilitated, and how health systems must be set up to support sustainable integration of digital health interventions. The chapter starts by establishing the theoretical framework. These theoretical perspectives are not presented in isolation but are critically appraised for their applicability, limitations, and relevance to the two-way SMS reminder intervention tested in this study.

The empirical review is organised around seven thematic subsections corresponding directly to the study's five research questions. It begins with the epidemiological and clinical context, the prevalence of non-attendance among gynaecological patients and its consequences, before reviewing the intervention landscape, the evidence for SMS and mHealth in oncology and NCD contexts, the feasibility and acceptability of two-way SMS in African cancer settings, patient-specific acceptability dimensions, and the economics of SMS reminder integration. Each subsection concludes with an explicit identification of the evidential gap that motivates

the present study. The chapter concludes with a presentation of the integrated conceptual framework, synthesising the theoretical and empirical threads reviewed throughout.

The chapter's theoretical and empirical architecture reflects deliberate methodological choices that are worth articulating explicitly. The decision to ground the review in five complementary theoretical frameworks, rather than a single overarching model, is motivated by the multi-dimensional nature of the phenomenon under study. No single theory adequately captures the full explanatory space required to understand how patients adopt and benefit from SMS reminders. While the Social Cognitive Theory discusses the behavioural reinforcement mechanisms that allow reminder-induced self-efficacy to be sustained over time, the Technology Acceptance Model and Theory of Planned Behaviour together explain the cognitive and motivational antecedents of adoption decisions at the individual patient level. The Diffusion of Innovations framework shifts focus to the provider and organisational level, explaining how clinical teams adopt and routinise new technologies within institutional contexts. The WHO Building Blocks framework operates at the health system level, providing the structural vocabulary for assessing feasibility, sustainability, and scalability. Together, these five frameworks constitute a multi-level explanatory model whose levels align directly with the multi-method structure of the study: the quantitative RCT addresses individual-level effectiveness, the qualitative inquiry explores provider- and patient-level adoption and acceptability, and the economic evaluation addresses the system-level resource implications of integration.

The empirical literature review is organised thematically rather than chronologically or geographically, because the research questions are thematic in structure and the evidence base is most meaningfully interrogated by theme. This approach allows the review to move beyond cataloguing individual studies to identifying patterns, contradictions, and gaps across bodies of evidence. The decision to include NCD evidence from beyond gynaecological cancers,

particularly from HIV care, diabetes management, and cervical cancer screening, is methodologically defensible and explicitly justified as the limited volume of oncology-specific SMS studies in LMIC settings necessitates carefully bounded analogical reasoning from comparable chronic disease contexts. Each instance of cross-domain borrowing is subject to critical scrutiny for transferability, rather than assumed to apply directly. This approach ensures that the review is both comprehensive and honest about the specificity of its evidence base.

2.2. Industry Field and Theoretical Structure

A strong study is based on a strong theoretical framework, according to Alavi et al. (2018). To help readers comprehend how events behave, theories are evaluated. They assist researchers in questioning and extending what is already known. Consequently, the research will assess theories of planned behaviour, the technological acceptance model, and social cognitive theory.

2.2.1. Model of Technology Acceptance

In order to model and explain how humans adopt new technical tools as they evolve on their own, Fred Davis created the Technology Acceptance Model (TAM) in 1985 (Davis, 1985; Davis, 1989). Davis claims that the user's perception of the usefulness and ease of use of the pertinent technology is one of the concept's pillars (Venkatesh & Davis, 2000). Both perceived utility and ease of use have an impact on a person's desire to use a particular technological advancement; "intention to use" serves as a mediator between framework use and actual use (Figure 1). The table illustrates the connection between behavioral intention, actual system usage, perceived utility, and perceived usability (Davis et al., 1989).

The constructs central to the TAM and its extensions have been widely examined in the information systems and organizational behaviour literature. The model is based on four core characteristics that have explanatory value in predicting technology adoption: behavioural intention, attitude toward behaviour, perceived utility, and perceived ease of use.

Although intention does not ensure actual conduct, behavioural intention is the degree to which a person intends to carry out a particular act. It is considered a proximal determinant of usage, reflecting the motivational factors that influence whether a person will engage with a system. N. Shannon and Ross (2015) emphasized that behavioural intention captures the likelihood of future action, while Schepers and Wetzels (2007) demonstrated its predictive validity in explaining practical computer utilization. Within TAM, behavioural intention is shaped by attitudes toward conduct and perceived usefulness, and it has an immediate impact on actual system use.

Attitude towards behaviour represents the degree to which an individual evaluates performing the behaviour as positive or negative. It reflects affective and cognitive judgments about the desirability of using a system. Early studies by Higgins and Huff (1999), Guimaraes (1997), and Taylor and Todd (1995) established that attitudes are critical in shaping behavioural intention, as individuals are more likely to adopt technologies they perceive as beneficial, enjoyable, or aligned with their values. In TAM, attitudes serve as a mediating construct, linking perceptions of usefulness and ease of use to behavioural intention.

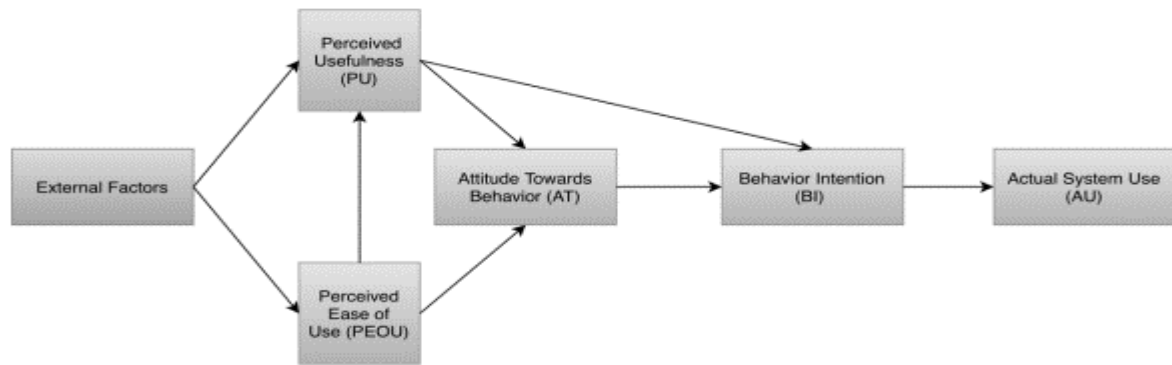
The degree to which a person thinks that utilizing a specific system will improve their performance at work is known as perceived usefulness. Davis (1989) introduced this construct as a cornerstone of TAM, arguing that usefulness is the most significant determinant of adoption. Subsequent studies by Gefen and Straub (2003) and Hu et al. (2001) confirmed that perceived usefulness consistently predicts acceptance across organizational contexts. It reflects the instrumental value of technology, capturing whether users see tangible improvements in efficiency, effectiveness, or productivity as a result of system use.

Perceived ease of use refers to the degree to which a person believes that using a system will be free of effort. Davis (1989) conceptualized ease of use as a determinant of both perceived usefulness and attitude, suggesting that systems perceived as simple are more likely

to be judged as useful and positively evaluated. Venkatesh et al. (2003) and Mathieson (1991) reinforced this relationship, showing that ease of use reduces cognitive burden and enhances user confidence, thereby increasing the likelihood of adoption. In organizational environments, ease of use is particularly important when introducing new technologies to users with varying levels of technical expertise.

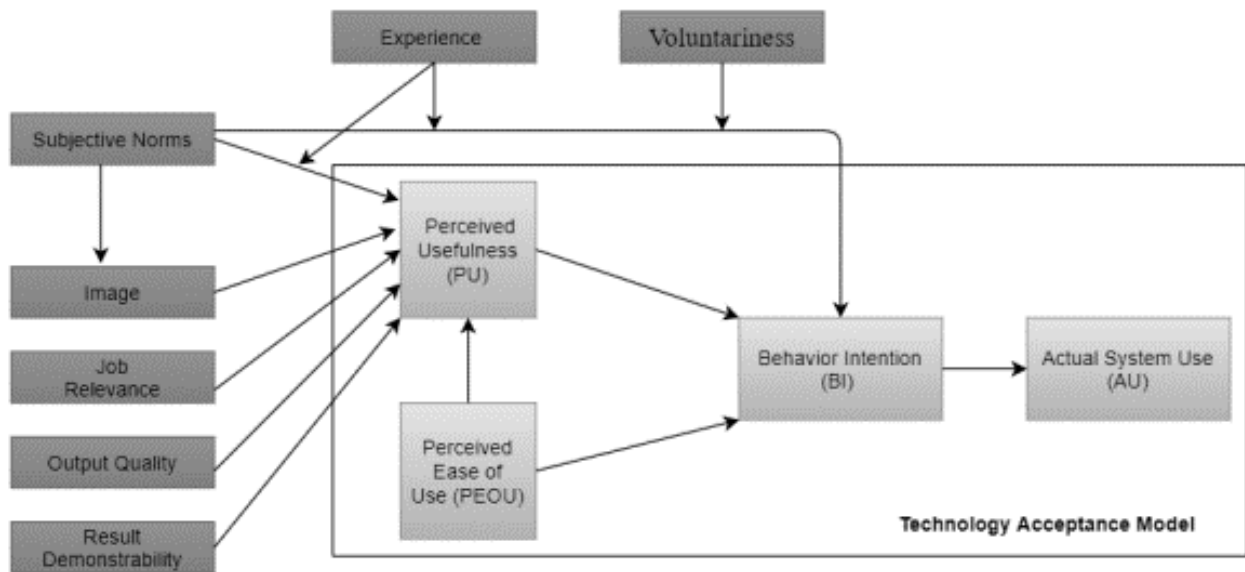
Together, these constructs form a coherent model that explains technology acceptance by linking perceptions, attitudes, intentions, and behaviour. The literature consistently demonstrates that perceived usefulness and ease of use shape attitudes, which in turn influence behavioural intention and ultimately determine system utilization. This framework has been applied across diverse contexts, from workplace information systems to mobile health applications, and provides a robust theoretical basis for examining the adoption of SMS reminders in oncology care.

Similarly, Figure 1 depicts how real-world computer use is directly influenced by behavioural intention, which is influenced equally by attitudes toward conduct and perceived utility. The perceived usability, utility, and ease of use all have a direct impact on behavioural attitudes. The TAM focuses on perceived usefulness and perceived ease of use to explore people's attitudes and perceptions around technological innovation adoption. Perceived utility and perceived ease of use are both affected by external factors, and perceived ease of use influences perceived utility directly. (Zaineldeen et al. 2020).

Figure 1*Technology Acceptance Model*

Source: Davis et al. (1989)

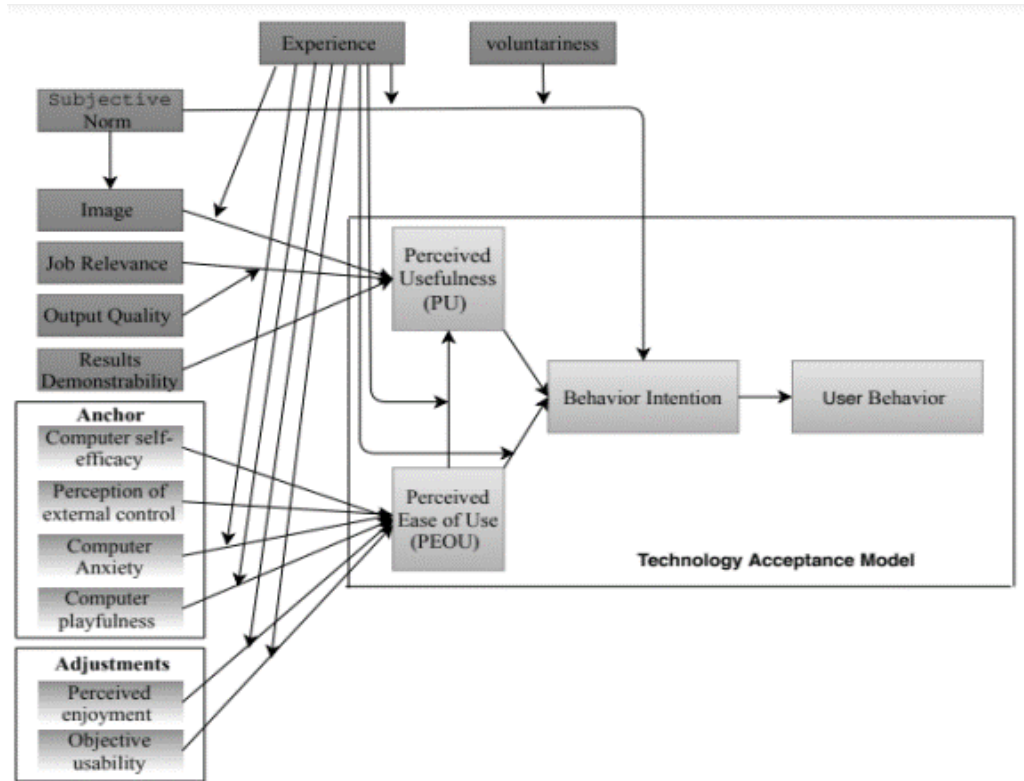
Besides the cognitive instrumental processes such as perceived ease of use, result demonstrability, output quality, and task relevance, the model also integrates social influence factors including subjective norms, image, and voluntariness. In the same context, Venkatesh and Davis (2000), further refined the Technology Acceptance Model by identifying additional determinants that affect perceived usefulness, leading to the development of Technology Acceptance Model 2 (Figure 2)

Figure 2:*Technology Acceptance Model 2*

Source: **Venkatesh and Davis, (2000)**

Over the years, Technology Acceptance Model 2 has been expanded to include additional determinants that shape individuals' willingness to use computer technologies. As illustrated in Figure 3, perceived usefulness is affected by several variables, including job relevance, quality of output, image, ease of use, result demonstrability, and subjective norms. According to Zaineldeen et al. (2020) moderating factors include personal attributes, level of expertise, and voluntary participation. Similarly, Howard et al. (2010), observed that users' experience and knowledge influence perceived usefulness and perceived ease of use, while computer anxiety also affects behavioural intention to adopt technology.

A conceptual framework consisting of four major dimensions is commonly applied in explaining Technology Acceptance Model 3. Based on the central constructs of perceived usefulness and perceived ease of use, these dimensions include individual differences, technological characteristics, social influences, and facilitating conditions (Venkatesh & Bala, 2008).

Figure 3*Technology Acceptance*

Source: **Zaineldeen et al.** (2020)

Nadal et al. (2020) observed that alignment between information systems is important in health care environment because users' perceptions regarding technological interference may influence their adoption or rejection of the digital innovational use. The advances in digital technologies have transformed everyday activities and enhanced health care delivery through innovations such as mobile applications, electronic service systems and communication platforms (Huang et al., 2015).

According to Hai and Alam Kazmi (2015), the paradigm has been criticized for not being trustworthy enough to explain consumer behaviour when they decide whether to purchase, decline, or use technology. While perceived usefulness remains a central determinant within Technology Acceptance Model (TAM) demographic characteristics such as age, level

of education may also influence individuals' willingness and preparedness to adopt technological innovations. Behavioral measurements remain complex because individual characteristics and underlying personal attributes may shape how people respond to technology. (Ajibade, 2018). Health care quality improvement may benefit from effective quality improvement systems including SMS based reminder platforms that can strengthen clinic appointments.

Critical appraisal of TAM requires attention to a fundamental limitation that is particularly pertinent when applying the model to patient populations in oncology settings: the model was developed and primarily validated in organisational and occupational contexts, where technology adoption is a volitional work-related behaviour subject to managerial influence and training provisions (Davis, 1989; Venkatesh et al., 2003). Applying TAM to patients' adoption of health technologies introduces important boundary conditions that the original model does not fully anticipate. Patients adopting an SMS reminder are not employees adopting a work system; they are individuals managing a serious illness within a constrained and often emotionally charged context, where illness severity, prior healthcare experience, and psychosocial distress may moderate their perceptions of both usefulness and ease of use in ways that workplace TAM studies do not capture.

This limitation has been explored in the patient-facing mHealth literature with increasing attention. Holden and Karsh (2010), in a systematic review of TAM applications in healthcare, found that while the model's core constructs consistently predicted technology acceptance across studies, the effect sizes were smaller and more variable in patient-user contexts than in clinical staff contexts, attributing this to greater heterogeneity in patient baseline characteristics and more complex perceived benefit structures. In cancer care specifically, Mougalian et al. (2018) noted that patients' perceived usefulness of mHealth tools was strongly conditioned by illness stage and treatment phase; patients in active treatment

attributed higher usefulness to appointment reminders than those in surveillance, because the cognitive burden of treatment scheduling is greatest when treatment intensity is highest. This stage-dependent moderation of perceived usefulness is not captured in standard TAM operationalisation and suggests that future mHealth adoption studies in oncology should specify the treatment phase of participants as a potential moderator of TAM-predicted adoption.

A further relevant extension of TAM is the Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh et al., (2003) developed UTAUT to integrate eight models of technology adoption into one unified model with four core constructs: performance expectancy, effort expectancy, social influence and facilitating conditions. UTAUT explicitly incorporates social influence as a determinant of adoption intention alongside individual perceptions, making it particularly relevant to the Kenyan oncology context, where family members and community members may exert normative influence over patients' technology use decisions. However, UTAUT's increased complexity relative to TAM comes at the cost of parsimony, and for a pilot study evaluating a relatively simple behavioural mechanism, whether receiving an SMS reminder prompts appointment attendance, the explanatory bandwidth of UTAUT may exceed what the data can sustain. TAM's focus on perceived usefulness and ease of use as the primary adoption predictors is appropriate here precisely because of its parsimony: the relevant theoretical question is not the full adoption decision architecture but the extent to which patients perceive SMS reminders as useful and low-burden, which maps directly onto the acceptability measures employed in the present study's qualitative phase.

In the Kenyan mHealth context, several empirical studies have examined TAM constructs among patients and healthcare workers. A study by Waema and Ndung'u (2019) on technology adoption in Kenyan public health institutions found that perceived ease of use was the strongest determinant of mHealth acceptance among patients with low prior technology

experience, a finding with direct implications for the design of the two-way SMS reminder in the present study, where minimising cognitive burden was a primary design principle. Similarly, research on community health worker adoption of mobile health technologies in rural Kenya (Braun et al., 2013) found that system reliability and interface simplicity were more important determinants of sustained use than perceived usefulness per se, suggesting that ease of use deserves particular emphasis in LMIC mHealth implementation.

Digital technology use in health care has made clients to build a relationship with their health care providers. The WhatsApp and video conferencing strengthens and personalizes the communications and care. This further enhances quick request for transportation via uber services. (Lee, 2016; Ma, 2016). Acceptance of these technological innovations by public may contribute to greater adoption and improved efficiency in service delivery. (Gbongli & Amedjonekou, 2019). With rapid advancement of ICT and mHealth technologies (Nunes et al., 2019), there is growing interest in determining whether mHealth technology can increase clinic attendance among gynaecological cases in Kenya particularly Kenyatta National Hospital. Therefore, the theoretical ideas covered in this study offer a basis for determining how well mobile-based interventions work to increase clinic attendance among gynecological oncology patients. The framework further examines how perceived value may influence the intention to use ICT solutions. In this context, the theory supports the use of SMS reminders as part of mHealth interventions, to enhance patient acceptance, practically, and overall health outcomes.

2.2.2. Social Cognitive Theory

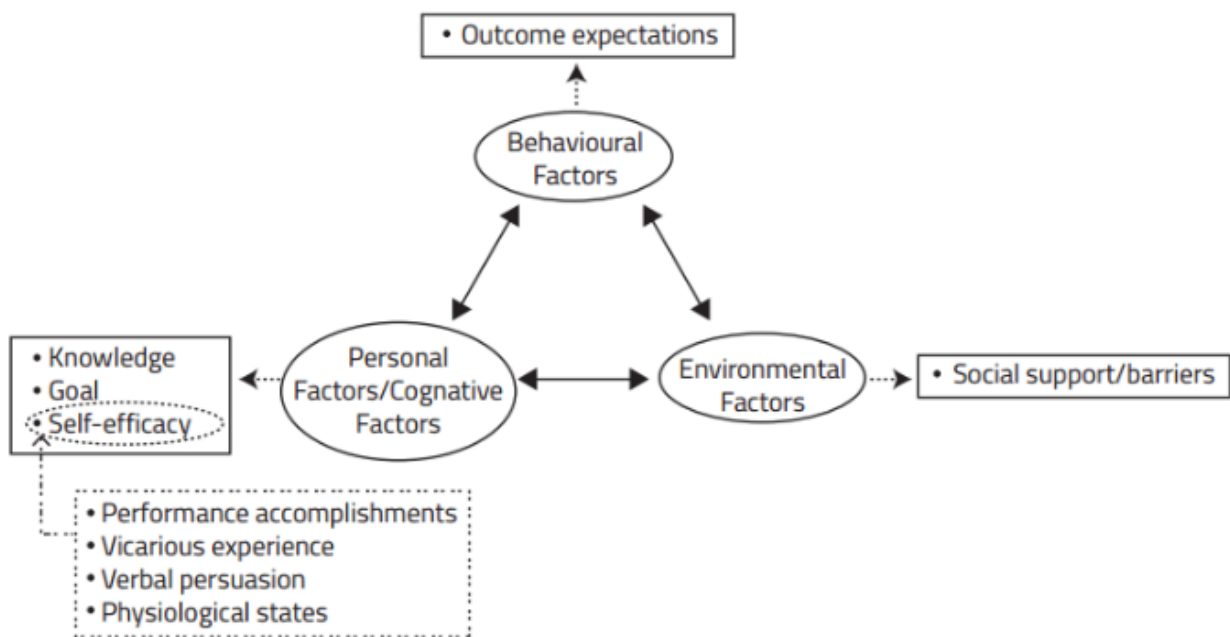
Social cognitive theory developed by Bandura's (1971) explains human behaviour as being influenced by internal cognitive process including individual needs, desires and motivations. The theory suggests that people develop behaviors through both personal experience and observing the actions and experience of others (Figure 4). Learning therefore

occurs through observation and continues interaction between individuals and their surrounding environment.

According to Bandura (1977), human behaviour is shaped by underlying personal factors that influence how individuals think and act. As a result, people's actions are not random but are driven by internal motivations and personal experiences. The theory also highlights the fact that a large portion of human behaviour is acquired through social influence and interactions with the environment, either consciously or unconsciously.

Figure 4:

Model of Social Cognitive Theory



Source: **Bandura** (1989)

In the healthcare sector, the hypothesis is frequently used to guide behaviour modification programs. Researching how people engage with their surroundings may be particularly useful

in rural regions. Social Cognitive Theory (SCT) helps explain how early experiences and social influences shape the change of behaviour. The theory emphasizes that behavior can be influenced through observational learning, expectations, self-efficacy, and reinforcement mechanisms, thereby creating opportunities for social support (Bandura, 1986). For example, SCT explains how families influence children's behavior through the values and practices demonstrated at home. Behaviors such as the use of inappropriate language, smoking, alcohol consumption, and exposure to certain media may be observed and imitated by children, eventually becoming lifelong habits. According to Bandura (1989), When young people receive some form of reward or benefits, they are more likely to adopt such behaviours.

In public health practice, however, SCT has several limitations that must be acknowledged. One of the assumptions is that changing a person's environment will automatically change their personality or behavior. In reality, behavior is shaped by a complex interaction between individuals and their surroundings, and the relative influence of each factor remains uncertain. In addition, SCT mainly emphasizes cognitive processes while giving limited attention to genetic influences that may independently affect behaviour regardless of prior experiences or expectations. The theory also places less emphasis on emotions and motivation unless they are connected to earlier experiences.

In the Kenyan gynaecological context specifically, the SCT construct of observational learning, whereby patients adopt health behaviours in part by observing the outcomes experienced by peers, has relevance for SMS reminder uptake. If patients observe that peers who respond to and act on SMS reminders successfully maintain their appointments and receive timely treatment, this social modelling may reinforce their own self-efficacy for attendance. This suggests a potential community amplification effect that extends beyond the

direct relationship between the reminder and the individual recipient, and that could be harnessed in future intervention designs through peer support components.

Social Cognitive Theory (SCT) is also useful in understanding and modifying individual behavior because it incorporates multiple levels of the social ecological model. In this study, the theory is particularly relevant in explaining patients' behavioral intentions toward the use of mobile health (mHealth) interventions. Evidence from previous studies supports the effectiveness of SCT-based physical activity programs in lowering the likelihood of prediabetes progressing to diabetes among rural populations (Shamizadeh et al., 2019). Furthermore, Grace-Farfaglia (2019) associated social cognitive principles with web-based strategies aimed at improving the effectiveness and long-term sustainability of mHealth interventions.

Consequently, SCT provides an important framework for health promotion programs by supporting the use of mHealth interventions to develop comprehensive strategies that address harmful social practices rather than focusing solely on individual behavior change. In the Kenyan context, such approaches may contribute to improved clinic attendance among patients receiving gynae-oncology services.

2.2.3. Theory of Planned Behavior

The Theory of Planned Behaviour (TPB) emerged as an extension and refinement of the Theory of Reasoned Action (TRA), which was developed by Icek Ajzen and Martin Fishbein in 1980. TPB is built on three major components: attitudes, subjective norms, and behavioral intentions. The theory explains how these factors influence an individual's intentions and ultimately predict actual behavior (Al-Suqri & Al-Kharusi, 2015).

According to TRA, individuals who hold favorable attitudes toward a particular activity, perceive social approval for engaging in it, and believe they have sufficient behavioral control are more likely to develop stronger intentions to perform that behavior. Conversely, negative attitudes and limited perceived control may reduce the likelihood of participation (Ajzen, 1991). The purpose of TRA is to explain the relationship between attitudes and behavior by examining how pre-existing beliefs and behavioral intentions shape an individual's actions (Ajzen & Fishbein, 1980).

The theory states that the attitude of an individual towards a behaviour and subjective norms influence the behavioural intention. Behavioural intention is the extent to which an individual is motivated or willing to perform a particular activity. While attitude reflects a person's thoughts about the expected consequences of engaging in an action, subjective norms are related to perceived social expectations from significant individuals and the pressure to conform to those expectations. In essence, a person's intention to undertake a specific action is shaped by their attitude toward that action and their perception of how others may view their involvement in it (Ajzen & Fishbein, 1980).

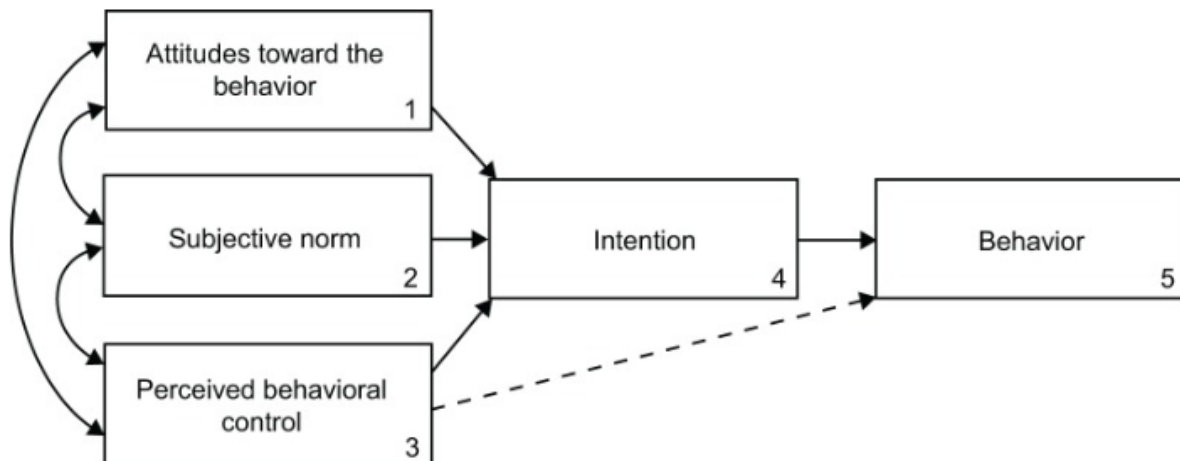
Despite its influence, critics argue that the theoretical foundation of attitudes does not consistently predict actual human behaviour (Nabi & Riddle, 2008). In response to concerns regarding inconsistencies in the attitude-behaviour relationship, later revisions were made to the Theory of Reasoned Action (TRA) to strengthen its explanatory ability (Ajzen, 1991; Gillmore et al., 2002). However, limitations remained, particularly in generating sufficient explanatory frameworks for research within rapidly advancing technological contexts.

To address these shortcomings, Icek Ajzen and Martin Fishbein expanded the original framework and introduced the Theory of Planned Behaviour (TPB) in the early 1980s (Ajzen & Fishbein, 1977).

The TPB is based on the idea that three types of factors impact human behaviour: normative, behavioural, and control beliefs. Behavioural beliefs, normative views, and control beliefs combine to produce positive or negative attitudes towards behaviour, a subjective standard, and perceived behavioural control (Ajzen & Fishbein, 2000). When the viewpoint on the action, the subjective norm, and the apparent behavioural control combine, a behavioural goal is formed. (Ajzen 1991).

Perceived behavioural control is considered to influence actual behaviour both directly and indirectly through behavioural intention (Noar & Zimmer, 2005). An individual's attitude toward an activity, which reflects how much they see it favourably or unfavourably, is the primary determinant of behavioural intention. The subjective norm, or perceived social pressure to engage in or refrain from engaging in a specific behaviour, is the second determinant. Perceived behavioural control, which characterizes a person's assessment of the ease or difficulty of executing an activity, is the third determinant (Godin & Kok, 1996).

According to the Theory of Planned Behaviour, intention is shaped by three key constructs. First, attitude involves an individual's evaluation of behaviours, events, objects, or people, which may be favourable or unfavourable. Second, perceived behavioural control reflects an individual's perception of the degree of control they have over performing a behaviour and whether the task is likely to be easy or difficult to accomplish. Third, subjective norms encompass social expectations and commonly accepted behaviours, influenced by whether significant others perceive the behaviour as appropriate or acceptable (Figure 5).

Figure 5*Planned Behaviour Theory*

Source: **Ajzen** (1991)

When a person's attitude and subjective norm for behaviour are more positive, they are generally more motivated to implement the intended behavioural change and feel more in control of their actions (Ajzen, 2020). Additionally, it is anticipated that the proportional weights assigned to attitude, subjective norms, and perceived behavioural control in forecasting intention and action will vary depending on the group and conduct (Ajzen, 1991).

When people have a strong desire to act in a healthy way, believe it will be easy, and believe others will support them, they are more likely to do so. A person is less likely to act in a positive way if they have unfavourable attitudes about it, think it's hard to do, and think that significant others would not approve of it. The Theory of Planned Behaviour (TPB) demonstrates strong theoretical and social relevance, with evidence of adequate internal

consistency. The model extends the Theory of Reasoned Action (TRA) by enabling researchers and organisations to predict behavioural intentions while accounting for perceived behavioural control. It further provides insight into factors that influence behavioural intentions and decision-making processes.

However, TPB proposes that behaviour is primarily determined by attitude, perceived behavioural control, and subjective norms. This perspective has been criticised for not adequately accounting for other determinants of behaviour, including social, emotional, and biological influences. As highlighted in the Technology Acceptance Model 3 (TAM3), behavioural intention may also be shaped by factors such as fear, perceived threats, mood, and previous experiences. Additionally, TPB does not explicitly incorporate environmental or economic influences that may affect an individual's willingness to perform a behaviour. The model also assumes that behaviour follows a rational and sequential decision-making process and gives limited consideration to behavioural changes over time.

Despite these limitations, TPB has demonstrated practical value in health-related interventions. For example, Ahsan et al. (2013) reported that mHealth intervention strategies contributed to reducing tobacco dependence in the United States by applying theory-based approaches. Similarly, the significance of mHealth treatments in enabling patients to participate more actively in the management of chronic illnesses has been reaffirmed by TPB. For example, people with hypertension can use smartphone apps to enhance medication adherence and remotely monitor blood pressure (Song et al., 2019). The current study aims to evaluate the acceptability and sustainability of mHealth interventions, specifically SMS reminders, in the short and long term by evaluating their efficacy and practicality. Subject norms, attitude principles, and the patient's perceived behavioural control are also considered. Therefore, if individuals see value in the intervention, they are more likely to accept the signals and pay

attention to the reminders, increasing the possibility that they will frequently and punctually attend their clinic visits.

Empirical applications of the TPB to mHealth-mediated health behaviour change in African LMIC contexts support the model's relevance but highlight context-specific moderators. Tarkang et al. (2023), applying the TPB to health behaviour in sub-Saharan Africa, found that subjective norms exerted a particularly strong influence on health behaviours in collectivist social contexts, a finding relevant to the Kenyan gynaecological oncology setting, where family attitudes toward a patient's cancer treatment and attendance decisions carry considerable normative weight. An SMS reminder from the clinical team may function as an institutional norm signal, reinforcing the social expectation of attendance and thus strengthening the subjective norm component of the attendance intention pathway.

Although many theoretical models of health behavior are based on similar core ideas, each uses distinct terminology to describe the features it considers important. These theories' testable hypotheses—which vary in their conceptualization and empirical validation—are a crucial component.

The established beliefs in the healthcare business shape the field, the definition of the practice's scope, and the institutionalization of its stakeholders (Osanloo & Grant, 2016). Many research have confirmed the usefulness of SMS reminders in promoting clinic attendance using a range of theoretical models.

According to Lewin's Change Theory, both social and individual aspects influence a patient's behaviour. In other words, while human behaviour cannot be altered, technology can be leveraged to deliver healthcare and related services (Kaminski, 2011). This idea is backed by TAM, which addresses broad variables impacting digital health care adoption and aids in

understanding how patients interact with digital and/or technology in their daily lives (Venkatesh & Davis, 2000).

The Nola Pender health promotion model (NPHPM), established by Pender, has been used to explain and promote healthcare behaviour.

The NPHPM encourages people to maintain healthy lifestyles and improve their overall well-being. In order to assist nurses develop and implement patient-centered behaviours that support health, the approach incorporates theoretical recommendations (Pender et al., 2011). By offering a different reminder, the clinic improves patient behavior and increases the probability that patients will show up for their scheduled appointment.

Jong et al. (2017) demonstrated, based on behavioural theory, that mobile phone reminders can improve adherence to HIV care and reduce challenges associated with suboptimal attendance, which may contribute to antiretroviral therapy (ART) drug resistance. The study reported a significant positive effect of mobile phone reminders on clinic attendance among people living with HIV (PLWH) in low-resource settings, particularly among mothers with young infants. Similarly, Schwebel and Larimer (2018) highlighted the usability of mHealth interventions, noting that text message reminders can function effectively as standalone interventions or as components of broader healthcare delivery systems. This flexibility strengthens the role of SMS reminders within healthcare services. Furthermore, SMS reminders have been identified as a promising innovation with the potential to improve healthcare delivery processes and patient engagement, warranting further exploration and application (Guy et al., 2012).

Attitudes, beliefs, expectations, and perceptions of future outcomes are important determinants of health-related behavioural change, according to cognitive theories such as the Social Cognitive Theory, Theory of Reasoned Action, Theory of Planned Behaviour, and Protection Motivation Theory (Stroebe, 2011; Gebhardt & Maes, 2001). These theories suggest that

individuals are likely to select behavioural options that they perceive as yielding the most beneficial outcomes when faced with multiple alternatives (Munro et al., 2007).

Building upon these theoretical perspectives, Finitsis et al. (2014) and related studies demonstrated that reminder systems contribute positively to clinical outcomes. Their findings identified six major factors influencing the effectiveness of reminders: patient engagement with reminders, accessibility of reminder systems, healthcare settings, broader social influences, cancellation processes, and appointment rescheduling mechanisms. Theoretical frameworks that affected these determinants included healthcare utilization theory, the theory of planned behaviour, the trans-theoretical model, rational choice theory, and complexity theory. When taken as a whole, these variables may have an impact on whether people show up for, skip, or reschedule medical appointments. As a result, the current study's data extraction framework was influenced by these theoretical considerations.

The current study seeks to investigate the efficacy and acceptability of SMS reminders in improving clinic attendance and patient-reported outcomes among gynaecological patients visiting the Gynaecology Clinic at Kenyatta National Hospital in Nairobi, Kenya. The study is based on well-established theoretical frameworks that clarify health behaviour and direct knowledge of the variables affecting patient involvement with medical services.

2.2.4. Diffusion of Innovations

One of the most important frameworks for comprehending how new concepts, practices, and technologies proliferate within social systems is the Diffusion of Innovation (DoI) theory, which was first developed by Everett Rogers in the early 1960s and improved in later editions of his groundbreaking work (Rogers, 2003). Fundamentally, the idea asserts that innovations are not adopted at random but rather follow a predictable process that is impacted by both the innovation's features and the social context in which it is introduced. Relative

advantage (the degree to which an innovation is thought to be superior to what it replaces), compatibility (the degree to which it aligns with existing values, experiences, and needs), complexity (the perceived difficulty of understanding and using the innovation), trialability (the chance to test the innovation before committing), and observability (the visibility of its results to others) are the five main characteristics that Rogers (2003) identified as influencing adoption decisions. To determine the rate and scope of dissemination, these characteristics interact with the stages of the adoption process, knowledge, persuasion, choice, implementation, and confirmation.

The theory has been widely applied in healthcare research to explain the uptake of new technologies and practices. For instance, Greenhalgh et al. (2005) conducted a systematic review of diffusion in service organizations and concluded that relative advantage and compatibility were consistently decisive in healthcare adoption, while complexity often slowed diffusion. In the context of digital health, Culjak (2017) mapped mobile and wearable medical technologies to the DoI stages, showing how knowledge and persuasion influenced uptake among clinicians. Dearing and Cox (2018) further argued that diffusion principles are critical for scaling health innovations, noting that innovations perceived as simple, compatible, and advantageous are more likely to be adopted across diverse health systems. In LMICs, DoI has been used to interpret the adoption of SMS reminders in HIV care and maternal health programs, where low complexity and high compatibility with patient routines facilitated uptake (Iribarren et al., 2017).

Despite its enduring influence, DoI has faced critiques. Scholars have argued that the model's linear progression from knowledge to confirmation oversimplifies the complex, iterative realities of healthcare adoption (Greenhalgh et al., 2005). Others note that the theory's emphasis on individual adopter categories, innovators, early adopters, early majority, late majority, and laggards, neglects structural and systemic barriers such as financing,

infrastructure, and policy constraints (Reinhardt et al., 2014). Equity concerns have also been raised, as DoI insufficiently addresses disparities in access, particularly in LMICs where digital divides affect adoption (Dearing & Cox, 2018). Furthermore, critics argue that the theory overemphasizes the attributes of innovations themselves, while underplaying contextual factors such as organizational culture, leadership, and external incentives.

Applied to the current study, DoI provides a useful lens for interpreting how two-way SMS reminders were adopted within KNH's oncology services. The intervention demonstrated clear relative advantage, as providers perceived reminders to reduce administrative burden and improve punctuality compared to paper cards. Compatibility was evident in patients' acceptance of SMS as a culturally appropriate and accessible communication tool. Complexity was low, since reminders were simple to understand and use. Trialability was inherent in the pilot design, allowing providers and patients to experience the intervention before wider scale-up. Observability may be reflected in visible improvements in attendance, which reinforces confidence in the intervention. At the same time, the study highlights critiques of DoI: adoption may be constrained by infrastructural bottlenecks such as delayed message delivery, showing that diffusion is not purely linear. Moreover, equity concerns like patients with limited literacy or unstable phone access may face barriers to adoption. Thus, DoI helps explain the uptake of SMS reminders.

The DoI framework also helps interpret potential adoption barriers at KNH. From a compatibility perspective, two-way SMS reminders are compatible with existing communication practices at KNH insofar as clinical staff already use mobile phones for informal patient contact in some contexts; the formalisation and systematisation of this practice through a structured reminder protocol represents a moderate change rather than a radical departure from existing norms. From a complexity perspective, the two-way design introduces slightly greater operational complexity than a one-way reminder, requiring staff to read and

respond to patient messages, a factor that may slow adoption among clinical staff with high workloads unless the system is designed to minimise the time burden of response management.

2.2.5. Framework for WHO Building Blocks

By identifying six key elements; service delivery, health workforce, health information systems, access to necessary medications, financing, and leadership/governance, the World Health Organization's Building Blocks framework offers a thorough model for analyzing health system performance (WHO, 2007). Because each block depends on the others, they work together to strengthen health systems and enhance health outcomes. The framework has been widely applied in both high-income and LMICs to assess system readiness, identify gaps, and guide interventions. Its utility lies in its ability to move beyond individual behaviour to situate health outcomes within the broader structural and organizational context.

In the current study, the Building Blocks framework offers a valuable lens for interpreting the feasibility, acceptability, effectiveness, and cost-efficiency of the SMS reminder intervention. At the level of service delivery, the intervention may improve punctuality and reduce missed appointments, thereby enhancing continuity of care. Within the health workforce block, providers can endorse the intervention as compatible with existing workflows, though recurrent costs may highlight the need for additional staff time and IT support. The health information systems block can be directly engaged, as SMS reminders represent a digital innovation that strengthens communication between patients and providers. Financing can be addressed through the cost analysis, which may demonstrate affordability at both patient and system levels, while also cautioning that sustainability requires investment in infrastructure and automation. Finally, leadership and governance may be implicit in the hospital's willingness to pilot the intervention and in the ethical safeguards that ensure patient confidentiality and trust.

Previous studies have applied the Building Blocks framework to evaluate digital health interventions in LMICs. For example, Rono et al. (2021) used the framework to assess SMS reminders in eye health services in Kenya, highlighting the importance of workforce training and financing for sustainability. Similarly, Iribarren et al. (2017) emphasised that mHealth interventions must be integrated into health information systems to achieve long-term impact. These applications confirm that the Building Blocks framework is particularly suited to analyzing interventions that cut across multiple system dimensions, as was the case in this study.

At the same time, critiques of the framework should be acknowledged. Scholars have argued that the Building Blocks model can be overly static, treating system components as discrete rather than dynamic and interdependent (Mounier-Jack et al., 2014). Others note that it pays insufficient attention to relational aspects of care, such as patient trust and provider empathy, which are critical to adoption and sustainability. In this study, patients described SMS reminders as signals of care, suggesting that relational value is an important dimension not fully captured by the framework. Thus, while the Building Blocks framework provides a robust structural lens, it must be complemented by theories that account for relational and behavioural dynamics.

Applied to the current study, the Building Blocks framework can demonstrate that the success of SMS reminders is not solely a matter of patient willingness but depend on system readiness across multiple domains. Service delivery can be strengthened, workforce efficiency improved, information systems enhanced, financing manageable, and governance support ethical implementation. Yet sustainability may require continued investment in infrastructure, workforce capacity, and leadership commitment. Applying this framework to the study underscores that digital health interventions must be understood as system-level innovations, not isolated behavioural tools. This insight advances both theory and practice, showing that

strengthening oncology care in LMICs requires integrated approaches that align patient, provider, and system dimensions.

Additionally, this framework demonstrates that the success of SMS reminders at KNH is not solely a matter of patient willingness but depends on system readiness across multiple domains, including adequate mobile telecommunications infrastructure, trained and motivated clinical staff, a reliable SMS platform, and institutional commitment to sustaining the intervention beyond the pilot period. The framework also provides the analytical language for interpreting the study's incremental cost findings. It acknowledges that costs should be understood not as isolated expenditures but as investments in specific building blocks, training (health workforce), mobile phones and SMS platform (health information systems and technology), and personnel time (service delivery and health workforce), whose combined configuration determines the overall resource requirements of the intervention.

2.2.6. Integrative Synthesis: Towards a Multi-Level Explanatory Architecture

The five frameworks reviewed in the preceding sections are not merely additive, presented sequentially, they might appear as independent lenses that could be applied interchangeably. However, a careful reading reveals that they operate at distinct but complementary levels of analysis and together constitute a coherent multi-level explanatory architecture for the present study's research questions.

At the individual patient level, TAM, TPB, and SCT each address a distinct psychological mechanism through which an SMS reminder might influence attendance behaviour. TAM focuses on the cognitive evaluation of the technology: does the patient perceive it as useful and easy to engage with? TPB addresses the motivational translation of that evaluation into a behavioural intention: do positive attitudes toward SMS reminders, combined with social norms around cancer care attendance and perceived control over barriers, produce a sufficiently strong intention to attend? SCT then addresses the behavioural

maintenance question: can the patient sustain attendance behaviour across multiple appointments, and does self-efficacy, reinforced by each successful response to a reminder, grow over time? These three constructs are sequential rather than parallel: TAM-type perceptions inform TPB-type attitude formation, which shapes the intention that SCT-type reinforcement mechanisms then sustain.

At the provider and institutional level, the DoI framework provides the explanatory vocabulary for understanding whether clinical staff at KNH adopt, routinise, and sustain the SMS reminder system in their workflows. The attributes of the innovation (its relative advantage over paper appointment cards, its compatibility with existing clinical communication norms, its low operational complexity, and the observability of its effects in improved patient punctuality) collectively determine whether the innovation diffuses within the clinical team or remains a marginal pilot with no pathway to sustainability. A positive individual-level patient response to the SMS reminder is a necessary but insufficient condition for programme success; provider adoption is equally essential.

At the health system level, the WHO Building Blocks framework situates both individual adoption and provider uptake within the structural context of a public tertiary hospital. Even if patients find reminders useful and providers adopt them willingly, the intervention's sustainability depends on whether the health system's financing, health information systems infrastructure, and governance structures can support it at scale. The Building Blocks framework thus functions as the explanatory framework for the economic and feasibility dimensions of the study; it is the lens through which the cost analysis and the provider KII data are most productively interpreted.

The conceptual framework developed in Section 2.4 formalises this multi-level architecture, but it is important to articulate the theoretical logic explicitly here: each level is necessary, none is sufficient, and the study's mixed-methods design is precisely calibrated to

generate evidence at all three levels simultaneously. This integration of theory and design is itself a contribution of the present study; it demonstrates how disparate theories can be deployed in a coherent and non-redundant way to explain a multi-level health behaviour phenomenon.

2.3. Literature Review Themes and the Research Gaps Identified

2.3.1 Search Strategy and Inclusion Criteria

We used a systematic search strategy to find relevant studies assessing the effectiveness of short message service (SMS) reminders in enhancing clinic attendance. The search was conducted across multiple electronic databases, including PubMed, ScienceDirect, Sage Journals, Emerald Insight, and BioMed Central, supplemented by targeted searches of grey literature (conference proceedings, policy briefs, and NGO reports) to ensure comprehensiveness. Keywords and Boolean operators were combined to capture the breadth of relevant evidence: *“SMS reminder” OR “text message” OR “mobile health” OR “mHealth” AND “clinic attendance” OR “appointment adherence” AND “oncology” OR “gynaecological cancers” OR “cancer care” OR “non-communicable diseases (NCDs)”*. Reference lists of included articles were also hand-searched to identify additional studies.

The inclusion criteria were deliberately structured to balance focus with breadth. First, priority was given to studies that examined SMS reminders in oncology care, and especially in gynaecological cancers, as these are most directly relevant to the present study. However, given the limited number of oncology-specific publications, studies of SMS reminders in other non-communicable disease (NCD) contexts (such as HIV, diabetes, hypertension, and maternal health) were also included where they provided conceptual or methodological insights into the use of SMS reminders for chronic care attendance. This dual approach allowed for a richer critical appraisal while highlighting the gap in oncology-specific evidence.

2.3.1.1. Inclusion Criteria

Eligible studies were required to:

1. Be published in peer-reviewed journals between 2010 and 2025. Although SMS technology predates this period, the 15-year window was chosen to reflect the era of rapid mobile penetration and ICT expansion in LMICs, particularly in Kenya, where mobile coverage and mHealth adoption accelerated after 2010.
2. Report on the use of SMS reminders (one-way or two-way) as an intervention to improve clinic attendance, screening uptake, or treatment adherence.
3. Be written in English, given its wide accessibility in academic and professional practice.
4. Provide sufficient methodological detail to allow appraisal of study design, population, and outcomes.

2.3.1.2. Exclusion Criteria

Exclusion criteria included:

1. Studies that did not focus on SMS reminders (e.g., mobile apps without SMS functionality).
2. Publications lacking empirical data (e.g., opinion pieces, editorials).
3. Duplicate reports of the same study.
4. Studies with insufficient methodological transparency or outcomes unrelated to clinic attendance.

This strategy yielded a body of literature that is both directly relevant to oncology care and comparatively informative from broader NCD contexts. By critically appraising this evidence, the review identifies the persistent gap: while SMS reminders have been widely studied in chronic disease management, there remains a paucity of research on their application

in oncology, and virtually none in gynaecological cancers within LMICs. This gap underscores the significance of the present study.

To ensure methodological transparency and reproducibility, the search strategy was documented in detail, with particular attention to the rationale for including non-oncology NCD evidence where it offered conceptual or methodological parallels, and with explicit acknowledgement of the limited oncology-specific evidence base in LMIC and sub-Saharan African contexts. While the approach did not constitute a formal systematic review in the Cochrane sense, it was conducted to the standards expected of a comprehensive critical literature review at PhD level in the health sciences. The process involved structured searches across multiple databases, supplemented by grey literature, and was guided by clear inclusion and exclusion criteria. Taken together, this yielded a multi-contextual body of evidence that is both directly relevant to oncology care and comparatively informative from NCD contexts, providing a robust empirical foundation for the critical appraisal and synthesis presented in following sections.

2.3.2. Timely Clinic Attendance Among Gynae-Oncology Patients: Prevalence of Non-Attendance and Its Consequences

Timely and consistent clinic attendance is a cornerstone of effective oncological care, particularly for patients with gynaecological malignancies. Regular outpatient visits enable clinicians to monitor disease progression, detect recurrence early, manage treatment-related toxicities, and provide structured psychosocial support, functions that are indispensable in chronic cancer management (Royal College of Radiologists [RCR], 2024). Despite this, non-attendance at scheduled oncology appointments is a pervasive and poorly resolved challenge across both high-income countries (HICs) and LMICs, with consequences that extend beyond individual patient outcomes to systemic healthcare efficiency and equity. This subsection critically appraises the available evidence on the prevalence of missed appointments among

oncology patients, with particular attention to gynae-oncology, and delineates the structural and patient-level factors that drive this problem, especially within sub-Saharan African and Kenyan contexts.

The global burden of gynaecological cancers is substantial and rising. GLOBOCAN 2022 estimates document that Eastern Africa carries the world's highest age-standardised incidence rate of gynaecological cancers, at 50.7 per 100,000 women, surpassing even Southern Africa (48.5 per 100,000), with cervical and uterine corpus cancers constituting the dominant malignancies (Zhu et al., 2024). In Kenya specifically, the International Agency for Research on Cancer (IARC) recorded 44,726 new cancer cases in 2022, with a five-year prevalence of 102,152 and 29,317 cancer-related deaths, making Kenya the second most cancer-affected country in Eastern Africa (Harsch et al., 2025). The actual disease burden is likely considerably greater, given low screening uptake, poor case detection infrastructure, and widespread under-reporting. Amid this escalating epidemiological context, the ability of patients to attend scheduled appointments on time is critical not merely for individual treatment outcomes but for the sustainability of the entire oncological care pathway.

Non-attendance at oncology outpatient appointments is a documented problem across diverse healthcare systems. In radiation oncology settings in the United States, for instance, Chen (2023) found that certain sociodemographic groups, particularly racial and ethnic minorities and those of low socioeconomic status, exhibited disproportionately higher rates of missed appointments, with race ultimately surpassing socioeconomic status as the strongest independent predictor of non-attendance in multivariate models. The implications for health equity are significant: the very patient groups most at risk of inferior cancer survival are simultaneously most likely to miss the appointments that could mitigate that risk. In the United Kingdom, Coleman and Newton (2020) surveyed 49 gynaecological cancer centres and found that non-hospital-based follow-up regimes, including patient-initiated follow-up and telephone

follow-up, are increasingly adopted in part to address persistent non-attendance, yet the randomised controlled trial evidence base for the clinical safety of such alternatives in detecting gynaecological cancer recurrence remains limited and methodologically heterogeneous.

The consequences of missed appointments in oncology are clinically severe. Delayed or disrupted follow-up impedes the timely detection of disease recurrence, a particular concern in gynaecological cancers, where many patients require post-treatment surveillance for residual or progressive disease (RCR, 2024). Treatment discontinuity is associated with poorer survival outcomes; research consistently demonstrates that delays in initiating or maintaining oncological treatment are linked to tumour progression to incurable stages (Neal et al., 2015, cited in Chen, 2023). Beyond individual patient harm, non-attendance generates substantial systemic costs, consuming appointment slots, disrupting multi-disciplinary team planning, and contributing to extended waiting times for other patients, a particularly acute problem in resource-constrained settings where oncology capacity is already critically limited.

In Kenya and across sub-Saharan Africa, the structural determinants of poor clinic attendance in oncology are well-characterised. A landmark qualitative study by Atun et al. (2018) and subsequent research identify financial barriers, including the direct costs of treatment and indirect costs of transportation, as the primary obstacle to accessing oncology services. Most cancer care facilities in Kenya are geographically concentrated in Nairobi, yet 78% of Kenya's population resides in rural areas, creating profound access disparities and resulting in long waiting times that cause some previously curable tumours to progress to incurable stages (Wambalaba et al., 2019). The evidence suggests that, at Kenyatta National Hospital, the study site for the present research, the scale of unmet need is considerable: as of the Kenyatta National Hospital Patient Navigation Programme needs assessment conducted in 2015, patients with cancer faced systematic barriers spanning health literacy, financial

constraints, logistical challenges, and physical access, leading to the programme navigating 14,956 new cancer patients between 2017 and 2023 (Umar et al., 2025).

Research conducted in Kenya further corroborates that poor communication between providers and patients constitutes a critical driver of non-attendance. A qualitative study by Atun and colleagues (2018) identified poor provider-to-patient communication as one of seven key barriers to cancer treatment in Kenya, alongside high costs, low knowledge levels, poor health-seeking behaviour, long distances, inadequate decentralised facilities, and weak cancer policy infrastructure. In the gynae-oncology context specifically, health worker accounts from Kenya describe patients being navigated across multiple hospital departments, surgical clinic, pathology, treatment, with results being lost and care delayed at each transition (Cross et al., 2024). This fragmentation of the care pathway is not only a structural inefficiency but a proximate cause of patient disengagement and missed appointments.

The clinical necessity of timely follow-up among gynae-oncology patients is well-established in international guidance. The RCR (2024) recommends that post-treatment follow-up should be used to detect recurrence, manage late toxicities, and provide psychosocial support, with MRI at three months post-treatment and PET-CT where residual or progressive disease is suspected. A randomized controlled trial nested within a cervical cancer prevention program in Cameroon, one of the few such studies in the African context, showed that telephone reminders to women who missed posttreatment appointments significantly increased adherence to posttreatment follow-up. This highlights the importance of posttreatment follow-up for gynecological malignancies and cervical precancer in LMICs (Nkfusai et al., 2025). The study's overall missed appointment rate remained high despite these encouraging results, and the authors warned that cultural, financial, and geographic barriers must be addressed through multi-component interventions because they function in tandem with amnesia.

There is a notable paucity of studies that directly report the prevalence of missed clinic appointments among gynae-oncology patients in sub-Saharan Africa, and virtually none from Kenya. The most relevant African evidence pertains to cervical cancer screening attendance and posttreatment follow-up adherence, rather than ongoing outpatient oncology attendance per se. This evidential gap is itself significant: as *Delays in Seeking, Reaching, and Accessing Quality Cancer Care in Sub-Saharan Africa* (Lombe et al., 2023) concludes in its systematic review, the majority of studies are clustered in Northern and West Africa, with the majority focusing on breast and cervical cancers. Major causes of cancer-related mortality, including ovarian and uterine cancers, which constitute the primary gynaecological malignancies under management at KNH, are almost entirely unaddressed in the LMIC attendance literature.

A scoping review on digital health in oncology in Africa by Kabukye et al. (2021) found that East African countries, including Kenya, had the largest number of digital health projects in the region, but that none of the included studies directly measured or intervened on missed outpatient appointments in a gynae-oncology context. More broadly, Lee et al. (2025), in a scoping review of interactive, patient-centric mHealth interventions in sub-Saharan Africa, explicitly noted that no studies have focused on cancer, a damning indictment of the current state of the field and a direct statement of the evidential gap the present study is designed to address.

The broader oncology literature consistently demonstrates that missed appointments are not random events. Rather, they are patterned according to socioeconomic, structural, and psychosocial determinants. In sub-Saharan Africa, cancer patients who are uninsured, reside far from treatment facilities, have low health literacy, or lack familial support are disproportionately represented among those who default on follow-up (Harsch et al., 2025; Lombe et al., 2023). Stigma and beliefs about cancer, including attribution of illness to witchcraft, have been documented as barriers to care-seeking in Kenya, with qualitative

accounts from Kenyan oncology nurses describing rarely, if ever, seeing early-stage cancer patients at their facilities (Cross et al., 2024). The convergence of these factors suggests that non-attendance at gynae-oncology clinics in the Kenyan context is both prevalent and multi-determined, demanding intervention strategies that are structurally sensitive, contextually adapted, and delivered through widely accessible modalities.

It is within this evidential and contextual landscape that SMS-based mHealth interventions have begun to attract scholarly attention as a potentially scalable and low-cost strategy for improving appointment adherence in oncology. Critically, however, the systematic evidence base for SMS interventions in oncology, and particularly in gynae-oncology, remains sparse. A systematic review of mHealth interventions to improve cancer screening and early detection (Schliemann et al., 2022) identified that text messaging and telephone reminders are the dominant mHealth modalities used across cancer screening contexts, and that receipt of at least one reminder is associated with improved attendance outcomes. Nevertheless, the reviews consistently note that the evidence base is concentrated in high-income settings, with few methodologically rigorous studies in LMICs, and virtually none in gynae-oncology specifically. Similarly, a systematic review of text messaging interventions on cancer screening rates (Uy et al., 2017) found that SMS reminders demonstrated statistically significant improvements in mammography and cervical cancer screening uptake across a limited number of RCTs, but underscored that evidence from LMIC populations, particularly in sub-Saharan Africa, was conspicuously absent.

The gap in gynae-oncology-specific evidence from Kenya and the broader LMIC region represents a critical deficit in the literature. While studies in related oncology contexts, such as Nkfusai et al.'s (2025) RCT in Cameroon on telephone reminders for cervical precancer posttreatment follow-up, and Kennedy et al.'s (2022) feasibility study of ePRO-based remote follow-up for ovarian cancer in the UK, offer conceptual and methodological insights, they

cannot be uncritically extrapolated to gynae-oncology outpatient settings in Kenya. The Cameroonian study, while geographically proximate and epidemiologically relevant, addressed a narrow posttreatment follow-up context and noted that overall missed appointment rates remained high despite the reminder intervention, suggesting the need for complementary structural interventions. The study by Kennedy et al. (2022), conducted in a well-resourced NHS setting with high digital literacy and reliable infrastructure, has limited transferability to a public tertiary hospital context such as KNH, where smartphone penetration is lower, data costs are prohibitive for many patients, and SMS remains the most widely accessible mobile technology.

A dimension of non-attendance that merits dedicated attention in the gynae-oncology context, but which is often underemphasised in the structural determinants' literature, is the psychosocial burden of a cancer diagnosis and its interaction with attendance behaviour. In Kenya and across sub-Saharan Africa, cancer carries significant stigma, with qualitative studies consistently documenting that patients experience shame, fear of social exclusion, and reluctance to disclose their diagnosis to family members or employers (Harsch et al., 2025; Cross et al., 2024). This psychosocial burden is particularly pronounced in gynaecological cancers, which carry an additional layer of gendered stigma related to reproductive health, sexuality, and femininity. Qualitative studies by Bouskill et al. (2024) and Felisi et al. (2023) among Ugandan women with cervical cancer found that patients frequently concealed their diagnosis from family members and employers out of fear of abandonment and loss of livelihood, and that this concealment created a specific type of attendance barrier, the inability to request time off work or financial support for transport costs without disclosure of the diagnosis. This structural entanglement of stigma and attendance barriers is almost entirely absent from the quantitative non-attendance literature, which captures financial costs and

transport distances but not the social dynamics of concealment that make those costs disproportionately difficult to navigate.

For gynae-oncology patients at KNH, this psychosocial dimension is directly relevant to the design and acceptability of the SMS reminder intervention. An SMS reminder sent to a patient who has not disclosed her cancer diagnosis to household members or an employer risks inadvertent disclosure, particularly in contexts where phone-sharing is common. Equally, a patient who has successfully concealed her diagnosis may experience a reminder as a threat to that concealment rather than as supportive care. These dynamics motivate the careful attention to message design and privacy that is detailed in the methodology chapter and assessed in the acceptability findings: the language of appointment reminders must be neutral enough to avoid diagnostic disclosure while sufficiently specific to be actionable. More broadly, they underscore that the non-attendance problem in this population is not simply a logistical coordination failure; it is partly a manifestation of the psychosocial sequelae of cancer diagnosis in a stigmatising social environment, and any intervention that addresses only the logistical dimension without acknowledging the psychosocial context will achieve only partial effectiveness.

In summary, the evidence reviewed in this subsection establishes three interconnected findings. First, non-attendance at gynae- oncology appointments is a clinically significant and consequential phenomenon, associated with delayed recurrence detection, treatment discontinuity, and worsened survival outcomes. Second, the structural, socioeconomic, and psychosocial determinants of missed appointments in the Kenyan and sub-Saharan African context are well-characterised and multi-dimensional, extending beyond forgetfulness to encompass poverty, distance, stigma, low health literacy, and fragmented healthcare systems. Third, and most critically for the present study, there is a profound evidential gap: no study to date has directly examined the prevalence of missed appointments among gynae-oncology

patients in Kenya, nor rigorously tested an SMS-based mHealth intervention to address this problem in a Kenyan or East African LMIC setting. This gap constitutes the primary empirical justification for the present pilot randomised controlled trial at Kenyatta National Hospital, and underscores the significance of generating contextually valid, methodologically rigorous evidence in this under-studied population.

2.3.3. Interventions to Improve Clinic Attendance Among Oncology Patients

Addressing poor clinic attendance among oncology patients is not merely an administrative challenge, it is a clinical imperative with direct consequences for survival. Across the cancer care continuum, from screening and diagnosis through active treatment and post-treatment surveillance, dropout and disengagement at any stage can translate into delayed detection of recurrence, undertreated disease, and avoidable mortality. The interventions studied to address this problem are diverse in modality and theoretical orientation, ranging from structural redesigns of the care pathway to behavioural and health communication approaches. Critically, the depth and quality of the evidence base vary considerably across oncology sub-specialties and by geographic context, with HIC settings substantially better represented than LMICs, and gynae-oncology occupying a particularly underserved position within the literature.

The intervention research literature in this domain spans a wide methodological spectrum, from large multi-site RCTs in well-resourced healthcare systems through to small-scale observational studies and qualitative evaluations in under-resourced LMIC settings. This heterogeneity in study design, setting, and population makes direct comparison across studies challenging and reinforces the importance of contextually grounded evidence generation. McLean et al.'s (2016) systematic review of interventions to improve appointment attendance concluded that, while reminder interventions consistently show positive effects in aggregate, the magnitude and sustainability of those effects vary considerably by patient population,

healthcare context, and intervention design, a conclusion that applies with particular force in the oncology and LMIC contexts examined in the present study.

2.3.3.1. Patient Navigation as an Intervention for Improving Oncology Attendance

Patient navigation is among the most rigorously evaluated structural interventions for improving access to and continuity of cancer care. Originally developed for underserved populations in the United States by Harold Freeman in 1990, patient navigation programmes deploy trained health workers, navigators, to guide patients through the often fragmented and intimidating health system, assisting with appointment scheduling, transportation coordination, financial counselling, and health literacy support (Chan et al., 2023). The theoretical rationale is straightforward: if structural and informational barriers drive non-attendance, removing those barriers through a dedicated intermediary should improve engagement.

The evidence for patient navigation in improving cancer screening uptake and appointment attendance in HICs is encouraging. Chan et al.'s (2023) umbrella review of systematic reviews on patient navigation across the cancer care continuum, the most comprehensive synthesis to date, found that navigation was associated with improved screening rates, reduced discontinuation of appointments, and shortened time to diagnostic resolution. The effect was particularly consistent when navigation was combined with multi-strategy interventions, such as community education and culturally tailored reminders, with a combined odds ratio of 2.40 (95%CI=1.85–3.11) for navigation alongside media or educational components compared to control conditions (Chan et al., 2023). These findings suggest that no single intervention mode is likely to be sufficient in isolation and that patient navigation is most effective when embedded within a broader multi-component framework.

The transferability of the patient navigation model to LMICs, and to sub-Saharan Africa specifically, has received growing attention. A scoping review by Dalton et al. (2019) identified only fourteen studies reporting on patient navigation for cancer care in LMICs across Asia,

South America, and Africa, a strikingly sparse evidence base. The majority of those studies focused on women's cancers and addressed navigation across multiple points on the cancer care continuum, including awareness, screening, treatment adherence, and surveillance. The review concluded that patient navigation in LMICs is feasible and appropriate, but that the implementation science framework needed to evaluate a broader range of outcomes, beyond attendance rates, remained underdeveloped (Dalton et al., 2019). Critically, no LMIC study in that review focused specifically on gynae- oncology outpatient attendance.

In the Kenyan context, the most substantive evidence comes from the Kenyatta National Hospital (KNH) Patient Navigation Programme, evaluated by Umar et al. (2025). Using a repeated cross-sectional design across three surveys of 1,126 adults with cancer between 2018 and 2022, Umar et al. (2025) found that a higher number of navigation encounters was associated with improved patient understanding of cancer and treatment, reduced financial barriers, and greater likelihood of completing treatment. The programme navigated 14,956 new patients between 2017 and 2023. However, while the findings affirm the potential of patient navigation at KNH, the study did not isolate attendance at scheduled outpatient appointments as a primary outcome, and its cross-sectional design limits causal inference. Moreover, patient navigation at KNH relies on dedicated human resources that may not be uniformly available across all clinic days and patient categories, a limitation that motivates the investigation of scalable, lower-cost adjunct interventions such as SMS reminders.

The evidence from Mexico City by Chavarri-Guerra et al. (2019) offers a useful comparator from an LMIC context. Their single-arm study of a patient navigation programme at a public general hospital demonstrated that navigation reduced referral time to specialised cancer care and reduced patient-reported barriers, with the proportion of patients obtaining a specialist consultation within three months rising substantially after navigation was implemented (Chavarri-Guerra et al., 2019). However, this programme operated in an

environment with better urban transport and infrastructure than rural or semi-urban Kenyan counties, and the study focused on referral rather than ongoing outpatient attendance, further underscoring the specificity of the evidential gap for this thesis.

A critical appraisal of the patient navigation literature in sub-Saharan Africa reveals two persistent methodological limitations that weaken the confidence with which navigation findings can be applied to the KNH context. First, the majority of LMIC navigation studies use pre-post or observational designs without randomisation or concurrent control groups, limiting causal inference. Second, the heterogeneity of navigator roles, training, and supported care domains across studies makes it difficult to identify which specific navigation components drive attendance improvements. These limitations reinforce the case for well-designed pilot RCTs, such as the present study, that can provide controlled estimates of intervention effects in specific LMIC oncology contexts.

2.3.3.2. Communication-Based and Reminder Interventions

Beyond patient navigation, communication-based interventions, particularly appointment reminders delivered through various channels, have been widely studied as low-cost mechanisms for improving outpatient attendance. The theoretical basis for reminder interventions draws on the health belief model and social cognitive theory: reminder messages address the forgetfulness dimension of non-attendance by reducing the cognitive burden of appointment recall and, in some formulations, reinforcing self-efficacy and perceived benefit of attending (Boksmati et al., 2016). A meta-analysis by Opon et al. (2020), drawing on 550 sources and thirteen systematic reviews, found that patient reminders were associated with an overall mean reduction in missed appointment rates of 41% and a 34% increase in clinic visit rates across a range of healthcare settings, with repeated reminders demonstrating stronger effects than single reminders.

The mode of reminder delivery matters. McLean et al. (2016) conducted a mixed-methods systematic review examining reminder systems across healthcare settings and patient populations, finding strong and consistent evidence that any form of reminder, telephone, letter, or text, improved appointment attendance. Critically, their review introduced the concept of ‘Reminder Plus’, reminders that contain additional contextual or educational content beyond the basic appointment details, and found these to be more effective at reducing no-shows than simple date-and-time notifications in certain populations. This distinction is directly relevant to the design considerations of the present study: a reminder containing the clinical rationale for attendance and information about what to expect at the appointment may exert a stronger behavioural effect than a bare prompt.

In the oncology context, however, the evidence for communication-based interventions on outpatient attendance is considerably thinner than in general healthcare settings. The majority of oncology reminder studies concentrate on cancer screening uptake, mammography, cervical cancer Pap testing, and colorectal cancer screening, rather than on ongoing attendance by patients already in the treatment system. Wijeratne et al. (2021), in a systematic review of text-based communication in supportive care for adult cancer patients, found that while most cancer patients expressed satisfaction with SMS-based communications during treatment, the evidence base was heterogeneous, with some outcome domains, including quality of life and symptom management, showing inconsistent effects. Critically, the review noted that the intervention most consistently associated with positive outcomes was SMS reminders for medication adherence, not outpatient attendance specifically, and that no studies from sub-Saharan Africa were included in their synthesis.

Within sub-Saharan Africa, the evidence on reminder interventions in oncology is particularly sparse. The most relevant oncology-adjacent study from the region comes from Botswana during the COVID-19 pandemic period, where Davey et al. (2021) described the OP

Care SMS reminder platform used within a multidisciplinary oncology team (MDT) clinic. The platform enabled mass patient contact, appointment management, and rescheduling, and was associated with a 33% rise in patient attendance at the MDT clinic in the pre-COVID period relative to the period before the platform was introduced (Davey et al., 2021). While this study is methodologically limited by its before-after design and lack of a control group, it is one of the very few to examine an SMS reminder intervention in an oncology clinic setting in sub-Saharan Africa and thus carries evidential significance despite its limitations.

In Kenya's gynaecological context, the only directly comparable study identified through the systematic search is Wanyoro and Kabiru's (2017) double-blind RCT at Thika Level 5 Hospital, which assessed whether SMS reminders improved ovarian tumour rescreening compliance. The study found that 67.1% of individuals in the intervention group re-attended rescreening compared to 20.3% in the control group, a substantial and statistically significant difference, leading the authors to recommend the integration of SMS reminders into gynaecological malignancy monitoring programmes in resource-limited settings in Kenya (Wanyoro & Kabiru, 2017). This is a landmark finding for the present thesis; however, it must be interpreted with several caveats. The study was conducted at a Level 5 county hospital rather than a national referral hospital with the attendant complexity of patient casemix, and it addressed rescreening rather than ongoing outpatient attendance across the treatment continuum. Notwithstanding these limitations, Wanyoro and Kabiru (2017) provide the strongest extant evidence base for the clinical case for SMS-based reminders in Kenyan gynaecology.

For patients with cervical cancer, the most prevalent gynaecological malignancy in Kenya, the evidence for reminder-based interventions in follow-up contexts comes primarily from a 2025 RCT in Cameroon by Nkfusai et al. (2025) Conducted within a cervical cancer prevention programme, the trial found that telephone reminders significantly improved

adherence to posttreatment follow-up appointments among women treated for cervical precancers. This is a methodologically rigorous, contextually relevant contribution to the literature, but its focus on posttreatment precancer follow-up, rather than active oncology outpatient management, and its use of telephone rather than SMS reminders limit direct applicability to the KNH context.

In summary, the evidence reviewed in this subsection demonstrates that a spectrum of intervention modalities, from patient navigation through communication-based reminders, has been explored to address non-attendance in oncology care. The strongest evidence comes from HIC contexts and from general healthcare settings, with the oncology-specific evidence base, particularly for LMIC and sub-Saharan African gynae-oncology settings, remaining critically underdeveloped. Patient navigation at KNH offers a promising structural platform, but its scalability and comprehensiveness is limited without a cost-effective technological adjunct. The evidence from Wanyoro and Kabiru (2017) and Nkfusai et al. (2025) offers preliminary proof of concept for reminder-based interventions in Kenyan and African gynae-oncology contexts, but leaves unanswered the question of whether SMS-based reminders can meaningfully improve clinic attendance among gynae-oncology patients managed in a high-volume national referral hospital. This gap is the direct evidential foundation for the present pilot RCT.

2.3.4. Application of mHealth and SMS in Improving Clinic Attendance: Evidence from Oncology and NCD Contexts

Mobile health, the use of mobile devices and wireless communication technologies to deliver health services and information, has attracted sustained scholarly attention as a potentially transformative tool for improving healthcare engagement in resource-constrained settings. Within oncology specifically, the application of mHealth to support patient attendance, medication adherence, and treatment engagement represents a rapidly developing

field, albeit one in which the evidence base remains skewed towards screening contexts in HICs and in which gynaecological cancers from LMICs occupies a particularly sparse position. This subsection critically synthesises the evidence on SMS-based mHealth interventions for improving clinic attendance and appointment adherence, drawing first on oncology-specific evidence and then, where the oncology evidence is insufficient, on conceptually and methodologically comparable evidence from other NCD contexts.

Lee et al.'s (2025) JCO Global Oncology scoping review of interactive, patient-centric mHealth in sub-Saharan Africa found that the majority of studies (86%) had at least one positive finding, but that no studies focused on cancer, an extraordinary finding that simultaneously affirms the general promise of mHealth in the region and the acute specificity of the evidential gap for the present study. This subsection critically synthesises the evidence on SMS-based mHealth interventions for improving clinic attendance, drawing first on oncology-specific evidence and then, where that evidence is insufficient, on conceptually and methodologically comparable evidence from NCD contexts.

2.3.4.1. SMS Reminders in Oncology: Screening, Follow-Up, and Treatment Contexts

The most extensively evaluated application of SMS in oncology is in the domain of cancer screening uptake. A systematic review by Hirst et al. (2017) and independently by the review by Mougalian, Gross, and Hall (2018), collectively demonstrate that SMS reminders are associated with measurable improvements in mammography and cervical cancer screening rates across diverse populations. In the breast cancer screening context, Mougalian et al.'s (2018) review noted that text messaging had been shown to improve attendance for screening mammograms both in remote locations and among higher-risk populations, with a Korean RCT reporting that 40% of women in the SMS arm underwent a planned mammogram compared to 25% in the control arm at six months post-intervention. These represent meaningful effect sizes

in a cancer screening context where even modest improvements in uptake can translate into significant numbers of early-stage diagnoses.

In the cervical cancer screening domain, most directly relevant to the present study given the high burden of cervical cancer among the gynaecological caseload at KNH, Huf et al. (2017) conducted a study in a low-coverage London borough examining how SMS reminder content affected cervical screening uptake. Utilising insights from behavioural science to tailor message framing, Huf et al. (2017) found that SMS reminders improved screening uptake, and that the specific content and framing of messages exerted an independent influence on attendance outcomes. This finding is theoretically significant: it suggests that SMS reminder effectiveness is not merely a function of delivery but is modulated by message design, a consideration that should inform the development of SMS reminder protocols in intervention studies such as the present one.

There is little but growing evidence from sub-Saharan Africa supporting the use of SMS in cervical screening. Addo-Lartey et al. (2024) carried out a quasi-experimental study in Ghana to see whether one-way SMS messages regarding cervical cancer would encourage urban women in the Greater Accra Region to get tested for HPV. In contrast to controls, the intervention group did not show a statistically significant increase in screening attendance. The authors attributed this finding not to the SMS modality per se, but to access barriers at screening centres, particularly time constraints and insufficient health insurance coverage, which the reminder alone could not overcome (Addo-Lartey et al., 2024). This finding is critically important for the present study: it reinforces the established principle that SMS reminders are not sufficient in isolation if structural barriers remain unaddressed, and that the effects of reminder interventions are most likely to be realised in populations where access barriers are moderate rather than prohibitive.

Wanyoro and Kabiru's (2017) double-blind RCT in Kenya remains the most methodologically rigorous oncology-specific SMS intervention study from an LMIC context identified through this review. Conducted at Thika Level 5 Hospital, the study found that SMS reminders were associated with a dramatic increase in ovarian tumour rescreening compliance, 67.1% in the intervention group versus 20.3% in the control group, with individuals who received a text notification being significantly more likely to rebook their appointments (Wanyoro & Kabiru, 2017). The study also found that those who benefited most from SMS reminders were women who had owned a mobile device for more than two years and who were in a stable relationship, suggesting that prior technology familiarity and social support may moderate the effect of SMS interventions in Kenyan oncology populations.

In the treatment and ongoing follow-up context rather than screening, evidence for SMS reminders specific to gynaecological or broader oncology outpatient attendance remains scarce. Linde et al. (2020) conducted a parallel-group RCT at three clinics in Tanzania examining whether one-way SMS boosted attendance at a 14-month HPV rescreening reminder among women with confirmed positive tests. The study found almost identical attendance rates in the intervention (24.0%) and control (23.8%) groups, concluding that one-way SMS reminders did not improve compliance among this population. The authors attributed this null result in part to structural factors, particularly the challenge of guaranteeing appropriate follow-up infrastructure at the facility level, and to the specific characteristics of the population, many of whom lacked reliable mobile access or faced transport barriers that a reminder alone could not mitigate. These findings serve as an important methodological caution against an over-optimistic reading of SMS efficacy in African low-resource settings.

A related development from Uganda, Ssedyabane et al.'s (2024) mixed-methods study developed a customised SMS intervention for reducing loss to follow-up among patients undergoing cervical cancer treatment at Mbarara Regional Referral Hospital. They found that

the main challenge to re-engagement was the complete absence of any reminder mechanism between healthcare providers and patients, and that development of an SMS-based solution was both feasible and acceptable. This East African study is particularly instructive: it confirms that the gap identified in the Kenyan gynaecological cancer context is not unique to KNH but reflects a systemic absence of structured follow-up communication across the region.

A more encouraging picture emerged from the wider meta-analytic literature. Using random-effects modelling across studies, Tang (2022) carried out a structured meta-analysis of twelve articles investigating the influence of SMS notifications on cancer clinic attendance rates. The findings demonstrated that SMS alerts considerably decreased the likelihood of non-attendance in comparison to no notifications, with significant variation (about 32%) between trials, indicating the context-dependence of SMS impacts. Tang (2022) concluded that SMS alerts are a low-cost and scalable approach to improving patient attendance in oncology, while acknowledging that their effectiveness is moderated by healthcare setting, population characteristics, and message design.

Turning to the specific question of ongoing outpatient treatment attendance, as distinct from screening, Mchidi (2024) provide the most directly relevant Kenyan evidence outside the gynaecological domain. Their study examined the impact of SMS support on chemotherapy treatment adherence among cancer patients at a Kenyan hospital, finding a statistically significant difference in adherence between the intervention and control arms, with a higher mean adherence score in the SMS arm. Critically, the authors identified health system factors as significant independent determinants of adherence, suggesting that SMS support is most effective when embedded in a system that also addresses medication availability and healthcare worker communication, a finding consistent with the broader intervention literature.

2.3.4.2. SMS Reminders in NCD Contexts: Conceptual and Methodological Parallels

Given the limited volume of high-quality SMS intervention studies in gynaecological cancers specifically, the present review extends to evidence from other NCD contexts, principally HIV care, diabetes management, and cervical cancer screening in LMICs, where the evidence base is richer and where conceptual and methodological insights are transferable to the oncology setting. This extension is explicitly justified by the search strategy, which permits inclusion of NCD evidence where it provides conceptual or methodological insight into the use of SMS reminders for chronic care attendance.

The most extensively studied NCD context for SMS reminders is HIV care. Zebina et al. (2019) conducted a prospective comparative study at Pointe-à-Pitre University Hospital examining the effect of an SMS reminder service on attendance rates among people living with HIV (PLHIV) receiving follow-up care at an outpatient clinic. The study found a modest but positive effect, with the SMS-receiving group exhibiting a 3% higher attendance rate, a difference that was not statistically significant but was directionally consistent with the SMS intervention having a beneficial effect. Importantly, the study design, a prospective comparison of patients who actively read and responded to reminders versus those who did not, introduces selection bias, and the null statistical finding should not be interpreted as evidence of ineffectiveness but as evidence of insufficient statistical power or a true marginal effect in a population with high baseline adherence.

More robustly, Linde et al. (2019) used random-effects models to aggregate effect estimates on medication adherence and appointment attendance in a comprehensive review and meta-analysis of eighteen randomized trials of one-way SMS in Africa across various health domains. One-way SMS demonstrated a statistically significant positive effect on appointment attendance across trials, but not on medication adherence. The effect was greatest for kid vaccine attendance (Linde et al., 2019). Significantly, the review found no compelling evidence

that one-way SMS improved the management of diabetes, hypertension, or reproductive health outcomes. This finding has direct methodological implications for the current study because it implies that, in African contexts, appointment attendance may be more responsive to SMS reminders than medication-taking behaviour. This distinction matters because the present study's primary outcome is precisely clinic attendance, not medication adherence.

Further NCD evidence from Kenya reinforces the potential of SMS interventions in the national context. In a different domain, Kithuka (2021) found, in an RCT at Thika Level 5 Hospital among patients with Type 2 Diabetes Mellitus, that mobile phone technology for health education was associated with significantly improved knowledge of risk factors, which in turn was associated with better treatment compliance, suggesting that health literacy-enhancing components in SMS messages may amplify their behavioural effect. Similarly, Karanja (2015), in a randomised controlled trial at the same hospital, demonstrated that women receiving SMS reminders were eight times more likely to adhere to scheduled cervical cancer rescreening compared to those who did not receive reminders (OR=8.02; 95%CI=4.69–13.73). This study underscores the feasibility and effectiveness of SMS-based recall systems in enhancing adherence to preventive care in Kenyan outpatient populations.

The broader systematic review literature supports a cautiously optimistic reading of SMS reminder effects on appointment attendance across diverse healthcare settings. Schwebel and Larimer's (2018) comprehensive review of 162 studies of SMS reminders found that 35% of studies specifically examined appointment reminders, and that 48 out of 56 appointment reminder studies reported positive effects on attendance, advance cancellation rates, or reductions in no-show rates. The review specifically highlighted that SMS appointment reminders were 'a useful tool for improving patient compliance with appointments and care,' while noting the need for ongoing assessment of optimal message timing and frequency.

Critically, however, the review literature consistently identifies an important caveat that has particular relevance for LMIC oncology settings: the populations most likely to be missed by SMS-based interventions are often those with the greatest need. Populations with older age, lower digital literacy, limited mobile ownership, or structural poverty face compounding barriers that a reminder alone cannot address. Boksmati et al. (2016), in their meta-analysis of 28 studies of SMS appointment reminders, found no significant variation in effect size by reminder timing, frequency, or content in the overall meta-analytic estimate, suggesting that population and structural factors, rather than message design parameters, are the primary moderators of SMS effectiveness. This finding has direct implications for the design of the present pilot RCT at KNH, where the target population of gynaecological patients includes women of diverse ages, literacy levels, and proximity to services.

Rossman et al. (2021), in a systematic review of digital health strategies for cervical cancer control in LMICs, reported that SMS reminders and related mobile interventions are increasingly deployed to enhance screening and follow-up adherence. However, the majority of studies were methodologically weak, with high risk of bias, limiting firm conclusions about effectiveness. The review underscores both the promise of SMS-based interventions in oncology and the urgent need for rigorous, context-specific trials in sub-Saharan Africa to establish their impact on clinic attendance and continuity of care.

In synthesis, the evidence reviewed in this subsection supports the following conclusions. First, SMS reminders have demonstrated consistent positive effects on cancer screening attendance across HIC contexts, and mixed but directionally positive effects in LMIC contexts, with the quality and direction of effects moderated strongly by structural and population characteristics. Second, the oncology-specific evidence for SMS reminders in ongoing treatment attendance contexts in sub-Saharan Africa is sparse, with only two studies from Kenya (Wanyoro & Kabiru, 2017; Mchidi, 2024) providing directly relevant evidence,

and only one (Wanyoro & Kabiru, 2017) specifically examining a gynaecological malignancy in a Kenyan hospital context. Third, NCD evidence from African LMIC contexts, particularly from HIV care and diabetes management in Kenya, provides methodologically and conceptually transferable evidence that SMS reminders can improve appointment attendance in chronic care settings, with the caveat that effects are population- and context-dependent. Taken together, this evidence base provides a compelling but not conclusive rationale for testing SMS reminders as an intervention to improve clinic attendance among gynae-oncology patients at KNH, a rationale that constitutes the primary empirical justification for the present pilot RCT and underscores the originality of the proposed research.

A further cross-cutting observation from the NCD literature is that the durability of SMS reminder effects tends to diminish over time as patients habituate to receiving messages. Schwebel and Larimer (2018) noted that several studies in their review reported initial attendance improvements that attenuated at later follow-up time points, a pattern attributed to reminder fatigue, the progressive desensitisation to repeated prompts. This temporal dimension has direct implications for the gynaecological context, where patients require sustained long-term follow-up rather than a short-term intervention. Future definitive trials should incorporate strategies to maintain engagement over extended periods, such as varying message content, incorporating personalised health information, or combining SMS reminders with periodic motivational messaging, features that move beyond the simple appointment prompt toward a richer patient communication strategy.

2.3.5. Feasibility and Acceptability of Two-Way SMS Reminders in Gynaecological Cancer Contexts

The preceding subsections have established both the clinical need for improved clinic attendance among gynae-oncology patients and the evidence base for SMS reminders as an intervention modality. However, before an mHealth intervention can be scaled or its

effectiveness tested, a foundational empirical and ethical question must be addressed: is the intervention feasible and acceptable to the target population in the specific context in which it will be deployed? This distinction, between an intervention that works in principle and one that is feasible and acceptable in a given setting, is not merely methodological. It is particularly salient for LMIC oncology settings, where mobile ownership patterns, digital literacy, infrastructure reliability, privacy concerns, and sociocultural dynamics introduce contextual factors that can determine whether an apparently promising SMS intervention succeeds or fails in practice. This subsection systematically appraises the evidence on the feasibility and acceptability of two-way SMS reminders in oncology and gynaecological cancer contexts, before extending to NCD comparators where the oncology-specific evidence is insufficient.

2.3.5.1. Defining Feasibility and Acceptability in the mHealth Pilot Context

In the framework of pilot and feasibility studies, ‘feasibility’ refers to the practicability of conducting an intervention, encompassing infrastructure requirements, recruitment rates, data completeness, and technical operability, while ‘acceptability’ refers to the degree to which the target population finds the intervention agreeable, appropriate, and tolerable (Ødegård et al., 2022). For SMS-based mHealth interventions in LMICs, feasibility is partly a function of mobile phone penetration and population-level SMS literacy, and partly a function of healthcare system readiness to integrate and sustain an automated messaging platform. Acceptability is a more complex and multidimensional construct: it encompasses patients’ willingness to receive health information via text message, their comfort with the modality, their privacy concerns, and the extent to which they perceive the messages as relevant and beneficial.

The WHO’s (2020) mHealth technical and evidence review underscores that digital health interventions, including SMS, must be evaluated not only for their clinical efficacy but for their acceptability, usability, and sustainability within local health systems. This is

particularly important in the African context, where, as Demsash et al. (2022) identified in a qualitative synthesis of barriers to SMS-based automated notifications in African settings, literacy gaps, anonymity concerns, repetitive messaging fatigue, poor ICT network coverage, and mobile phone loss or sharing all represent meaningful implementation challenges. Critically, however, Demsash et al. (2022) concluded that, despite these barriers, SMS remains an efficient and widely accepted notification method in African health systems when thoughtfully designed, a finding that sets the evidential backdrop for the present analysis.

2.3.5.2. Mobile Phone Access and SMS Readiness Among Kenyan Women in Cancer-Related Contexts

A necessary precondition for the feasibility of any SMS-based intervention is sufficient mobile phone access among the target population. In Kenya, the evidence on this precondition is broadly encouraging but nuanced. A national facility-based survey by Zurovac et al. (2013), conducted across 172 public health facilities and among patients, health workers, and caregivers, found that mobile phone ownership and SMS use were widespread in Kenya, though disparities existed by gender, age, education, and socioeconomic status. Crucially, the study found no significant association between poverty level and SMS use, suggesting that the low cost of SMS messaging does not constitute a barrier for utilisation even among the poorest populations, although poverty remains an obstacle to device acquisition. This has direct implications for the present study: while some gynae-oncology patients at KNH may not own a personal device, the low incremental cost of SMS once a phone is available means that SMS is a more equitable modality than data-dependent smartphone applications.

More directly relevant evidence comes from Stocks et al. (2022), whose observational study nested within a cluster RCT on HPV-based cervical cancer screening in western Kenya characterised mobile phone ownership and SMS use among women attending cervical cancer screening, a population with significant demographic overlap with the gynae-oncology patients

targeted in the present study. The study found that the majority of participants owned personal mobile phones, were comfortable reading, writing, and receiving SMS messages, and expressed willingness to receive SMS-based health information. However, the study identified a critical nuance: preferences for SMS-based communication shifted depending on the sensitivity of the information, with women screening positive for high-risk HPV showing a decreased preference for SMS result notification relative to those with negative results, a pattern the authors attributed to privacy concerns and stigma. This finding has direct design implications: in gynaecology, where cancer diagnosis carries significant psychosocial stigma in Kenya, SMS appointment reminders must be carefully crafted to avoid inadvertently disclosing a patient's diagnosis to household members who may access a shared phone.

The digital health readiness context in Kenya has evolved considerably since earlier surveys. Kenya's mobile subscription penetration stood at 91% in 2022, above the African average of 80%, with basic mobile phones being the most common device type, though smartphone and feature phone penetration had reached 53.4% and 67.9% respectively by 2021 (Kiburi, Paruk, & Chiliza, 2022). Critically, 58% of those without personal phone ownership reported sharing a device with another household member. These figures collectively suggest that the population-level infrastructure for an SMS-based intervention at KNH is favourable, but that individual-level ownership disparities and phone-sharing practices must be accounted for in the study's consent process and safety protocols to protect patient confidentiality.

2.3.5.3. Acceptability of mHealth Interventions in Gynaecological Cancer Settings

Turning to the acceptability evidence specific to oncology and gynaecological cancer populations, the literature from Africa and LMICs is sparse but instructive. Wijeratne et al.'s (2021) systematic review of text-based communication for supportive care in adult cancer patients found that the majority of cancer patients across included studies expressed satisfaction with SMS-based communication during treatment. Satisfaction was highest when messages

were perceived as personally relevant, non-intrusive in frequency, and clinically meaningful, for example, appointment reminders and medication prompts were rated more positively than generic informational broadcasts. This finding resonates with the behavioural science-informed understanding that the content, timing, and personalisation of SMS messages modulate their acceptability and, by extension, their effectiveness (Njuguna et al., 2024).

In gynaecology specifically, the most directly relevant acceptability evidence from an African context was provided by Moodley et al. (2019) in a mixed-methods study among 364 women in Cape Town, South Africa, investigating the feasibility of using mHealth technology for the follow-up of patients with precancerous cervical lesions. The study found that 98% of surveyed women owned a mobile phone, with the majority using it for calls and SMS. Participants rated SMS appointment reminders and results notification as simple, time-saving, and cost-effective, noting the convenience of not having to miss work for communication purposes. Privacy concerns were, however, raised as a substantive acceptability barrier: participants expressed worry about sensitive medical information being received by another person accessing their phone, about device loss or theft, and about poor network reception in their residential areas. Moodley et al. (2019) concluded that SMS is a feasible and acceptable modality for gynaecological follow-up in South African settings, but that privacy-by-design features, including the use of non-diagnostic language in reminder messages and patient consent to the messaging format, are essential for ethical deployment.

Choi et al. (2024) conducted a study in western Kenya assessing the impact of text messaging, both standard and ‘enhanced,’ on cryotherapy uptake following positive HPV results during cervical cancer community health campaigns. The study found that a one-size-fits-all SMS strategy did not meet the diverse communication needs of women in the setting, but that tailored, enhanced text messaging, with modified content, frequency, and timing, showed improved follow-up compared to standard messaging. The authors concluded that

mHealth delivery in this context must be responsive to individual patient characteristics and local cultural norms, including varying levels of literacy and differing comfort with health communication via technology. This finding reinforces the argument, consistently advanced in the mHealth feasibility literature, that pilot studies are essential before scaled implementation: they provide the population-specific acceptability and implementation data that cannot be reliably extrapolated from other settings (Mutebi et al., 2020).

Mrémi et al. (2021) provided additional acceptability evidence from rural Kilimanjaro, Tanzania, in a cross-sectional and cohort study of women who tested positive for HPV and received results via SMS. More than 80% of women who received SMS reminders returned for follow-up appointments, with the acceptability of receiving sensitive health information via SMS found to be high, and the majority expressing a preference for SMS result notification. This is a notable finding: it suggests that, even for sensitive health information in a low-resource sub-Saharan African context, SMS is an acceptable communication channel when patients have consented to it and when messages are designed with appropriate sensitivity.

Together, the evidence from Moodley et al. (2019), Choi et al. (2024), and Mrémi et al. (2021) suggests that among women engaged in gynaecological health services in sub-Saharan Africa, SMS acceptability is generally high but is modulated by three consistent contextual factors: the sensitivity of the health information conveyed, the privacy of the communication channel, and the perceived relevance and comprehensibility of the message content. All three of these factors are directly applicable to the gynaecological context at KNH and are explicitly addressed in the present study's intervention design and acceptability assessment methodology.

2.3.5.4. Two-Way Versus One-Way SMS: Feasibility and Comparative Evidence

The present study proposes a two-way SMS reminder intervention, one in which patients receive reminders and are able to respond to confirm, cancel, or query their

appointment. The distinction between one-way and two-way SMS is not merely technical: it is behaviourally and operationally significant. Two-way SMS enables a feedback loop between patient and provider, allows for the identification of individual barriers to attendance, and supports personalised follow-up responses. However, the evidence on two-way SMS is more limited and methodologically mixed than that for one-way SMS, particularly in oncology and LMIC contexts.

A systematic review by Ødegård et al. (2022) synthesised evidence from 31 randomised trials of two-way text message interventions conducted in sub-Saharan Africa across multiple health domains. The review found that two-way SMS improved medication adherence compared to standard care, but demonstrated an unclear and inconsistent impact on appointment attendance. The heterogeneity across studies was substantial, driven by differences in patient population, disease context, SMS platform design, and healthcare system capacity to respond to patient messages. Ødegård et al. (2022) concluded that, while two-way SMS holds promise, its genuine impact on appointment attendance in African settings requires further rigorous evaluation, a conclusion that directly motivates the present pilot RCT design.

The mechanistic question of why two-way SMS may or may not outperform one-way SMS in improving attendance is illuminated by Njuguna et al.'s (2024) RCT in South Africa, which tested a behaviourally informed two-way SMS intervention against standard one-way messaging in the HIV care context. The study found that two-way messages with behavioural economics-informed content, including loss aversion framing, social norm messaging, and personalised barrier identification, did not result in significantly better return-to-care rates than one-way messages in the overall sample. However, the two-way system was able to extract rich data on reasons for missed appointments, which the authors argued could substantially enhance targeted outreach strategies for future interventions. This finding suggests that the value of two-way SMS may lie not solely in its direct behavioural effect on attendance, but

also in its capacity to generate actionable intelligence about barriers to care, a potentially valuable secondary benefit for the present study.

The human-centred design process for developing a two-way SMS platform described by Mureithi et al. (2024) in the context of HIV care in Malawi offers further methodological insight. Their study demonstrated that involving healthcare workers and patients co-operatively in the design and iteration of the two-way texting system was critical to securing buy-in, optimising usability, and ensuring that the platform met the operational realities of a low-resource clinical environment. This finding has direct relevance for the present study at KNH: the feasibility of a two-way SMS intervention depends not only on patient acceptance but on healthcare worker capacity to manage incoming patient responses within a high-volume outpatient oncology setting, a contextual factor that underscores the importance of the pilot study design in generating operational learning before any scaled implementation.

The evidence from Ødegård et al. (2022), Njuguna et al. (2024), and Mureithi et al. (2024) collectively suggests that the effectiveness of two-way SMS on appointment attendance in African settings is not yet established with the same degree of certainty as its effect on medication adherence, and that the operational feasibility of managing bidirectional patient communication is a critical implementation consideration that is often underestimated in intervention planning. These findings directly motivate the pilot RCT design of the present study: generating preliminary evidence on both the effect of two-way SMS on attendance and the operational feasibility of managing the two-way communication in a high-volume gynaecology clinic at KNH is essential before any scaled implementation can be responsibly recommended.

2.3.5.5. *Barriers to mHealth Feasibility in LMIC Oncology Contexts*

The broader barriers to mHealth feasibility in LMIC settings are well-characterised in the literature. Kruse et al.'s (2019) systematic review identified five recurring barrier

categories: technological (limited device access, poor network connectivity, platform incompatibility), financial (device cost, data costs), literacy (inability to read SMS, low digital literacy), sociocultural (stigma, privacy concerns, gender power dynamics around phone access), and health system (inadequate provider training, absence of integration with clinical workflows). Critically, the relative salience of each barrier category varies by context and disease domain: privacy concerns and stigma are particularly acute in cancer contexts given the psychosocial burden of a cancer diagnosis, while literacy barriers are more prominent in older and rural populations.

In the oncology mHealth context in Africa specifically, Kabukye et al. (2021) confirmed that text messaging interventions were limited almost exclusively to screening programmes, with no studies examining two-way SMS in a gynaecological treatment context, confirming the evidential gap the present study addresses. Data security, privacy, and shared device access were consistently identified as implementation concerns requiring deliberate design attention.

Mapping Kruse et al.'s (2019) five barrier categories to the specific context of gynaecology patients at KNH illuminates which barriers are most salient and which mitigation strategies are most relevant. Technological barriers in this context are primarily driven by device access disparities and network reliability rather than platform incompatibility: the two-way SMS platform operates over basic GSM networks, which are available across most of Kenya, and requires only a basic feature phone, not a smartphone. The more pressing technological concern is network reliability in semi-rural counties outside Nairobi, where a significant proportion of KNH's outpatient population resides. Delayed or undelivered messages due to network congestion or poor coverage represent a feasibility risk that cannot be mitigated by patient behaviour alone and that requires monitoring during implementation to identify whether non-delivery is driving non-attendance in the control arm equivalent.

Financial barriers in this context are primarily related to device acquisition rather than per-message costs, since the SMS charges in the present study are borne by the provider rather than the patient. The literature consistently shows that once a device is available, the marginal cost of receiving an SMS is effectively zero for the recipient (Zurovac et al., 2013), and the present study's provider-cost model is therefore appropriate for avoiding patient financial burden as an implementation barrier. However, the indirect cost of attending the clinic, transport, time, and lost income, remains a structural barrier that the SMS reminder alone cannot address, and this is acknowledged explicitly in the study's limitations.

Literacy barriers are acute in the KNH gynae-oncology context. Low literacy intersects with SMS feasibility in two ways. First, patients with limited reading ability may be unable to interpret the reminder message, even if it is written in plain Swahili. Second, patients who rely on others to read their messages face the same privacy vulnerability as phone-sharing patients. For these reasons, the intervention design specifically used short, simple Swahili-language messages and allowed patients who could not read independently to self-identify and discuss alternative communication arrangements during enrolment. The qualitative findings on feasibility provide the opportunity to examine whether literacy barriers materialised in practice and how the system responded.

Sociocultural barriers, particularly stigma and gender power dynamics around phone access, represent the most contextually specific and difficult-to-mitigate barrier category for gynae-oncology SMS interventions at KNH. As discussed in Section 2.3.2, the psychosocial burden of a gynaecological cancer diagnosis in Kenyan social contexts creates a specific type of feasibility challenge: the SMS reminder itself may be experienced as a disclosure risk that undermines rather than supports attendance.

Taken collectively, the evidence reviewed in this subsection supports three key conclusions that directly inform the design and justification of the present pilot RCT. First,

mobile phone penetration among Kenyan women in gynaecological health contexts is sufficiently high to make SMS-based interventions technically feasible at the population level, though personal device ownership disparities and phone-sharing practices require careful attention in intervention protocols. Second, SMS appointment reminders and follow-up notifications are generally acceptable to gynaecological cancer and precancer populations in African settings when designed with appropriate sensitivity to privacy, language, and personalization, but acceptability is not universal and is moderated by diagnosis type, literacy level, and phone-sharing patterns. Third, two-way SMS, while theoretically advantageous over one-way reminders for its interactivity and barrier-identification capacity, has a more limited and mixed evidence base in African NCD and oncology contexts, with no published feasibility study from a gynaecological outpatient setting in Kenya. This triple evidential gap, of feasibility, acceptability, and two-way SMS effectiveness, in the specific context of gynaec-oncology at a Kenyan national referral hospital constitutes the precise scientific justification for the present pilot randomised controlled trial at Kenyatta National Hospital.

2.3.6. Gynae-Oncology Patients' Acceptability of Two-Way SMS Reminders

Research question three of the present study asks: 'What is the acceptability of two-way SMS reminders for improving clinic attendance among gynaecological patients at Kenyatta National Hospital?' This question sits at the intersection of two scholarly traditions, the mHealth acceptability literature and the patient experience literature in oncology, and its methodological design, drawing on both a quantitative Likert-scale survey and a qualitative exploration of patient perspectives, reflects the multi-dimensional nature of acceptability as a construct. Before presenting the original findings in subsequent chapters, this subsection critically reviews what is already known about patient acceptability of SMS-based mHealth interventions in cancer and gynaecological contexts, identifies the theoretical framework that underpins the measurement of acceptability in the present study, and delineates the specific

evidential gaps that justify a de novo investigation of this question in the Kenyan gynaecological setting.

This dedicated standalone subsection of patient acceptability distinct from the broader feasibility discussion in the last section reflects two considerations. First, acceptability is a primary research question in its own right, warranting depth of critical appraisal proportionate to its evidential and methodological weight. Second, the measurement of acceptability through a validated six-item five-point Likert scale in the quantitative phase and through semi-structured qualitative interviews requires a dedicated theoretical and empirical grounding. By anchoring the acceptability analysis in Sekhon et al.'s (2017) Theoretical Framework of Acceptability and mapping the five key acceptability dimensions onto both measurement instruments, this subsection provides the theoretical scaffolding for the study findings.

2.3.6.1. Defining and Theorising Acceptability in the mHealth Context

In everyday usage, 'acceptability' is frequently treated as synonymous with patient satisfaction or willingness to use a technology. In the health intervention sciences, however, acceptability has a more precise and multi-dimensional meaning that has important implications for how it is measured and interpreted. The most widely adopted theoretical framework for this purpose is Sekhon, Cartwright, and Francis's (2017) Theoretical Framework of Acceptability (TFA), published in BMC Health Services Research. The TFA defines acceptability as 'a multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it to be appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention' (Sekhon et al., 2017, p. 4). The framework comprises seven component constructs: affective attitude (how a participant feels about the intervention), burden (the perceived effort required to participate), perceived effectiveness (the extent to which the intervention is seen as likely to achieve its purpose), ethicality (alignment with the participant's value system), intervention coherence

(understanding of what the intervention entails), opportunity costs (what must be forgone to participate), and self-efficacy (confidence in one's ability to engage with the intervention).

The TFA has been rapidly and widely adopted since 2017, accumulating over 1,000 citations by 2023 and being applied across diverse intervention contexts including cancer care, surgical settings, and mHealth interventions in sub-Saharan Africa (Paynter et al., 2023). Critically for the present study, the TFA explicitly accommodates both quantitative operationalization, through Likert-scale questionnaires designed to capture each of its seven constructs, and qualitative exploration through focus group topic guides. This dual-method compatibility makes the TFA directly applicable to the present study's mixed-methods design, in which intervention participants rate acceptability on a six-item five-point Likert scale in the quantitative phase, while focus group discussions explored the depth and texture of their experiences. The TFA's construct of intervention coherence is particularly relevant: patients who understand what two-way SMS involves, that it will remind them of appointments and allow them to respond to confirm or cancel, are better placed to engage with it, and low coherence may itself be a driver of non-engagement even among patients who in principle support the intervention.

An important conceptual distinction within the TFA, and one with particular relevance for a pilot RCT context, is between prospective (anticipated) and retrospective (experienced) acceptability (Sekhon et al., 2017). Prospective acceptability, measured before the intervention commences, captures willingness and anticipated perceptions, while retrospective acceptability, measured at the end of the trial, captures actual experienced responses. Most mHealth acceptability studies in LMIC settings measure prospective acceptability, typically through cross-sectional surveys of willingness to receive SMS health messages, and fewer capture the richer and arguably more valid retrospective acceptability that emerges from having lived the intervention. The present study's design, which assesses acceptability among

intervention participants at the end of the trial period, measures retrospective acceptability, a methodologically stronger approach that yields data more directly informative for intervention refinement and scaling.

2.3.6.2. Patient Acceptability of SMS Reminders in Oncology: Evidence from the Literature

In oncology contexts broadly, the available evidence on patient acceptability of SMS-based communications is generally, though not uniformly, positive. Wijeratne et al.'s (2021) systematic review of text-based communication for supportive care in adult cancer patients found that the majority of participants across included studies reported satisfaction with receiving SMS messages during treatment. Within the review, satisfaction was highest for functional communications specifically appointment reminders and medication prompts and lower for generic health information broadcasts. This gradient of acceptability by message type is theoretically consistent with the TFA: appointment reminders have high intervention coherence (patients clearly understand their purpose), high perceived effectiveness (the reminder directly addresses forgetfulness, which patients themselves report as a cause of missed appointments), and low perceived burden (receiving and reading a short text requires minimal time or effort). Generic health information, by contrast, scores lower on coherence and perceived effectiveness relative to the patient's immediate clinical situation.

In the colorectal cancer screening context, the M-TICS RCT conducted in Catalonia, Spain by Vives et al. (2024) embedded a telephone survey-based acceptability assessment within a randomised trial of SMS reminders for fecal immunochemical test return. The study found that the majority of intervention participants rated the SMS reminder as appropriate and useful, with high reported acceptability across the constructs of affective attitude and perceived effectiveness. Importantly, a small but notable minority raised concerns about the intrusiveness of receiving health-related SMS, and a minority with lower digital literacy expressed difficulty interpreting the message content, a finding directly relevant to the literacy dimension of

acceptability in the KNH context. The M-TICS study is methodologically notable for its integration of a formal acceptability process evaluation within the RCT design, demonstrating the scientific value of treating acceptability as a primary outcome in its own right rather than an afterthought.

Acceptability of SMS interventions in gynaecological cancer and cervical cancer contexts from sub-Saharan Africa provides the most directly relevant evidence base for the present study, and this literature is characterised by high overall willingness but significant contextual qualifications. Moodley et al.'s (2019) mixed-methods study among 364 women in Cape Town found near-universal mobile phone ownership and broad receptiveness to SMS appointment reminders and results notifications among patients attending follow-up for precancerous cervical lesions. Patients highlighted simplicity, convenience, and time-saving as the primary drivers of their positive affective attitude toward SMS communication. However, the qualitative component surfaced three substantive concerns that qualify the positive aggregate finding. First, privacy and confidentiality, the risk that a diagnostic SMS might be seen by another household member accessing a shared device. Second, network unreliability uncertainty about whether messages would be received in areas with poor coverage; and third, language accessibility, concerns that clinical or technical language might be incomprehensible to patients with lower literacy. These three concerns map precisely onto TFA constructs (ethicality, burden, and intervention coherence respectively), illustrating the analytical value of a theoretically grounded approach to acceptability assessment.

Mrémi et al.'s (2021) cohort study in rural Kilimanjaro, Tanzania, provides further evidence of high SMS acceptability in the gynaecological cancer adjacent context of HPV follow-up. Among women who received HPV results via SMS, 98.4% reported being willing to receive future test results via text message, and 82% of those with positive HPV results returned for follow-up after receiving an SMS reminder, a remarkably high return rate in a rural

sub-Saharan African context. The acceptability finding here is noteworthy: even for sensitive diagnostic information in a stigmatised health domain, SMS was the modality preferred by the majority of women surveyed, provided they had consented to it and were confident in the privacy of their device. This suggests that among women already engaged in gynaecological health services, as gynae-oncology patients at KNH would be, the threshold for SMS acceptability is likely high, particularly when interventions are designed with explicit attention to consent, language, and privacy.

In the Kenyan context more broadly, the evidence on patient acceptability of mHealth interventions converges on a broadly positive but contextually nuanced picture. A study in Mombasa, Kenya by Aunon et al. (2023), which evaluated a theory-informed mHealth intervention for HIV care among women, found high participant-level acceptability of SMS-based support, with the relational dimension of the intervention, feeling cared for and remembered by the health system — identified as a particularly salient driver of positive affective attitude. This finding is likely to have direct relevance to gynae-oncology patients at KNH, for whom the psychological burden of a cancer diagnosis and the impersonality of a high-volume tertiary hospital context may mean that a personalised SMS reminder carries therapeutic relational significance beyond its purely logistical function.

2.3.6.3. Dimensions of Acceptability Relevant to the KNH Gynaecological Context

Translating the general acceptability literature to the specific context of gynaecological patients at KNH requires attention to five dimensions that the evidence base consistently identifies as critical moderators of SMS acceptability in African LMIC settings: willingness to receive reminders, privacy and confidentiality, literacy and language comprehension, preferences for message content, timing and frequency, and cultural and psychosocial dimensions.

With respect to willingness to receive reminders, the literature is broadly consistent that patients in African health settings, including Kenya, express high willingness to receive SMS health messages, provided they understand the purpose of the messages and have consented to their receipt. A systematic review by Nesidai et al. (2023), examining patient-centric factors influencing mHealth uptake for NCD management across LMICs including Kenya, found willingness to engage with SMS reminders to be consistently high across studies, particularly among patients who perceived their health condition as serious and who expressed a desire for more contact with their healthcare providers. Gynaecological patients, managing serious, potentially life-threatening conditions, are likely to score highly on both of these dimensions, suggesting that willingness to receive two-way SMS reminders at KNH is a reasonable baseline expectation. However, the literature also cautions that willingness reported in cross-sectional surveys conducted before an intervention may not translate directly into sustained engagement once the intervention is underway, particularly when forgetfulness, phone loss, or competing life demands intervene (Demsash et al., 2022).

Privacy and confidentiality concerns represent the most consistently reported barrier to SMS acceptability in the African mHealth literature, and they are particularly acute in oncology contexts due to the psychosocial stigma associated with cancer diagnoses in many African societies. A scoping review of ethical, legal, and sociocultural concerns in mHealth use in East Africa (Stocks et al., 2022) identified privacy as the primary sociocultural concern, noting that phone-sharing practices, prevalent in Kenya, where 58% of those without personal device ownership share a device with a household member, create genuine risks of unintended diagnostic disclosure. In gynaecology specifically, this concern is compounded by the sensitive nature of gynaecological conditions, which carry additional gendered stigma in Kenyan social contexts. The literature consistently recommends that SMS interventions in this context use non-diagnostic language, appointment reminders phrased as generic hospital reminders rather

than condition-specific notifications, and that patients explicitly consent to the modality and language of communication during enrolment (Moodley et al., 2019; Stocks et al., 2022). These design considerations are directly relevant to the present study.

Literacy and language comprehension constitute a third critical dimension. The KNH patient population includes women of diverse educational backgrounds and primary languages, with Swahili being the dominant vernacular in the Nairobi context but significant proportions of patients arriving from counties where other languages predominate. Harsch et al.'s (2025) scoping review of cancer health literacy in Kenya found low health literacy to be a pervasive challenge across the cancer care pathway, with patients frequently unable to read, interpret, or act on written health information. For SMS interventions, low literacy and language barriers translate into reduced intervention coherence in TFA terms, patients who cannot read or understand the reminder cannot benefit from it. A qualitative study in sub-Saharan Africa on mHealth barriers by Aboye, Simegn, and Aerts (2024) similarly found that low digital literacy and inability to read SMS messages were among the most frequently reported barriers to mHealth engagement, particularly among older women, which is a relevant demographic in gynaecology. This evidence argues strongly for the use of plain, short, vernacular-language messages in any SMS intervention at KNH, and for the qualitative phase of acceptability research to specifically probe comprehension of the messages received.

Patient preferences for message content, timing, and frequency, dimensions that map onto TFA's constructs of affective attitude and burden, have been investigated in several cancer-adjacent contexts. A systematic review of mHealth interventions across sub-Saharan Africa (Aboye et al., 2023) found that patients consistently preferred messages that were brief, actionable, personalised with their name or appointment details, and sent at a convenient time (typically morning or early afternoon on weekdays). Frequency preferences showed more variability: while multiple reminders were associated with better attendance outcomes in the

reminder literature (McLean et al., 2016; Opon et al., 2020), patients in qualitative studies expressed concerns about messaging fatigue and intrusiveness when reminders were perceived as excessive. The two-way design of the present study's intervention is particularly relevant here: by enabling patients to respond to their reminder, confirming, cancelling, or querying their appointment, the intervention actively positions the patient as an agent rather than a passive recipient, which has been associated with higher acceptability and more sustained engagement in the mHealth literature (Njuguna et al., 2025).

Finally, the cultural and psychosocial dimensions of acceptability in the KNH gynae-oncology context deserve particular attention. A cancer diagnosis carries profound psychosocial weight for Kenyan women, encompassing fear of stigma, anxieties about fertility, concerns about family burden, and, in some cases, beliefs about cancer causation that intersect with traditional and religious frameworks (Springer Nature Link, 2024; Harsch et al., 2025). These psychosocial dimensions shape how patients experience and evaluate the acceptability of any clinical intervention, including an SMS reminder. Patients who feel their condition is stigmatised may be reluctant to engage with a modality that, however benignly intended, creates a digital trace of their cancer care that could be seen by others. Equally, patients who feel abandoned or inadequately supported by the health system may experience a personalised SMS reminder as a form of relational care that significantly enhances their affective attitude toward the intervention and their trust in the clinic. The qualitative phase of the present study's acceptability assessment is particularly well-positioned to capture these nuanced psychosocial dimensions, which cannot be fully apprehended through a Likert-scale survey alone.

2.3.6.4. Evidence Gaps and Justification for a De Novo Acceptability Investigation

The critical appraisal conducted in this subsection reveals a consistent and significant evidential gap: no published study has directly investigated patient acceptability of a two-way SMS reminder intervention among gynae-oncology patients in Kenya or, to the best of the

reviewer's knowledge, in any East African LMIC national referral hospital context. The studies closest to the present study's context, Wanyoro and Kabiru (2017) on ovarian tumour rescreening SMS reminders at Thika Level 5 Hospital, Kenya, and Mchidi et al. (2024) on SMS-supported chemotherapy adherence in Kenya, neither measured acceptability as a primary outcome nor employed a two-way SMS design. The cervical cancer follow-up studies from Tanzania (Mrémi et al., 2021) and South Africa (Moodley et al., 2019) provide the nearest analogues in the gynaecological cancer acceptability domain, but were conducted in distinct settings with different patient populations, intervention designs, and healthcare system contexts.

This gap has practical as well as scientific significance. Without population-specific acceptability data from gynae-oncology patients at KNH, it is not possible to responsibly scale or recommend an SMS reminder intervention for this setting. The acceptability of such an intervention is not a given: the phone-sharing practices, literacy diversity, privacy concerns, and psychosocial burden characteristic of this patient population could all, in principle, limit acceptability to a degree that would undermine the intervention's clinical utility even if its efficacy in improving attendance were demonstrated. It is precisely because these questions cannot be answered by extrapolation from other contexts that RQ3 of the present study represents an original and necessary contribution to the evidence base — one whose findings will directly inform whether, and under what conditions, a two-way SMS reminder system could be justifiably scaled within the gynae-oncology services at KNH and potentially replicated in analogous LMIC cancer care settings.

2.3.6.5. Healthcare Provider Acceptability: An Underexplored Dimension

The preceding subsections have reviewed patient acceptability of SMS reminder interventions in considerable depth. However, sustainable implementation of any mHealth system in a clinical setting depends equally on the acceptability of the intervention to healthcare

providers, whose workflow demands, professional judgements, and institutional relationships determine whether the system is operated consistently, enthusiastically, or perfunctorily. Provider acceptability is not merely a background condition for patient-facing interventions; it is an independent implementation determinant that has received growing attention in the mHealth literature, particularly as two-way SMS systems that require staff to read and respond to patient messages create a non-trivial operational burden.

Ameyaw et al. (2025), in a qualitative study of health worker perspectives on mHealth adoption in Ghana, found that health workers valued mHealth tools that reduced administrative workload and improved patient communication, but expressed resistance when tools introduced unfamiliar responsibilities or were perceived as deprioritising face-to-face care. The two-way SMS reminder system tested in the present study creates a specific burden on clinic nurses: they must not only initiate reminders but read and interpret incoming patient responses, which may include requests for appointment rescheduling, reports of travel difficulty, or expressions of symptom concern that require clinical triage. How clinical staff at KNH's gynae-oncology clinic perceived this responsibility, whether as an extension of their care role or as an uncompensated addition to an already demanding workload, is a critical feasibility and acceptability question that this study addresses.

The mHealth literature from East Africa consistently identifies perceived workflow compatibility and manageable burden as the primary predictors of health worker acceptability. A qualitative study of health worker attitudes toward SMS-based HIV care reminders in Kenya by Braun et al. (2013) found that nurses who perceived the SMS system as reducing the volume of missed-appointment-related follow-up phone calls, work they were already doing informally, exhibited substantially higher acceptability than those who experienced it as a new and additional administrative task. This finding directly applies to the KNH context: if clinic nurses at the gynae-oncology clinic already invest informal effort in tracking patients who miss

appointments, the formalisation of this function through an SMS platform may be experienced as a workload reduction rather than an addition. Conversely, if the two-way response function generates patient queries that nurses feel unequipped to answer, for example, clinical questions about symptoms or treatment that fall outside the scope of an administrative reminder system, it may generate professional discomfort or boundary ambiguity that erodes acceptability over time. The key informant data in the present study are specifically designed to surface these provider-level dynamics.

2.3.7. Incremental Cost of Integrating Two-Way SMS Reminders into Routine Gynaecology Clinic Services

Establishing that an intervention improves a clinical outcome is a necessary but insufficient condition for health policy adoption, particularly in resource-constrained LMIC settings such as Kenya's public health system. Policymakers and health system managers require evidence not only that an intervention works but that it is affordable to implement, scalable within existing resource envelopes, and delivers value relative to the resources it consumes. For mHealth interventions specifically, where the promise of low-cost delivery is often asserted but rarely rigorously demonstrated, economic evidence is essential to substantiate the case for integration into routine services. This subsection critically reviews the evidence on the costs of SMS-based mHealth interventions, with particular attention to microcosting frameworks, the composition and drivers of incremental costs, and cost per beneficiary benchmarks from comparable LMIC contexts, to situate the economic evaluation undertaken in the present study within the existing literature and to highlight the evidential gap it addresses.

This is especially pertinent in Kenya's public health system, where Ministry of Health budget constraints mean that new interventions compete for allocation within severely limited

resource envelopes. The cost of an mHealth intervention is interpretable as affordable or not only in relation to the clinical value it delivers and the alternatives it displaces. Framing economic evidence in terms of the cost per additional timely attendee provides a directly actionable metric that health system managers at KNH can use to weigh the intervention against the operational costs of managing missed appointments, rescheduling patients, and dealing with the downstream clinical consequences of treatment discontinuity in gynae-oncology.

2.3.7.1. Economic Evaluation Methods for mHealth Interventions: Microcosting in LMIC Contexts

Economic evaluation in health encompasses a spectrum of methods ranging from simple cost analyses through cost-effectiveness analysis, cost-utility analysis, and cost-benefit analysis, each appropriate to different decision contexts and data availability constraints (Drummond et al., 2015). For pilot and feasibility studies, where the primary aim is to generate implementation data and estimate effect sizes to power a definitive trial, a full cost-effectiveness analysis is methodologically premature. This is because the sample sizes are too small to generate reliable estimates of incremental health outcomes, and the short follow-up periods do not capture the long-term health and cost consequences of the intervention. In this context, an exploratory economic evaluation using microcosting to estimate the incremental provider costs of delivering the intervention is the methodologically appropriate and widely recommended approach (Eldridge et al., 2016; Thabane et al., 2010).

Microcosting, the systematic identification, measurement, and valuation of all resource inputs consumed by an intervention, is the gold standard for estimating the true incremental costs of a new health programme in an LMIC context, particularly where standard tariff data are unavailable or unreliable (Vassall et al., 2017). The microcosting framework disaggregates total costs into start-up (one-time) and recurrent components, enabling health system managers to distinguish between fixed implementation costs and the ongoing operational costs that will

determine affordability over time. This distinction is critical for mHealth interventions: the initial costs of platform development, device procurement, and staff training are typically high relative to the scale of a pilot study but fall substantially on a per-beneficiary basis as the intervention scales up, a pattern consistently observed across the mHealth costing literature (Iribarren et al., 2017; Chen et al., 2020).

The Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist provides the international standard for transparent reporting of health economic evaluations. A systematic review of the economic evidence for mHealth interventions by Iribarren et al. (2017) synthesised 39 economic evaluations spanning 19 countries. It found an average CHEERS reporting completeness of 79.6%, and identified that behaviour change communication interventions, the category most analogous to SMS appointment reminders, had the highest rate of positive costing outcomes (74.1%), with SMS being the mHealth function most frequently associated with positive economic findings. Critically, the review found that the majority of evaluations were conducted in upper and upper-middle income countries, with sub-Saharan Africa significantly under-represented, a finding that reinforces the importance of LMIC-specific economic evaluations such as the present study.

2.3.7.2. Incremental Costs of SMS Interventions in LMIC Health Contexts: Benchmarks and Comparators

The most directly comparable published economic evaluation to the present study is the Mobile WACHX cost analysis conducted by Chen et al. (2020) in Kenya, published in JMIR mHealth and uHealth. The Mobile WACHX trial evaluated an interactive, semiautomated two-way SMS text messaging intervention to improve antiretroviral therapy adherence and retention in care among peripartum HIV-positive women at two sites in Nairobi and Western Kenya. Using microcosting methods and a public provider perspective, identical in design to the approach employed in the present study, Chen et al. (2020) estimated the weighted average

annual incremental costs of the two-way SMS arm at USD 3,725 per facility, USD 62 per beneficiary, and USD 0.85 per contact to reach 115 beneficiaries. For the one-way SMS arm, equivalent figures were USD 2,542 per facility, USD 41 per beneficiary, and USD 0.66 per contact. Personnel costs constituted the dominant cost driver, accounting for 48.2% of total two-way SMS costs, a finding the authors attributed to the additional staff time required to read, triage, and respond to incoming patient messages in the two-way design.

Several methodological features of the Chen et al. (2020) study merit critical attention for the purpose of benchmarking against the present study. First, the Mobile WACHX intervention involved semiautomated SMS delivery through a purpose-built platform, incurring significant software development and system-hosting costs that accounted for 29.9% of combined programme costs. The present study at KNH, by contrast, uses a simpler, manually managed SMS delivery approach without bespoke platform development costs, which substantially reduces the fixed cost component and thus alters the cost composition profile. Second, Chen et al. (2020) operated in a clinical trial context in which research project salaries were higher than typical Ministry of Health rates; a scenario analysis replacing research salaries with standard MOH wages reduced the cost per beneficiary by 50%, from USD 62 to USD 31, underscoring the sensitivity of mHealth cost estimates to labour valuation assumptions. Third, the Mobile WACHX study was conducted at two large urban facilities with dedicated research infrastructure, whereas the present study is embedded in a single busy national referral hospital clinic with standard staffing, making the KNH cost estimates potentially more representative of real-world deployment conditions.

A further benchmark is provided by the mHealth cost analysis conducted in Malawi by Larsen-Cooper et al. (2016), which estimated the cost of an mHealth community health worker intervention at USD 29.33 per user and USD 4.33 per successful contact, with sensitivity analyses showing costs could be reduced by 48% if the service operated at full capacity. The

consistent finding across these studies, that per-unit costs decline substantially with scale, is directly relevant to the present study's findings, which reflect pilot-scale costs with a small denominator of 61 patients. The cost per additional timely attendee estimated in the present study must therefore be interpreted as a ceiling estimate under pilot conditions, likely to decrease considerably if the intervention were integrated into routine clinic operations with a larger patient population.

In the oncology domain specifically, economic evaluations of SMS or mHealth interventions remain extremely sparse. The systematic review by Iribarren et al. (2017) identified outpatient clinic attendance as one of the three most common outcome domains for mHealth economic evaluations, but none of the included oncology-adjacent studies provided microcosting data from sub-Saharan Africa. Fischer et al.'s (2017) pragmatic evaluation of SMS appointment reminders across a large integrated safety-net health system in the United States found that SMS reminders both raised attendance rates and reduced operational costs, but reported costs in the context of a large-scale, fully automated system that is not directly transferable to a manual, small-scale LMIC deployment. The evidence gap for oncology-specific mHealth cost data from sub-Saharan Africa is therefore substantial, further underscoring the contribution of the present study.

2.3.7.3. Cost Composition: Personnel, Communication, and Hardware as the Principal Drivers

Across the mHealth microcosting literature, three cost categories consistently dominate: personnel time, communication charges (airtime and per-SMS costs), and, where applicable, hardware procurement and platform development. Understanding the relative weight of each is essential for interpreting cost estimates and for projecting the economics of scale-up. Personnel costs are universally the largest single driver in two-way SMS interventions, given the additional labour required to manage bidirectional patient

communication. Chen et al. (2020) found personnel at 48.2% of total costs in their two-way SMS arm; Iribarren et al.'s (2017) systematic review confirmed this pattern across multiple settings. This has a critical implication for scale-up planning in LMIC settings. Unlike per-message communication costs, which are relatively fixed per contact regardless of scale, personnel costs can be optimised through task-shifting, assigning SMS management to lower-cadre health workers or community health volunteers, or through automation of response functions, both of which reduce the marginal cost of each additional patient reached.

Communication costs, the per-SMS tariff multiplied by total messages sent — are highly context-specific, reflecting national mobile telecommunications pricing structures. In Kenya, the SMS tariff used in the present study (USD 0.20 per message) is consistent with published estimates for Kenyan commercial SMS rates during the study period. By comparison, Chen et al. (2020) operated on a similar Kenyan SMS cost base, while studies from other African contexts report higher per-message costs in countries with less competitive mobile markets (Iribarren et al., 2017). The relatively low per-SMS cost in Kenya is a structural advantage for SMS-based mHealth interventions and is an important contextual factor that limits the generalisability of cost estimates from higher-cost telecommunications environments.

Hardware costs in the present study were limited to the procurement of two basic mobile phones at USD 10 each, a deliberately minimal investment reflecting the low technological threshold of an SMS-based intervention relative to smartphone-dependent mHealth applications. This is a notable advantage of SMS over data-dependent digital health modalities: the capital requirements are low, the technology is widely available, and the operational skills required to manage the system are within the competency profile of standard clinical nursing staff without specialised training. The modest hardware outlay in the present study contrasts with the much larger platform development costs in studies deploying

automated or app-integrated SMS systems (Chen et al., 2020; Iribarren et al., 2017), reinforcing the practical scalability of the present intervention design.

2.3.7.4. The Cost per Additional Timely Attendee as an Efficiency Metric

The primary economic efficiency metric employed in the present study, the incremental cost per additional timely attendee, is directly interpretable by health system managers considering whether to invest in the intervention and by what margin it delivers value. Unlike cost-effectiveness ratios that require a clinical outcome denominator (such as lives saved or DALYs averted), the cost per additional timely attendee is a pragmatic, process-level metric that captures the efficiency of the intervention in achieving its proximate goal: bringing patients who would otherwise miss appointments into timely clinic attendance. This metric has precedent in the mHealth appointment reminder literature: Fischer et al. (2017) calculated operational cost savings per recovered appointment in their safety-net health system analysis, finding that SMS reminders substantially reduced the cost of recovered appointments relative to the counterfactual of missed-appointment management.

The interpretation of a cost per additional timely attendee must be contextualised against the cost of non-attendance. In oncology settings, missed appointments carry significant downstream costs: delayed recurrence detection necessitating more intensive and expensive treatment, emergency presentations that consume unplanned inpatient resources, and the operational costs of wasted appointment slots and disrupted multi-disciplinary team planning (Chen, 2023). While the present study does not conduct a full cost-offset analysis, which would require a longer follow-up period and health outcome data beyond the scope of a pilot trial, the literature consistently suggests that the downstream costs of missed oncology appointments are substantially greater than the cost of preventing them (Davey et al., 2021). In this context, even a pilot-scale cost per additional timely attendee can represent a clinically and economically

meaningful investment when weighed against the clinical consequences of non-attendance in gynae-oncology.

A further methodological consideration is the distinction between provider-perspective costs, which the present study captures, and the full societal costs of the intervention, which would additionally include patient-borne costs such as transport and time, relevant in the Kenyan context where financial barriers constitute a primary driver of non-attendance (Harsch et al., 2025). While a full societal cost analysis is beyond the scope of an exploratory pilot-embedded economic evaluation, future studies with adequate sample sizes and follow-up periods should incorporate patient-perspective cost data to generate a more complete economic picture.

2.3.7.5. Scalability and the Economics of mHealth at Scale

A recurring and theoretically well-grounded finding across the mHealth economic literature is that the per-unit cost of SMS interventions decreases substantially with scale. This is driven by the large proportion of fixed start-up costs, training, hardware, platform development, that are amortised across a growing denominator of beneficiaries as the programme scales, while marginal recurrent costs (per-message charges and incremental staff time) grow proportionally but at a lower rate. Chen et al. (2020) demonstrated this empirically: their scenario analysis projected that expanding the two-way SMS intervention to more than 500 beneficiaries would reduce the cost per beneficiary from USD 62 to USD 43, and the cost per contact from USD 0.85 to USD 0.63. Similarly, Larsen-Cooper et al. (2016) found that operating an mHealth intervention at full capacity could reduce per-user costs by 48%. These scalability economics are particularly relevant for the present study. A routine deployment serving all eligible gynae-oncology patients at KNH's outpatient clinic, which processes hundreds of patients monthly, would distribute the same start-up costs across a much larger patient base, dramatically reducing the cost per patient and per additional timely attendee.

In summary, the economic evidence reviewed in this subsection establishes four conclusions that directly contextualise the exploratory economic evaluation in the present study. First, microcosting from a provider perspective, with disaggregation into start-up and recurrent components, is the methodologically appropriate and internationally recognised approach for an exploratory economic evaluation embedded within a pilot RCT in an LMIC setting. Second, personnel costs consistently constitute the dominant driver of total programme costs in two-way SMS interventions, with per-message communication costs and hardware representing smaller but contextually variable shares. Third, the cost per beneficiary and per additional outcome achieved in the present study are broadly consistent with published benchmarks from comparable Kenyan and African LMIC mHealth microcosting studies, particularly the Mobile WChX evaluation by Chen et al. (2020), but are appropriately higher at pilot scale relative to projected routine-deployment costs. Fourth, and most critically, no published microcosting study has estimated the incremental provider costs of a two-way SMS reminder intervention in a gynae-oncology outpatient context in Kenya or the broader LMIC region, a gap that the present study's exploratory economic evaluation is uniquely positioned to begin to address.

2.3.7.6. The Cost of Non-Attendance: Contextualising the Intervention's Economic Value

A limitation of isolated cost analyses for mHealth interventions is that the cost per additional outcome achieved is interpretable as high or low only in relation to the cost of the counterfactual. In this case, the cost of a missed oncology appointment and its downstream consequences. The health economics literature on appointment non-attendance across multiple specialties consistently demonstrates that the full cost of a missed appointment substantially exceeds its face value as a wasted appointment slot, because it encompasses rescheduling administrative costs, disruption to multi-disciplinary team planning, wasted preparation of

clinical materials, and the downstream cost of managing the clinical consequences of delayed care (Dantas et al., 2018; Kheirkhah et al., 2016; Werner et al., 2023).

In oncology specifically, the downstream cost of non-attendance is particularly acute. A missed appointment in an active treatment cycle may necessitate treatment modification or restart, extending the overall treatment duration and increasing the total pharmaceutical and clinical management costs. A missed surveillance appointment at which a recurrence would otherwise have been detected results in the detection of that recurrence at a later and more advanced stage, where treatment is both more expensive and less likely to achieve remission. Chen (2023), reviewing the costs associated with non-attendance in radiation oncology in the United States, estimated that each missed appointment in an active course of radiotherapy generated administrative and rescheduling costs of USD 113 per slot, in addition to the clinical costs of treatment disruption. While this figure is not directly transferable to a Kenyan public hospital context, it establishes the principle that the economic cost of non-attendance is substantially greater than the operational inconvenience captured in simple slot-costing models.

In Kenya's public health system specifically, the cost of non-attendance at KNH's gynae-oncology clinic must be considered in the context of already severely constrained capacity. Gynae-oncology outpatient slots are a scarce resource: missed appointments are wasted capacity that cannot easily be reallocated to other patients on short notice, given the specialist clinical and multidisciplinary team coordination requirements of the clinic. The operational cost of a missed appointment at KNH includes the nursing and medical staff time allocated to a patient who does not attend, the cost of preparing clinical notes and preparing for that patient's visit, and the administrative time spent on follow-up and rescheduling. While a precise estimate of the per-appointment non-attendance cost at KNH is beyond the scope of the present pilot study, which focuses on intervention costs rather than cost-offset analysis,

contextualising the incremental cost per additional timely attendee against even a conservative estimate of the per-appointment non-attendance cost provides a directional economic argument that supports the intervention's value proposition. If the cost of preventing one missed appointment is substantially less than the direct and indirect costs of managing one missed appointment, the SMS reminder intervention represents a positive economic proposition even before accounting for the downstream clinical costs of delayed care detection.

Future definitive trials incorporating a full cost-offset analysis should collect data on the per-appointment operational costs at KNH's gynae-oncology clinic, the costs of rescheduling missed appointments, and the incremental treatment costs associated with disease progression attributable to non-attendance. Such a comprehensive economic evaluation, building on the microcosting framework established in the present pilot study, would provide the evidence base for a full cost-effectiveness analysis that directly informs Ministry of Health investment decisions on digital health integration in oncology services.

2.3.8. Integrative Conclusion

The empirical literature reviewed in this chapter establishes a clear and urgent rationale for the present study. First, the prevalence of non-attendance among oncology patients, and particularly gynae-oncology patients in LMICs, is both clinically consequential and systemically disruptive. Missed appointments delay recurrence detection, interrupt treatment continuity, and impose significant costs on already resource-constrained health systems. Yet, despite the scale of this problem, there is a striking paucity of evidence specifically documenting attendance patterns in gynae-oncology in Kenya.

Second, a spectrum of interventions to improve attendance has been explored internationally, ranging from structural approaches such as patient navigation to behavioural and communication-based strategies such as appointment reminders. While navigation programmes at Kenyatta National Hospital have demonstrated promise in reducing barriers to

care, their scalability is limited by human resource constraints. Communication-based interventions, particularly SMS reminders, offer a potentially cost-effective adjunct, but the oncology-specific evidence base in sub-Saharan Africa remains critically underdeveloped.

The evidence further demonstrates that the effectiveness of any single intervention modality is limited when structural barriers remain unaddressed. Patient navigation addresses structural and informational barriers but requires sustained human resources; SMS reminders address the forgetfulness and communication dimensions but cannot overcome prohibitive transport costs or severe health literacy deficits. The convergence of these findings points toward multi-component intervention models, in which SMS reminders function as a scalable, low-cost adjunct to the structural support provided by patient navigation and other system-level interventions, as the most promising direction for future research and implementation at KNH.

Third, the literature on the effectiveness of SMS reminders shows consistent positive effects in screening contexts and mixed but directionally encouraging results in treatment and follow-up settings. The strongest Kenyan evidence comes from Wanyoro and Kabiru's (2017) RCT on ovarian tumour rescreening, which demonstrated substantial improvements in compliance. However, no study has yet tested SMS reminders for ongoing outpatient attendance among gynae-oncology patients in a national referral hospital context.

Fourth, the feasibility and acceptability of SMS interventions in African oncology settings are broadly supported by high mobile penetration, widespread willingness to receive health messages, and positive patient attitudes toward reminders. Nonetheless, contextual barriers such as phone-sharing, literacy diversity, privacy concerns, and stigma require careful design attention. Two-way SMS, while theoretically advantageous for its interactivity, has a more limited and mixed evidence base, underscoring the need for pilot evaluation in the KNH context.

Fifth, the incremental cost evidence indicates that SMS interventions are affordable at scale, with per-beneficiary costs declining substantially as programmes expand. Microcosting studies in Kenya and Malawi confirm that personnel time is the dominant cost driver, while communication and hardware costs are modest. Yet, no published economic evaluation has estimated the incremental provider costs of a two-way SMS reminder intervention in gynaecological conditions in Kenya, leaving a critical gap in the evidence base for policy adoption.

Taken together, these findings converge on three overarching conclusions. First, that non-attendance in gynae-oncology is a significant and under-researched problem in Kenya. Second, SMS reminders are a promising, feasible, and acceptable intervention, but their effectiveness and cost in this specific context remain untested. Last, there is a critical evidential gap in oncology-specific, LMIC-based studies that integrate effectiveness, feasibility, acceptability, and cost into a single evaluation framework.

It is this gap that the present pilot randomised controlled trial at Kenyatta National Hospital is designed to address. By evaluating the effectiveness, feasibility, acceptability, and incremental cost of two-way SMS reminders for gynae-oncology patients, the study will generate contextually valid evidence to inform both clinical practice and health policy in Kenya and comparable LMIC settings.

2.4. Conceptual Framework

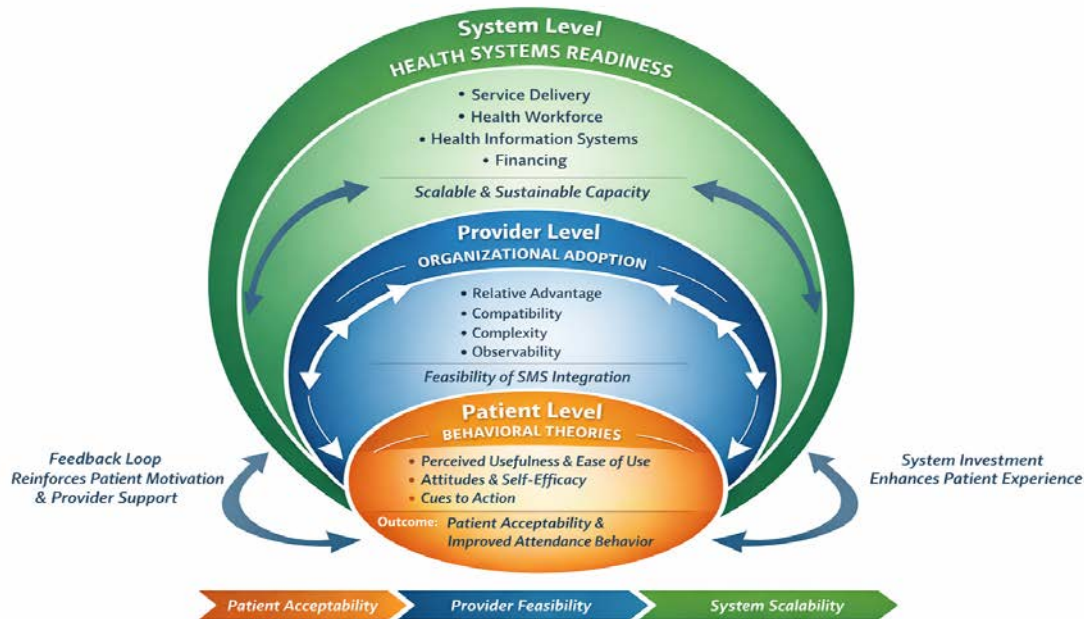
This study is guided by a multi-layered conceptual framework that integrates individual, provider, and system perspectives to explain the acceptability, feasibility, and effectiveness of two-way SMS reminders in improving clinic attendance among gynae-oncology patients at Kenyatta National Hospital (KNH) (Figure 6). The framework draws on behavioural theories (TAM, TPB, SCT), innovation adoption theory (Diffusion of Innovations), and health systems perspectives (WHO Building Blocks).

At the individual level, the TAM and TPB explain how patients' perceptions of usefulness, ease of use, attitudes, subjective norms, and perceived behavioral control shape their acceptance of SMS reminders and their intention to attend clinics. SCT complements these by highlighting the role of self-efficacy, reinforcement, and cues to action in sustaining attendance behavior. Together, these theories illuminate the mechanisms through which SMS reminders influence patient motivation, planning, and punctuality.

At the provider level, the Diffusion of Innovations framework explains how healthcare workers assess the relative advantage, compatibility, complexity, and observability of SMS reminders in their workflows. Provider endorsement and adoption are critical for feasibility, as they determine whether the intervention can be integrated into routine practice and scaled within KNH.

At the system level, the WHO Health Systems Building Blocks framework situates SMS reminders within broader infrastructural and resource considerations. Service delivery, health workforce, health information systems, and financing are all implicated in the sustainability of the intervention. This perspective highlights that feasibility and scalability depend not only on patient and provider acceptance but also on system readiness and investment.

In summary, the conceptual framework posits that patient acceptance and motivation (individual level) drive attendance behavior, provider adoption (organizational level) ensures integration into workflows, and system readiness (structural level) determines scalability and sustainability. These levels interact dynamically, with feedback loops, for example, system investment improving patient experience, or provider support reinforcing patient motivation. This integrated framework directly aligns with the study's four research questions.

Figure 6*Integrated Framework for Improving Gynae-oncological Clinic Attendance*

Source: Author's construct (2025)

The framework has several important implications for the interpretation of the present study's findings. If the quantitative results show a significant improvement in timely attendance in the intervention arm, the multi-level framework helps explain the mechanisms: did patients receive and comprehend the reminder (intervention coherence, TFA), did the reminder activate their intention to attend (TPB), did it reinforce their self-efficacy for navigation (SCT), and did clinical staff manage the two-way communication efficiently (DoI compatibility and health workforce building block)? Conversely, if effects are modest or null, the framework directs attention to system-level conditions that may have constrained the intervention's performance, poor network coverage (health information systems), high personnel burden of two-way response management (health workforce), or low patient literacy limiting message

comprehension (service delivery). This diagnostic utility of the multi-level framework is one of its principal advantages over single-theory approaches to mHealth evaluation.

The framework also has implications for the scalability and transferability of the intervention. By identifying the individual, provider, and system-level conditions under which the SMS reminder system is expected to work, the framework specifies the prerequisites that must be in place for replication in other LMIC oncology settings. A setting with equivalent mobile penetration, comparable patient health literacy, a motivated clinical team, and institutional support for digital health innovation would be expected to achieve similar outcomes; a setting with lower infrastructure readiness or weaker health system capacity would require additional system-strengthening investments before the intervention could perform at scale. This transferability analysis, grounded in the conceptual framework, extends the study's value beyond the specific KNH context.

2.5. Conclusion

Numerous research demonstrates the efficacy of SMS reminders in improving patient clinic attendance, according to the review. Nonetheless, a number of the studies employed distinct methodologies, showcased examples in diverse settings, and offered a variety of results and conclusions. According to the review, not much research has been done on how SMS reminders affect clinic attendance at KNH. The identification of bias, issues with generalizability, and disparities in a number of the research lend credence to the current investigation. Likewise, no study has focused specifically on gynecological patients. The cost of sending SMS reminders to motivate gynecological patients to attend clinics was not considered in any of the research. This knowledge gap will be addressed in the proposed study which aims to assess the feasibility and efficacy of using SMS reminders to improve clinic attendance in gynecological patients attending KNH.

The theoretical frameworks reviewed, including the Technology Acceptance Model, Social Cognitive Theory, the Theory of Planned Behaviour, the Diffusion of Innovations framework, and the WHO Health Systems Building Blocks, collectively provide a multi-level explanatory architecture for understanding not only whether the SMS reminder intervention is likely to work, but how and under what conditions. Individually, each framework captures a partial view of the adoption and behaviour change process; together, they constitute an integrated explanatory model spanning the individual patient's cognitive and motivational processes, the healthcare provider's adoption decision, and the health system's capacity to enable and sustain the intervention. This integration, formalised in the conceptual framework, ensures that the study's findings are interpreted with appropriate sensitivity to context and complexity rather than as decontextualised effect estimates.

The chapter also demonstrates the methodological richness required to address the research questions adequately. A quantitative pilot RCT alone could establish whether two-way SMS reminders improve attendance rates under controlled conditions, but would leave unanswered the questions of why and how the intervention produces its effects, whether patients find it acceptable, and at what cost it can be delivered. The mixed-methods design of the present study, embedding a qualitative acceptability study and an exploratory economic evaluation within the pilot RCT, is directly motivated by the evidential landscape reviewed in this chapter, which consistently shows that questions of implementation, acceptability, and affordability are as important as questions of efficacy for translating mHealth innovations from pilot evidence into sustainable clinical practice.

CHAPTER 3: RESEARCH METHODS

3.1. Introduction

The design procedures involved in carrying out a randomized controlled trial (RCT) are thoroughly examined in this chapter. The need of developing a precise research question and identifying the particular results or variables of interest is emphasized at the start of the chapter. The sample size is discussed in the section that follows, and it emphasizes the necessity of having a specific and manageable research topic to direct the selection of the study population.

It underlines the need of defining the target population and eligibility conditions for the study to guarantee that the participants are representative of the group being studied. This chapter also addresses how to calculate an adequate sample size to ensure statistical power and precision in the study findings. The importance of randomization is highlighted in the next portion of the chapter. It discusses the reasoning behind the participants' random assignment to various study groups in addition to highlighting its function in reducing selection bias and guaranteeing group comparability. The following section of the chapter discusses the use of interventions and control conditions. It highlights how important it is to deliver treatments in a consistent, protocol-driven way to the right study groups. The chapter also addresses problems with standard care, alternate control conditions, or placebo treatments, depending on the kind of study question and intervention under investigation.

The important procedure of gathering and analyzing data is discussed at the end of the chapter. It examines a variety of data collection techniques, including surveys, interviews, observations, and medical testing, and emphasizes the importance of accurate and reliable measures. It emphasizes the use of suitable statistical analysis to evaluate the efficacy of the intervention and compare results between groups. All things considered, this chapter offers a thorough summary of the design procedures needed to carry out a randomized control trial. It provides direction and insights on how to develop research questions, calculate sample sizes,

carry out interventions, randomize participants, and analyze data. Using references to recent peer-reviewed literature and textbooks, the chapter supports the methodologies approach and explains why the selected design is best for accomplishing the goals of the study.

3.2. Research Design, Methodology, and Philosophy

The methodological framework used to operationalize the study objectives is described in this section. It outlines the strategic strategy and structural design used to answer the research questions, as well as the study's philosophical stance. Given that the study sought to evaluate the effectiveness of a two-way SMS reminder intervention while simultaneously examining feasibility, acceptability, and implementation cost within a real-world clinical context, careful consideration was required in selecting an approach capable of integrating experimental rigour with contextual inquiry.

Accordingly, this section presents: 1) the philosophical foundations guiding the study; 2) the research approach underpinning the integration of quantitative and qualitative strands; and 3) the specific research design employed to implement the intervention and assess outcomes. The alignment between philosophy, approach, and design ensures methodological coherence and strengthens the internal validity and practical applicability of the study findings.

3.2.1. Research Philosophy

Research philosophy provides the foundational assumptions regarding ontology (the nature of reality), epistemology (the nature of knowledge), and methodology (the process of inquiry), which together shape the design and conduct of research (Saunders et al., 2019). The philosophical stance adopted in a study determines how phenomena are conceptualised, how evidence is generated, and how findings are interpreted.

This study was grounded in pragmatism, a paradigm widely associated with mixed-methods research (Tashakkori & Teddlie, 1998; Creswell & Plano Clark, 2018). Pragmatism emerged as a response to the perceived incompatibility between positivist and interpretivist

traditions and rejects the forced dichotomy between quantitative and qualitative approaches. Instead, it prioritises the research problem and practical consequences of inquiry over strict adherence to any single philosophical doctrine (Morgan, 2007).

Ontologically, pragmatism assumes that reality can be both singular and multiple depending on the dimension of inquiry. In the context of this study, clinic attendance constitutes an objective and measurable outcome, consistent with post-positivist assumptions that reality can be approximated through systematic observation (Bryman, 2020). Conversely, patients' perceptions of the feasibility and acceptability of SMS reminders reflect socially constructed meanings, aligning with interpretivist perspectives that emphasise subjective experience (Bazeley, 2022).

Epistemologically, pragmatism permits the integration of empirical measurement with experiential understanding. The randomised controlled trial component of this study aligns with post-positivist epistemology, seeking to generate statistically verifiable evidence regarding the effectiveness of two-way SMS reminders. At the same time, the qualitative component draws on interpretivist principles to explore contextual and experiential dimensions of intervention acceptability (Creswell & Poth, 2018).

Methodologically, pragmatism supports the use of mixed methods when such integration enhances the comprehensiveness and applicability of findings (Tashakkori & Teddlie, 1998; Creswell & Plano Clark, 2018). Given that this study sought not only to determine effectiveness but also to examine feasibility, acceptability, and implementation cost within a real-world hospital setting, a pragmatic paradigm was considered most appropriate. This orientation enabled the combination of experimental rigour with contextual insight, thereby strengthening both internal validity and practical relevance for health system decision-making.

3.2.2. Research Approach

The research approach provides the overarching logical framework that guides how a study addresses its research problem. It determines how evidence is conceptualised, how different forms of data are positioned relative to one another, and how conclusions are derived. While research philosophy defines the foundational assumptions of a study, the research approach operationalises those assumptions into a coherent strategy of inquiry.

Broadly, research approaches may be quantitative, qualitative, or mixed-methods. Quantitative approaches are typically deductive in nature, involving hypothesis formulation, variable measurement, and statistical testing (Mohajan, 2020). They are particularly suited for examining relationships between variables and estimating the magnitude of intervention effects. Qualitative approaches, in contrast, are commonly inductive, focusing on exploring meanings, experiences, and contextual influences that shape observable outcomes (Tomaszewski et al., 2020).

However, complex health service interventions often require more than a single methodological lens. Evaluating an intervention such as two-way SMS reminders in a clinical oncology setting involves not only determining whether the intervention improves clinic attendance, but also understanding how it is perceived by patients, whether it is feasible within operational workflows, and whether it is acceptable in the sociocultural context in which it is implemented. A singular quantitative or qualitative approach would therefore provide only partial insight.

In recognition of this complexity, this study adopted a mixed-methods research approach. Mixed-methods research intentionally combines quantitative and qualitative strategies within a single inquiry to generate a more comprehensive understanding of the phenomenon under investigation (Creswell & Plano Clark, 2018; Tashakkori & Teddlie, 1998).

It reflects an integrative logic of inquiry in which numerical trends and experiential insights are viewed as complementary rather than competing forms of evidence.

Importantly, mixed-methods research is not defined solely by the collection of different types of data. Rather, it requires deliberate integration, either during design, data collection, analysis, or interpretation. In this study, integration was conceptualised at the planning stage, with each methodological strand designed to address specific but interconnected research objectives. The quantitative strand was structured to generate measurable evidence regarding intervention outcomes, while the qualitative strand was intended to provide explanatory depth concerning feasibility and acceptability. The cost component further extended the approach by incorporating an applied health systems perspective.

The research approach in this study was therefore characterised by methodological complementarity. Deductive reasoning underpinned the hypothesis-driven evaluation of clinic attendance outcomes. Inductive reasoning informed the exploration of participant perceptions regarding SMS reminders. Abductive reasoning occurred at the interpretive stage, where findings from both strands were synthesised to produce the most plausible and contextually grounded explanations for observed effects.

Adopting a mixed-methods approach strengthened the study in several ways. First, it enhanced explanatory power by linking outcome measurement with contextual interpretation. Second, it improved practical relevance by incorporating implementation considerations alongside effectiveness estimation. Third, it mitigated the limitations inherent in relying on a single methodological tradition.

Thus, the research approach adopted in this study reflects a structured integration of quantitative and qualitative strategies aligned with a pragmatic philosophical stance. This integrative logic enabled the study to move beyond simple effectiveness testing to generate multidimensional evidence relevant for clinical practice and health system decision-making.

3.2.3. Research Design

This study employed a pilot parallel-arm randomised controlled trial (RCT) design with an embedded qualitative component and exploratory cost analysis. The randomised controlled trial is widely regarded as the most rigorous experimental design for evaluating the effectiveness of health interventions due to its ability to minimise selection bias and enhance internal validity through random allocation (Hulley et al., 2013; Rosenberger & Lachin, 2016). In experimental research, the investigator actively introduces an intervention and observes its effect on a predefined outcome while controlling for potential confounders.

This design's main goal was to find out if a two-way short message service (SMS) reminder system improves gynae-oncology patients' clinic attendance at Kenyatta National Hospital. In order to achieve comparability between groups at baseline, random assignment to intervention and control groups is used. This ensures that observed differences in attendance outcomes can be more confidently attributed to the intervention rather than systematic pre-existing differences. The study followed a parallel-group structure in which participants were allocated in a 1:1 ratio to either:

1. Intervention arm: receipt of structured two-way SMS reminders before scheduled clinic appointments;
2. Control arm: receipt of standard care without SMS reminders.

The trial was conducted over three months. Each participant remained in their assigned arm throughout the duration of follow-up, and no crossover occurred.

This study was designed as a pilot randomised trial. Pilot trials are conducted to assess feasibility, recruitment processes, acceptability, and preliminary estimates of intervention effect prior to larger-scale definitive trials (Siddaway et al., 2019). In addition to estimating intervention effectiveness, this design allowed the study to evaluate operational processes such as SMS delivery systems, participant engagement, and integration into existing clinic

workflows. The pilot structure, therefore, aligned with the broader objectives of feasibility and acceptability assessment.

Randomisation was conducted using a computer-generated random sequence, ensuring unpredictability of allocation. Block randomisation with varying block sizes was employed to maintain balance between study arms throughout the recruitment period while preserving allocation concealment. Participants were randomised before appointment scheduling, ensuring that allocation was not influenced by clinic timing or administrative processes. Allocation codes were prepared in sealed, opaque, sequentially numbered envelopes. These envelopes were opened only after participant eligibility had been confirmed and informed consent obtained.

Allocation concealment was maintained to minimise selection bias. Recruiters and enrolling staff were unaware of upcoming assignments and could not predict allocation sequences. The allocation was revealed only at the point of assignment after enrollment procedures were completed. This process ensured that recruitment decisions were not influenced by knowledge of group assignment.

Due to the nature of the intervention, blinding of participants and healthcare providers was not feasible. Participants were aware of whether they received SMS reminders, and clinic staff could reasonably identify participants receiving messages. Therefore, the study was conducted as an open-label trial. However, the primary outcome, clinic attendance, was obtained from hospital attendance records rather than self-report, thereby reducing detection bias and enhancing outcome objectivity.

The randomised design strengthened internal validity by distributing both known and unknown confounding variables across study arms. With the inclusion of disease stage data (predominantly Stage I and II patients), baseline comparability could be assessed more

rigorously in subsequent analysis. Random allocation reduces systematic differences between groups, thereby enhancing causal inference.

Furthermore, the primary outcome, timely clinic attendance, was objectively verifiable through clinic administrative records. This minimised information bias and eliminated reliance on participant recall. Notably, there was no attrition during follow-up, as attendance outcomes were extracted from hospital records for all enrolled participants.

While the RCT formed the quantitative backbone of the study, it was embedded within a broader mixed-methods design. The qualitative component complemented the experimental structure by exploring participants' perceptions of feasibility and acceptability, thereby contextualising quantitative findings. Additionally, an exploratory cost analysis was incorporated to estimate incremental resource requirements associated with implementing SMS reminders within routine service delivery.

The choice of a randomised controlled design was informed by the need to establish causal inference regarding the effectiveness of SMS reminders. Observational designs, while informative, are susceptible to confounding and selection bias. Randomisation, when properly implemented and concealed, minimises systematic differences between groups and strengthens confidence that outcome variations are attributable to the intervention itself.

In summary, this study utilised a pilot parallel-arm randomised controlled trial with embedded qualitative and exploratory cost components. The design combined experimental rigour with practical implementation assessment, thereby generating evidence not only on effectiveness but also on feasibility and real-world applicability within a national referral hospital context.

3.3. The Research Study's Population and Sample

This section describes the study setting, target population, eligibility criteria, and sampling procedures employed in the randomised controlled trial and qualitative components.

A clear specification of the study population and sampling framework is essential to establish the scope of inference, ensure internal validity, and support transparency in participant selection. In experimental research, the precision with which the study population is defined determines the generalisability of findings and the degree to which observed effects can be attributed to the intervention rather than to systematic differences between groups (Eldredge, Weagel, & Kroth, 2014). For this pilot RCT, the population specification was therefore designed to be both clinically precise, ensuring that participants were appropriately similar in their diagnosis, treatment trajectory, and attendance requirements, and practically achievable within the operational constraints of the KNH Gynae-oncology Clinic.

3.3.1. Study Area

The study was conducted at Kenyatta National Hospital (KNH) in Nairobi, Kenya. KNH is the largest public referral and teaching hospital in the country and functions as a Level 6 national referral facility. Established in 1901, the hospital has grown to a capacity of approximately 1,800 beds and serves patients from across Kenya and neighbouring East and Central African countries.

KNH provides highly specialised services, including oncology, cardiothoracic surgery, neurosurgery, renal transplantation, and critical care services. As a national referral centre, it receives complex cases from lower-tier public hospitals that lack specialised oncology services. At the time of the study, comprehensive cancer care in Nairobi was available primarily at KNH and a limited number of private institutions, which are often financially inaccessible to a large proportion of the population.

The gynae-oncology clinic is an outpatient unit located within the oncology department and operates weekly. It manages patients diagnosed with cervical, ovarian, uterine, vulvar, and vaginal cancers. The clinic receives referrals from across the country and serves as a major treatment centre for women with gynaecological malignancies.

The selection of KNH as the study site was informed by:

1. Its high patient volume;
2. Its central role in national cancer referral services;
3. The documented challenge of clinic non-attendance; and
4. The presence of existing digital infrastructure capable of supporting SMS-based communication.

The Gynae-oncology Clinic operates as a weekly outpatient service within the oncology department and manages approximately 60 patients per month across all stages of gynaecological malignancy. The clinic is staffed by consultant gynae-oncologists, clinical nurses, and nursing officers who collectively manage patient assessment, treatment monitoring, and follow-up scheduling. Patients are typically required to attend multiple times over their treatment and surveillance trajectory, making consistent appointment adherence a critical determinant of care quality. The clinic also functions as a training facility for postgraduate medical and nursing students, providing a teaching component to its operating mission. The choice of KNH as the study site was thus motivated not only by its patient volume and institutional character, but by the specificity of the attendance challenge documented within the Gynae-oncology Clinic itself, where non-attendance rates of 61.1% (2022) and 49.9% (2023) had been formally recorded in hospital administrative data, providing an unambiguous and measurable starting point for intervention evaluation. Conducting the study within this specific institutional context enhanced the relevance and potential scalability of findings within the Kenyan health system.

3.3.2. Population of the Research Study

The target population comprised adult female patients diagnosed with gynaecological cancers who were receiving follow-up care at the KNH Gynae-oncology clinic during the study period. This population was defined by a shared clinical trajectory, a confirmed gynaecological

malignancy diagnosis, an established outpatient follow-up schedule, and access to a mobile communication device, that made them both clinically appropriate and logistically eligible for the SMS reminder intervention. The accessible population consisted of patients attending scheduled outpatient appointments during the recruitment phase, of whom the majority are at Stage I or Stage II at the time of follow-up, reflecting the clinical composition of post-treatment surveillance attendees. The patient profile is heterogeneous with respect to cancer type, encompassing cervical, ovarian, uterine, vulvar, and vaginal malignancies, as well as by age, educational attainment, and socioeconomic status, all of which were recognised as potential sources of variation in attendance behaviour and SMS engagement. This heterogeneity was addressed in the study design through stratified analysis of covariates rather than through population restriction, thereby preserving the generalisability of findings to the broader Gynaecology Clinic patient base. The trial was conducted over six months, allowing adequate recruitment to achieve the required sample size. Healthcare providers were also included to provide their insights to enrich the study. These were health information officers, nurses, nurse managers, and oncologists in the clinic where patients were seen.

3.3.2.1. Inclusion Criteria

Participants were eligible for inclusion if they:

1. Were female patients aged 18–70 years;
2. Had a confirmed diagnosis of gynaecological cancer (cervical, ovarian, uterine, vulvar, or vaginal cancer);
3. Were scheduled for follow-up appointments at the KNH gynaecology clinic;
4. Had access to a mobile phone capable of sending and receiving SMS messages (either personally or through a trusted proxy); and
5. Were able to provide informed consent.

The inclusion of patients with access to mobile phones was essential, given that the intervention required receipt and potential response to SMS reminders. Restricting participation to adults ensured legal capacity for informed consent.

Disease stage data were obtained and incorporated into the analysis. The majority of participants were classified as Stage I or Stage II at recruitment, reflecting the clinical composition of patients attending follow-up services during the study period.

3.3.2.2. *Exclusion Criteria*

Patients were excluded if they:

1. Were critically ill or clinically unstable at the time of recruitment;
2. Were unable to provide informed consent;
3. Did not have reliable access to a mobile phone;
4. Were not scheduled for ongoing outpatient follow-up during the study period.

Patients with other chronic illnesses, such as hypertension or diabetes, were not excluded solely on that basis unless such conditions impaired their ability to participate. These exclusion criteria were designed with three principles in mind. First, clinical safety: critically ill or unstable patients were excluded because the demands of trial participation, including responding to SMS messages and attending four consecutive appointments, could have placed undue burden on patients whose primary clinical need was stabilisation rather than routine outpatient follow-up. Second, intervention feasibility: patients without reliable mobile phone access could not have received the SMS reminder and would therefore have been unable to benefit from the intervention or contribute to the primary outcome measurement. Third, ethical protection: patients unable to provide informed consent were excluded to ensure that participation was genuinely voluntary and that the study did not inadvertently enrol participants who could not fully understand or exercise their right to withdraw. Importantly, exclusion criteria were applied conservatively. Patients with comorbid chronic conditions were not

excluded unless those conditions directly impaired participation capacity, ensuring that the trial sample remained representative of the diverse clinical reality of gynaecological follow-up care at KNH.

3.3.3. Sample Size and Sampling Procedure

3.3.3.1. Sample Size Determination

Sample size estimation was undertaken to ensure adequate statistical power to detect a meaningful difference in clinic attendance between the intervention and control groups. The calculation was based on a two-sided test of proportions, assuming equal sample sizes in each arm and a 1:1 allocation ratio. The formula applied was:

$$n \text{ per group} = \frac{2\delta^2(Z_{1-\alpha/2} + Z_{1-\beta})^2}{\delta_0}$$

where n represents the required sample size per group, $Z_{1-\alpha/2}$ is the standard normal deviate corresponding to the chosen level of significance, $Z_{1-\beta}$ is the normal deviate corresponding to the desired statistical power, δ is the assumed difference in proportions between the two groups, and δ_0 is the clinically acceptable margin of error.

For this study, the level of significance was set at 5% ($\alpha=0.05$), corresponding to $Z_{1-\alpha/2}=1.96$. Statistical power was set at 90% ($\beta=0.10$), corresponding to $Z_{1-\beta}=1.28$. The expected proportion of timely attendance in the intervention group was assumed to be 0.90, based on evidence from similar mHealth interventions in chronic disease contexts, while the control group proportion was assumed to be 0.55, reflecting baseline attendance challenges documented in oncology follow-up settings. The difference in proportions ($\delta=P_2-P_1$) was therefore 0.35. A clinically acceptable margin of error was set at 0.05.

Substituting these values into the formula yielded:

$$n = \frac{2 * (0.35)^2 (1.96 + 1.28)^2}{0.05} = 51.4382$$

Thus, the minimum required sample size was approximately 51 participants per group. To account for potential attrition, a 20% adjustment was applied, resulting in a final sample size of 61 participants per group and a total of 122 participants.

In practice, no attrition occurred during the conduct of the trial, as attendance outcomes were extracted directly from clinic administrative records, ensuring complete follow-up for all randomised participants. Beyond statistical considerations, the chosen sample size was also appropriate for the pilot nature of the study, providing sufficient data to estimate preliminary effect sizes, assess feasibility parameters, and inform the design of future larger-scale trials.

For the qualitative component of the study, two focus group discussions made up of six participants each were held, together with four key informant interviews with healthcare professionals. Thus, there were 18 participants in this phase.

3.3.3.2. Sampling Procedure

Eligible participants were recruited consecutively from patients attending scheduled clinic appointments during the recruitment period. Consecutive sampling minimised selection bias while ensuring feasibility within the clinic workflow. Following eligibility confirmation and informed consent, participants were randomly assigned to either the intervention or control arm using a computer-generated block randomization sequence with varied block sizes to ensure allocation balance.

Sealed, opaque, sequentially numbered envelopes that were produced ahead of time were used to assure allocation concealment. Envelopes were opened only after enrollment procedures were completed. Recruiters were unaware of upcoming assignments before allocation. A total of 122 participants were randomised in a 1:1 ratio:

1. 61 participants assigned to the intervention group;
2. 61 participants were assigned to the control group.

All randomised participants were included in the analysis.

For the qualitative component, purposive sampling was used to select participants from the intervention arm for focus group discussions. Two focus group sessions were conducted, each comprising six participants, to explore perceptions of feasibility and acceptability. Additionally, purposive sampling was used in selecting the four key informant interviews were conducted with healthcare professionals working within the gynae-oncology clinic, including nurses, nurse managers, oncologists, and health information officers. These interviews provided institutional perspectives on implementation feasibility and operational considerations. The qualitative sample size was guided by informational adequacy and thematic saturation rather than statistical power.

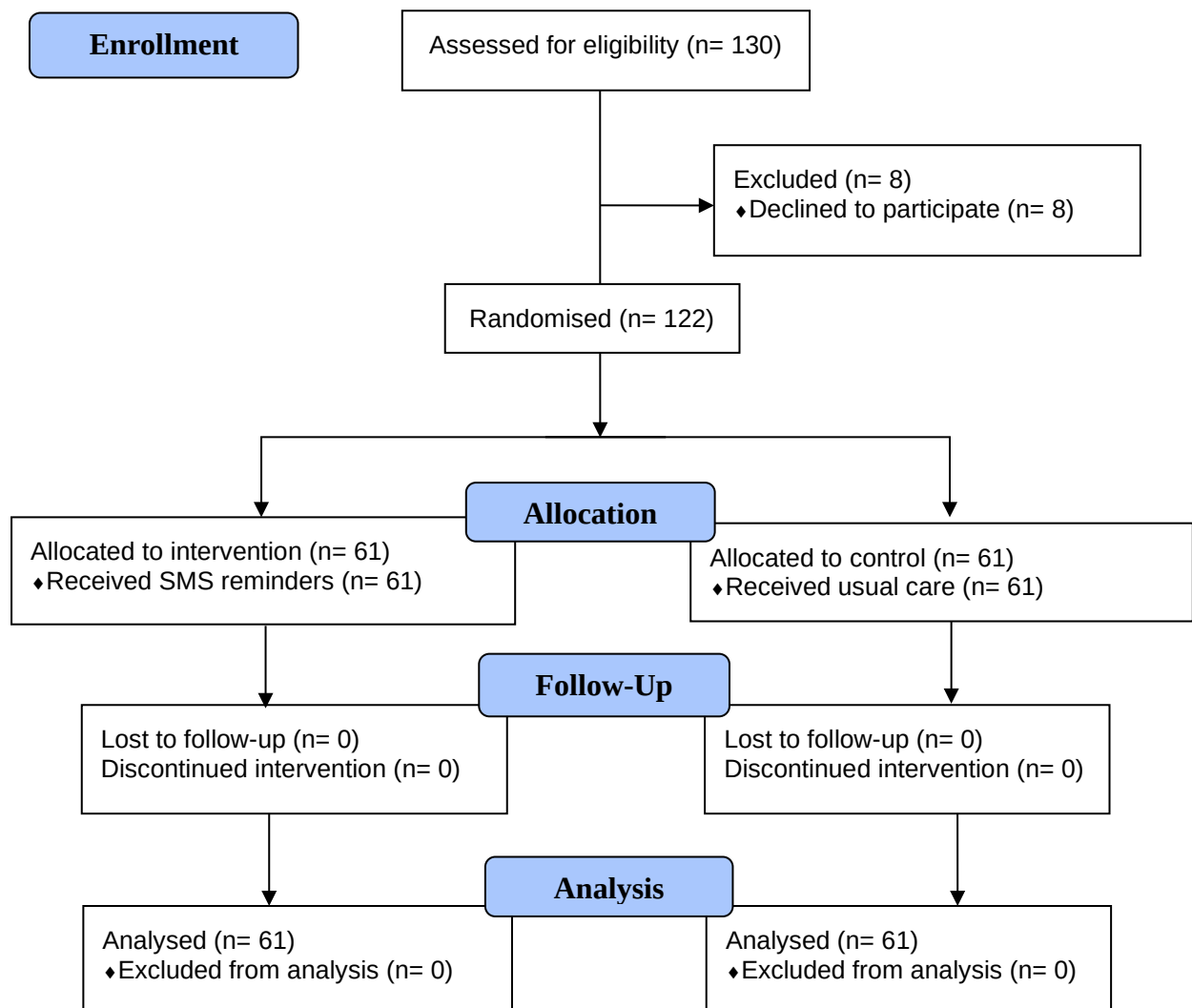
3.3.4. Participant Flow (CONSORT Diagram)

Transparency of recruitment and randomization was documented using the CONSORT 2010 flow diagram, which is the internationally recommended reporting standard for parallel-arm randomised trials. A total of 130 patients were screened for eligibility during the recruitment phase, of whom eight declined to participate and were therefore excluded prior to randomisation. No patients were excluded on the basis of clinical ineligibility, reflecting the conservative exclusion criteria applied. The remaining 122 participants were randomised in a 1:1 ratio to the intervention arm (n=61) and the control arm (n=61). Baseline comparability between arms was confirmed at the point of randomisation, with no statistically significant differences in sociodemographic or clinical characteristics between groups. Complete follow-up was achieved for all 122 randomised participants, with zero attrition during the six-month trial period. This was made possible by the use of hospital administrative attendance records as the primary data source, which eliminated the risk of participant-initiated dropout from outcome measurement. All 122 participants were therefore included in the intention-to-treat analysis, ensuring that the estimated intervention effect reflected the full randomised sample rather than a selected completers sub-group as the outcome data were extracted from hospital

records for all participants. Figure 7 presents the CONSORT flow diagram summarising participant progression through the trial.

Figure 7

Participant Flow



Source: Author's construct (2025)

3.4. Materials/Instrumentation of Research Tools

This section describes the instruments and data collection tools employed in the quantitative and qualitative components of the study. It details their origin, development

process, structure, validation procedures, reliability assessment, and operational application within the randomised controlled trial framework.

Given the mixed-methods design of the study, multiple instruments were utilised to capture outcome, feasibility, acceptability, and contextual implementation data. These included:

1. A structured patient questionnaire
2. A focus group discussion (FGD) guide
3. A key informant interview (KII) schedule
4. Clinic attendance extraction forms (secondary data tool)
5. The SMS intervention platform (intervention instrument)

Each instrument was designed or adapted to align directly with the study objectives and research questions. The selection of multiple instruments reflected the mixed-methods design of the study, in which the quantitative instruments generated outcome and implementation data suitable for statistical analysis, while the qualitative instruments enabled the collection of contextual, experiential, and explanatory data that cannot be captured through structured surveys alone. The instruments were developed sequentially, with the quantitative questionnaire finalized prior to the qualitative guides to ensure that the FGD and KII topics could be deliberately oriented toward exploring dimensions of feasibility and acceptability that the questionnaire was not designed to capture in depth. Together, the five instruments provided complementary and mutually reinforcing data streams that supported a comprehensive evaluation of the two-way SMS reminder intervention across its effectiveness, feasibility, acceptability, and economic dimensions.

3.4.1. Quantitative Instrument: Structured Patient Questionnaire

3.4.1.1. Instrument Origin and Development

The origin of the study instrument was grounded in a comprehensive search of peer-reviewed empirical literature aimed at identifying validated tools that measure clinic attendance behaviour, acceptability of mHealth interventions, and feasibility of SMS-based reminders in oncology populations. The search strategy encompassed electronic databases including PubMed, Scopus, and Web of Science, and was supplemented by manual review of reference lists from relevant articles from 2000–2022. Keywords combined terms such as *oncology*, *clinic attendance*, *mHealth*, *SMS reminders*, *acceptability*, and *low- and middle-income countries*.

Although several scales assessing mHealth acceptability were identified in the broader chronic disease context, particularly in relation to HIV care and diabetes management, no instrument was found that specifically addressed clinic attendance behaviour and two-way SMS reminder acceptability within a gynae-oncology outpatient setting in a low- and middle-income country. This gap underscored the need to develop a context-specific instrument aligned with the study objectives and population characteristics.

Instrument development was guided by established principles of survey design and scale construction (DeVellis, 2017; Boateng et al., 2018). The process began with the identification of relevant constructs from the literature, including patient engagement, communication clarity, perceived feasibility, and cultural appropriateness of digital interventions. These constructs were systematically mapped to the predefined research objectives to ensure conceptual alignment. An initial item pool was drafted to reflect each construct, with attention to clarity, brevity, and avoidance of technical jargon.

The draft instrument underwent expert review by academic supervisors, clinical oncology specialists at Kenyatta National Hospital, and health systems researchers. Their

feedback focused on item relevance, clinical appropriateness, and contextual sensitivity. Ambiguous items were reworded, redundant items were removed, and language was simplified to enhance accessibility for patients with diverse educational backgrounds. The instrument was also reviewed by members of the University of Nairobi–KNH Ethics and Research Committee, ensuring that ethical and cultural considerations were incorporated into its design.

This iterative development process ensured that the final questionnaire was conceptually robust, clinically relevant, and contextually appropriate for use in a gynae-oncology outpatient setting in Kenya. Combining evidence from the literature with expert and ethical review ensured that the study produced a tailored instrument capable of capturing both behavioural and perceptual dimensions of clinic attendance and digital health intervention acceptability.

3.4.1.2. Structure of the Questionnaire

The questionnaire comprised three major sections labelled A through C. Section A covered participants' sociodemographic and clinical characteristics, including age, educational level, employment status, marital status, cancer type, and disease stage. These variables served both descriptive and analytical purposes, providing data for baseline comparability assessment and covariate adjustment in the regression models. Section B focused on the acceptability of the two-way SMS reminder intervention and comprised five thematic components: perceived usefulness of the reminder, clarity and comprehensibility of message content, appropriateness of timing and frequency, willingness to continue receiving SMS reminders in the future, and perceived impact on attendance motivation. Each component was measured using a five-point Likert scale anchored at 1 (strongly disagree) and 5 (strongly agree), with higher scores indicating more favourable perceptions. Section C captured participants' self-reported barriers to clinic attendance, including financial constraints, transport difficulties, forgetfulness, competing household responsibilities, and health system-related barriers. It also covered

documentation compliance, comprising possession of required documents and completion of required investigations prior to clinic attendance. Responses to Section C were analysed descriptively to characterise the pre-existing attendance challenge and contextualise the potential mechanisms through which SMS reminders could address specific barrier types. Attendance outcome, however, was primarily verified using clinic administrative records to enhance objectivity.

3.4.1.3. *Validity Assessment*

The validity of the questionnaire was established through a multi-stage process designed to ensure that the instrument accurately captured the constructs under investigation and was appropriate for use in the study population. Content validity was assessed through expert review. A panel comprising clinical oncology specialists and health systems researchers examined the questionnaire items for relevance, clarity, representativeness of constructs, and cultural appropriateness. Their evaluation ensured that each item reflected the intended domain and that the overall instrument adequately covered the breadth of concepts related to patient acceptability and adherence. Feedback from this process led to several refinements, including the rewording of ambiguous items, the removal of redundant questions, and the simplification of technical language to enhance accessibility for patients with varying levels of health literacy.

Construct validity was conceptually supported by the theoretical mapping of questionnaire domains to predefined constructs of the study objectives. Each domain was mapped to specific theoretical constructs underpinning the research, such as patient engagement, communication effectiveness, and perceived feasibility of digital interventions. This mapping process demonstrated that the instrument was theoretically grounded and capable of measuring the constructs central to the study's conceptual framework.

Face validity was further evaluated during pilot testing. Participants were asked to comment on the clarity, comprehensibility, and perceived relevance of the items. Their

feedback confirmed that the questions were understandable and culturally appropriate, thereby reinforcing confidence that the instrument would be interpreted as intended in the main study.

All together, these validity assessments assured that the questionnaire was both conceptually sound and contextually appropriate. The iterative refinement process strengthened the credibility of the instrument and enhanced its utility for generating reliable data in the main trial. The study ensured that the instrument achieved methodological rigour while remaining sensitive to the cultural and clinical realities of the target population.

3.4.1.4. Pilot Testing and Field Testing

Prior to full implementation, the questionnaire underwent pilot testing with a small subset of eligible patients who were not included in the main trial. The purpose of the pilot was to evaluate the comprehensibility of items, the average completion time, the clarity of response options, and the cultural sensitivity of the instrument. Twelve respondents participated in the pilot, representing approximately 10% of the target population, which is consistent with methodological recommendations for pilot sample sizes (Kistin & Silverstein, 2015).

Feedback from the pilot was systematically reviewed and informed several refinements to the instrument. Technical terminology was rephrased into more accessible language to improve respondent understanding, Likert scale anchors were adjusted to reduce ambiguity, and instructions were simplified to facilitate ease of completion. The pilot also provided an opportunity to assess logistical feasibility, including whether the questionnaire could be administered within the routine workflow of the gynae-oncology clinic without disrupting service delivery. This step was critical in ensuring that the instrument was not only valid but also practical in the real-world clinical environment.

Following pilot testing, the internal consistency reliability of the acceptability scale was evaluated using Cronbach's alpha coefficient. A threshold value of 0.70 was considered acceptable for exploratory research, in line with established psychometric standards (Nunnally

& Bernstein, 1994). All items retained in the final instrument achieved alpha values above this threshold, and the overall scale recorded a Cronbach's alpha of 0.73. This result indicated acceptable internal consistency and supported the reliability of the instrument for use in the main study.

The combination of cognitive testing, logistical assessment, and psychometric evaluation during the pilot phase strengthened the methodological robustness of the study. It ensured that the questionnaire was culturally appropriate, operationally feasible, and statistically reliable, thereby enhancing confidence in the validity of data collected during the main trial.

3.4.2. Secondary Data Instrument: Clinic Attendance Extraction Tool

The primary outcome of interest in this study was timely clinic attendance, which was assessed using routinely collected hospital administrative records. To facilitate systematic and consistent data capture, a standardised clinic attendance extraction tool was designed specifically for this research. This instrument enabled the structured retrieval of information from patient files and appointment registers, ensuring that all relevant variables were recorded in a uniform manner across participants. The tool captured the scheduled appointment date recorded in the clinic register, the actual attendance date, the required documentation status, and completion of scheduled investigations.

Attendance was operationalised according to the clinic's established policy, which defined adherence as arrival on the exact scheduled appointment date or within a short, acceptable window surrounding that date. This operational definition provided a clear and objective benchmark for evaluating whether patients maintained continuity of care. By grounding the measurement in institutional policy, the study ensured that the outcome was both clinically meaningful and contextually appropriate to the realities of service delivery at the study site.

The reliance on administrative records offered several methodological advantages. Unlike self-reported measures, which are vulnerable to recall bias and social desirability effects, hospital records provide contemporaneous documentation of patient behaviour. This reduced the likelihood of inaccuracies that often arise when patients are asked to retrospectively report their attendance patterns. Furthermore, because the data were extracted directly from routine clinical documentation, the measurement process was independent of patient or provider perceptions, thereby strengthening the objectivity of the outcome assessment.

Overall, the use of a standardised extraction tool applied to hospital administrative records enhanced the internal validity of the study. It ensured that the primary outcome was measured consistently across all participants, minimised common sources of bias, and provided a reliable foundation for evaluating the effectiveness of the intervention. This approach also increased the translational value of the findings, as the outcome measure reflected real-world operational definitions of attendance that are directly relevant to clinical practice and health system management.

3.4.3. SMS Intervention Platform and Fidelity Monitoring

In this study, the two-way SMS reminder system functioned not only as an intervention but also as a structured implementation instrument within the randomised controlled framework. Because the validity of trial outcomes depends on consistent and standardised delivery of the intervention, the SMS platform was designed to ensure uniform message content, timing, and response functionality across all participants allocated to the intervention arm.

The system was programmed to deliver appointment reminders prior to scheduled clinic visits. Each message included the appointment date, time, and any relevant instructions regarding required documentation or investigations. The language used in the messages was concise, culturally appropriate, and free of technical terminology to accommodate varying

literacy levels among patients. Message content was developed collaboratively with clinical oncology staff to ensure clinical accuracy and contextual relevance. Prior to implementation, draft messages were reviewed and refined to enhance clarity and appropriateness for the target population.

A two-way functionality was incorporated into the platform to allow patients to confirm attendance or communicate constraints affecting their ability to attend. This feature was included to enhance patient engagement and to assess the acceptability and feasibility of interactive digital communication within the outpatient oncology setting.

To preserve intervention fidelity, message scheduling and dispatch were automated using a centralised system. This minimised the risk of human error in delivery timing and ensured that all participants in the intervention group received reminders according to the same protocol. Delivery logs were routinely monitored to verify successful message transmission. Where feasible, receipt confirmations were documented to assess system performance and ensure consistent exposure to the intervention.

Standardisation of message content, automation of delivery, and monitoring of dispatch logs collectively strengthened intervention fidelity. These safeguards reduced variability in exposure, minimised implementation bias, and enhanced confidence that any observed differences in clinic attendance were attributable to the intervention rather than inconsistencies in its delivery. The SMS platform was carefully structured and monitored to function as a reliable and replicable digital health intervention within the trial design.

3.4.4. Focus Group Discussion (FGD) Guide

Focus Group Discussions (FGDs) were conducted to explore participants' perceptions, experiences, and contextual interpretations of clinic attendance behaviour and the SMS reminder intervention. A semi-structured FGD guide was developed specifically for this study,

informed by the overarching research objectives and the broader literature on mHealth implementation and patient engagement in oncology care.

The guide was organised around key thematic domains, including barriers and facilitators to clinic attendance, perceived usefulness of SMS reminders, communication clarity and cultural appropriateness, gender and social influences affecting attendance, and the acceptability of two-way digital interaction. Questions were deliberately open-ended and sequenced to move from general experiences to more specific reflections on the SMS intervention. Probing questions were incorporated to encourage elaboration, clarification, and the exploration of nuanced perspectives.

The design of the guide emphasised flexibility, allowing moderators to adapt to the flow of discussion while ensuring systematic coverage of constructs aligned with the study's conceptual framework. Draft versions of the guide were reviewed by academic supervisors and clinical experts to ensure clinical appropriateness, contextual sensitivity, and alignment with explanatory objectives. Minor modifications were made to refine wording, reduce technical jargon, and ensure cultural resonance, strengthening the credibility and contextual sensitivity of the instrument. This iterative process strengthened the credibility of the guide and enhanced its utility for eliciting rich qualitative data.

3.4.5. Key Informant Interview (KII) Guide

Key Informant Interviews (KII) were designed to elicit expert insights regarding systemic, organisational, and operational factors influencing clinic attendance and the implementation of SMS reminders. A semi-structured interview guide was developed to structure these interviews, drawing on the study objectives and existing literature on digital health implementation and oncology service delivery in resource-constrained settings.

The guide focused on domains such as patterns of patient attendance and observed barriers, provider perceptions of SMS reminder feasibility, workflow implications of digital

reminders, organisational readiness for mHealth integration, and sustainability considerations. The semi-structured format provided consistency across interviews while permitting in-depth exploration of context-specific issues raised by participants.

The draft guide was reviewed and improved by supervisor to ensure clarity, relevance, and consistency with the study's explanatory purposes. Feedback from reviewers emphasised the importance of framing questions in a way that encouraged reflection on both practical and systemic dimensions of implementation. The final guide thus balanced structure with flexibility, enabling the collection of detailed insights that complemented the patient-focused data from FGDs and contributed to a multidimensional understanding of intervention feasibility.

3.5. Operational Definition of Variables

In quantitative research, operational definitions specify how abstract constructs are translated into measurable variables. For this study, variables in the quantitative phase were defined in accordance with the research question and null hypothesis, which examined whether exposure to a two-way SMS reminder intervention influenced timely clinic attendance among gynae-oncology patients. The study incorporated several types of variables: an independent variable (exposure to the SMS intervention), a dependent variable (timely clinic attendance), a secondary construct (acceptability), and covariates (sociodemographic and clinical characteristics). Clear operationalisation of each variable was essential to ensure measurement consistency, support replication, and establish the analytical boundaries of the trial. In mixed-methods research, operational definitions also serve an integrative function: they delineate which constructs are measured quantitatively and which are explored qualitatively, thereby clarifying the complementary roles of the two methodological strands. The following subsections define each variable precisely, specifying its conceptual basis, the operational indicator used to measure it, the scale of measurement, and the coding scheme applied in

statistical analysis. The study involved one primary independent variable and one primary dependent variable. Secondary constructs related to intervention acceptability were measured descriptively and are also briefly defined.

3.5.1. Independent Variable: Exposure to Two-Way SMS Reminder Intervention

The independent variable was exposure to a structured two-way SMS reminder system, operationalised as a binary treatment condition within the randomised controlled trial. The intervention group (coded as 1) received standard care plus automated two-way SMS appointment reminders containing the date, time, and documentation instructions for scheduled visits. The control group (coded as 0) received standard care without SMS reminders.

Assignment to study arms was conducted using computer-generated block randomisation with variable block sizes in a 1:1 ratio. The intervention consisted of standardised text messages containing the appointment date, time, and required documentation instructions. The two-way functionality distinguished this intervention from conventional one-way reminders by permitting participants to confirm attendance or communicate anticipated barriers, request rescheduling, or seek clarification regarding appointment requirements, thereby introducing an interactive communication dimension that may enhance engagement through both informational and motivational pathways. The content of each SMS message was standardised across all intervention arm participants and included: the scheduled appointment date, the appointment time, the name of the clinic, and a list of documentation or items to bring (such as relevant clinical records, investigation results, or prescribed medications). Messages were composed in both English and Swahili, and participants were asked during enrolment to indicate their preferred language for message receipt. Message delivery was confirmed through the network provider's delivery report function, and undelivered messages were re-dispatched within 24 hours. For the purpose of the primary analysis, exposure to the SMS intervention was operationalised dichotomously: participants in

the intervention arm were coded as 1 regardless of whether they responded to the reminders, reflecting an intention-to-treat principle. This binary variable served as the primary predictor in the statistical analysis of clinic attendance outcomes.

3.5.2. Timely Clinic Attendance as a Dependent Variable

The dependent variable was timely clinic attendance, representing adherence to scheduled outpatient appointments over the study period. Clinic attendance has been operationalised in previous health services research using indicators such as appointment adherence rates, frequency of completed visits, and punctuality relative to scheduled dates (Linde et al., 2017; McLean et al., 2016). In mHealth intervention studies, attendance is commonly measured through objective administrative records rather than self-report, to minimise recall bias and reporting inaccuracies.

In this study, timely clinic attendance was operationalised as a dichotomous variable:

1. Yes (coded as 1): Participant attended all four scheduled clinic appointments on the exact appointment date.
2. No (coded as 0): Participant missed at least one scheduled appointment date during the study period.

Attendance data were extracted from hospital administrative records using a standardised data extraction tool. This objective measurement approach reduced potential reporting bias and enhanced internal validity. The binary nature of the variable facilitated inferential analysis, whereby the proportion of participants classified as “Yes” in the intervention group was compared to that in the control group to determine whether exposure to SMS reminders significantly improved appointment adherence. The use of administrative attendance records as the data source for this variable represented a deliberate methodological choice that prioritised objectivity and minimised the risk of social desirability bias inherent in self-reported attendance measures. Patients who know they have missed appointments may

under-report non-attendance in interview or questionnaire settings; extracting data from clinic registers eliminated this source of measurement error. The four-appointment observation window over the six-month trial period was considered sufficient to generate a reliable estimate of each participant's attendance pattern, as it encompassed the full standard follow-up schedule for the trial period and was consistent with the clinic's routine appointment frequency for post-treatment surveillance patients. The control group to determine whether exposure to SMS reminders significantly improved appointment adherence.

3.5.3. Secondary Construct: Acceptability of Two-Way SMS Reminders

Although not part of the primary hypothesis testing, the acceptability of the SMS reminder system was assessed as a secondary construct to evaluate participant perceptions of the intervention. Acceptability of digital health interventions has been defined in prior literature as the extent to which users consider a healthcare intervention to be appropriate, satisfactory, and beneficial (D'Arcy, 2020; Ngowi et al., 2020).

In this study, acceptability was measured using a structured questionnaire comprising Likert-scale items assessing perceived usefulness of reminders, clarity of message content, appropriateness of timing, and willingness to continue receiving SMS reminders. Responses were measured on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Composite scores were computed to summarise overall acceptability. Acceptability measurement was guided by Sekhon et al.'s (2017) Theoretical Framework of Acceptability (TFA), which conceptualises acceptability as a multi-dimensional construct encompassing affective attitude (how participants feel about the intervention), perceived effectiveness (whether they believe it achieves its purpose), intervention coherence (whether they understand what the intervention involves), and burden (the perceived effort required to engage). The six Likert-scale items in Section B of the questionnaire were mapped to these TFA constructs during instrument development to ensure that the quantitative acceptability measure was

theoretically grounded rather than purely descriptive. Responses were measured on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5), with higher composite scores indicating greater acceptability. This construct was treated as an ordinal variable for descriptive and exploratory analysis, providing insight into patient perspectives that complemented the primary attendance outcomes. It was categorised as having low or good acceptability levels.

3.5.4. Covariates

Sociodemographic and clinical characteristics, including age, marital status, education level, type of cancer diagnosis, and stage of cancer, were collected to describe the study population and assess baseline comparability between intervention and control groups. These variables were categorical or continuous as appropriate and were not primary predictors but were examined for two purposes: first, to confirm group equivalence at baseline, which is a requirement for valid causal inference in randomised trials; and second, to serve as adjustment variables in the logistic regression model estimating the adjusted odds ratio for the primary outcome. The clinical and epidemiological rationale for each covariate's inclusion was as follows. Age is a recognised correlate of health-seeking behaviour, with younger women in some LMIC contexts demonstrating higher mobility and greater digital literacy, both of which may influence SMS engagement and attendance. Marital status captures household support availability, with partnered patients potentially having greater logistical support for attending appointments. Educational level is a proxy for health literacy and may moderate the comprehensibility and perceived relevance of SMS reminders. Cancer type and disease stage reflect clinical severity and treatment intensity, both of which influence the urgency patients and clinicians attach to follow-up appointments and may therefore moderate the effect of the reminder intervention. These covariates were collected at baseline and retained in the multivariable model if they were associated with the primary outcome at $p \leq 0.20$ in univariable

analysis or of clinical significance, following standard variable selection practice for exploratory pilot studies. Their inclusion also allowed for exploratory analysis of potential moderating influences on attendance behaviour, thereby enriching the interpretive depth of the findings.

3.6. Study Procedures and Ethical Assurances

3.6.1. Study Procedures

Study procedures refer to the exact activities undertaken to implement the RCT, combining quantitative and qualitative methods to address the research objectives. These procedures are designed to ensure fidelity to the study protocol and generate complementary insights from both methodological perspectives (Beghin et al., 2008; Kadam, 2017).

The creation of a study protocol is the first step in the RCT process. This entails defining the study population, establishing the intervention and control conditions, stating the research question, and describing the outcome measurements. The protocol also includes plans for statistical analysis, data gathering techniques, randomization procedures, sample size calculations, and ethical issues. Ethical approval for the study was obtained from the University Research Ethics Committee (UREC), the UON KNH Ethics and Research Committee, and authorisation was granted by the Kenyatta National Hospital Medical Research and Reproductive Health Department before data collection.

Eligible participants attending the KNH Gynae-oncology clinic were approached and invited to participate after in-depth information regarding the goals and procedures of the study, as well as possible advantages and disadvantages, and their rights, had been shared with them. Willing participants provide informed consent, guaranteeing their understanding of the study and their voluntary agreement to participate.

Once participants were enrolled, randomisation was conducted to assign them to either the intervention or control groups. Randomisation aims to minimise bias and guarantee that

each participant has an equal chance of being allocated to either group. Computer-generated random sequence numbers were used in the randomisation. Qualitative perspectives were collected to complement the RCT. Participants were divided into the intervention and control arms in a 1:1 ratio using block randomisation with variable block sizes. At randomisation, study staff handed out sealed, opaque, sequentially numbered envelopes with the allocation codes to participants. Randomisation assignments were not concealed from patients or staff, consistent with the pilot nature of the trial.

Before intervention delivery, baseline data were collected from all the participants. This included demographic information, disease information, clinic attendance history, and feasibility indicators related to SMS communication. Baseline measures provided a reference point for group comparisons and established the initial status of participants.

The participants in the intervention group received the standard care plus automated two-way SMS reminders prior to scheduled clinic visits. Messages included appointment date, time, and documentation instructions, with functionality for participants to confirm or respond. The detailed documentation instruction included care procedures, such as any x-rays/ultrasound information and blood work required for the scheduled appointment. The control arm received standard care only. Intervention fidelity was maintained through adherence to a predetermined protocol and detailed documentation of procedures. Each SMS message dispatched was logged in a standardised delivery register maintained by the research assistant, recording the participant identifier, scheduled appointment date, message dispatch date and time, and delivery confirmation status. Participants in the intervention arm received two reminders per scheduled appointment: the first sent seven days before the appointment date, and the second sent 24 hours before. This two-reminder protocol was informed by evidence that dual reminders produce stronger attendance effects than single reminders (Opon et al., 2020; McLean et al., 2016). All incoming responses were reviewed by the research assistant within

24 hours and flagged to the relevant clinic nurse where a clinical response was required. Non-response to a reminder was not treated as a study withdrawal. The message content was reviewed and approved by the clinic's lead consultant and nurse manager prior to trial commencement to ensure clinical accuracy, cultural appropriateness, and consistency with existing patient communication standards.

The pilot trial lasted approximately six months, encompassing four scheduled clinic visits per participant. Attendance outcomes were tracked through administrative records, ensuring complete follow-up for all randomised participants.

3.6.2. Ethical Assurances

Ethical conduct in this study was governed by the core principles of biomedical research ethics as articulated in the Declaration of Helsinki (World Medical Association, 2013) and operationalised in accordance with the specific requirements of the Uganda Management Institute University Research Ethics Committee (UREC), the University of Nairobi/Kenyatta National Hospital Ethics Research Committee (UON-KNH ERC), and the KNH Medical Research and Reproductive Health departments. These principles include respect for persons (autonomy and informed consent), beneficence (maximising benefit), non-maleficence (minimising harm), and justice (equitable distribution of research benefits and burdens). Compliance with all applicable ethical standards was maintained from study design through data collection, analysis, and reporting. The following sub-sections describe the specific ethical procedures implemented to protect participant rights and welfare throughout the trial. These included standards on voluntary participation, informed consent, confidentiality and privacy, risk minimisation, formal approval, and researcher reflexivity.

3.6.2.1. Formal Approval

Ethical approval was obtained from three independent research ethics review bodies prior to the commencement of any data collection activities. First, ethical clearance was granted

by the Unicaf University Research Committee (UREC), which reviewed the full study protocol including the intervention design, consent forms, data management plan, and risk assessment. Second, approval was obtained from the University of Nairobi/Kenyatta National Hospital Ethics Research Committee (UON-KNH ERC), which evaluated the study's compliance with Kenyan national research ethics standards and the institutional policies of KNH as the study site. Third, research clearance was obtained from the KNH Medical Research and Reproductive Health departments, which assessed the operational feasibility and clinical appropriateness of conducting the RCT within the Gynae-oncology Clinic. All three review bodies independently confirmed that the study met the required ethical standards with respect to participant protection, informed consent procedures, data confidentiality, risk minimisation, and scientific validity. Data collection commenced only after all approvals were formally received, and the study was conducted strictly in accordance with the approved protocol throughout its duration. The researcher adhered to the guidelines and regulations set forth by the IRB.

3.6.2.2. *Voluntary Participation*

Voluntary participation was a cornerstone of this study, reflecting the ethical principle of respect for persons as articulated in international research ethics frameworks. All participants were informed that their involvement in the study was entirely voluntary, and that they retained the right to decline participation or withdraw at any stage without penalty or impact on their ongoing clinical care at Kenyatta National Hospital. This assurance was particularly important in the context of gynaecological oncology, where patients may feel vulnerable due to the seriousness of their diagnosis and the demands of treatment.

The informed consent process emphasised that participation was not a requirement for receiving medical services, nor would refusal or withdrawal affect the quality of care provided. Participants were explicitly told that their decision to participate, or not, would remain confidential and would not be disclosed to clinical staff outside the research team. This

safeguard was designed to minimise any perception of coercion, especially given the researcher's professional affiliation with KNH. By clarifying the separation between clinical care and research activities, the study reinforced the autonomy of participants in making decisions about their involvement.

Voluntary participation also extended to the qualitative components of the study, including focus group discussions and key informant interviews. Participants were reminded that they could choose not to answer specific questions, pause the discussion, or withdraw entirely if they felt uncomfortable. This flexibility respected the sensitive nature of conversations about cancer care, digital health interventions, and personal experiences with clinic attendance. It also acknowledged the emotional and cultural dimensions of participation, ensuring that engagement was both informed and freely chosen.

The researcher was mindful that her professional affiliation with KNH could inadvertently influence patients' perceptions of voluntariness. To mitigate this, the researcher clearly introduced herself as an independent investigator, explained her role, and reassured participants that their clinical providers were not involved in recruitment or data collection. This reflexive practice helped to maintain trust and minimise risks of coercion, reinforcing the voluntary nature of participation.

3.6.2.3. *Informed Consent*

Participants had a long discussion with the researcher and were given comprehensive information about the study. The goal of the study, its methods, potential dangers and advantages, and the participants' rights as research subjects were all properly explained to the participants. Informed consent was a foundational requirement for all participant enrolment and was treated as an ongoing process rather than a one-time administrative procedure. Prior to seeking consent, eligible patients were provided with a written participant information sheet in both English and Swahili, which explained in plain language the study's purpose, the nature

and duration of participation, the distinction between the intervention and control arms, potential benefits and risks, the voluntary nature of participation, and the participant's unconditional right to withdraw at any time without penalty or effect on their clinical care. Patients were given adequate time to read the information sheet and to consult with family members if they wished before making a decision. Research assistants were trained to answer questions clearly and without pressure. For participants with limited literacy, the information sheet was read aloud and consent was documented through a witnessed verbal consent procedure supplemented by a thumbprint signature, consistent with the consent protocols approved by the UON-KNH ERC. Prior to their participation, participants gave their informed consent, guaranteeing that they were aware of the purpose of the study and willingly consented to take part. Written consent forms were used for this.

3.6.2.4. Confidentiality, Privacy, and Anonymity

The researcher ensured the confidentiality and privacy of participant data. This involved processing participant information safely, storing data in secure systems, and replacing identifying personal information with codes or pseudonyms. The researcher clearly described the procedures used to protect participant privacy and confidentiality. Data confidentiality was protected through a multi-layered system of procedural and technical safeguards. All participants were assigned unique study identification codes at enrolment, and these codes, rather than names or hospital record numbers, were used on all data collection forms, entry spreadsheets, and analysis files. Physical records including signed consent forms and data extraction sheets were stored in a locked filing cabinet accessible only to the principal investigator. Electronic data files were stored on a password-protected device, with access restricted to the research team. The SMS platform used for reminder delivery was configured to send messages from a non-identifiable sender number, ensuring that recipients' phones did not display clinic-specific information that could inadvertently disclose a gynaecological

cancer diagnosis to household members with access to a shared device. This was a particularly important design consideration given the documented prevalence of phone-sharing among Kenyan women in lower-income households, where a cancer-related SMS notification could pose a risk of unintended disclosure and associated social harm. The researcher maintained participant confidentiality and anonymity when disseminating study results. In order to ensure that no specific participant could be recognized when the study results were reported, pseudonyms or participant codes were used in place of disclosing personal identifiers.

A further ethical consideration specific to the gynae-oncology context deserves explicit mention. Because participants in the intervention arm received SMS messages to mobile devices that, in some cases, may have been shared with household members, the intervention design incorporated a privacy protocol as part of the informed consent process. At enrolment, each participant in the intervention arm was asked to confirm whether their registered mobile number was accessible exclusively to them, or whether other household members had access to the device. Where participants confirmed shared access, the reminder message language was adapted to omit any clinic-specific language that could inadvertently disclose the participant's gynaecological cancer status. This privacy-protective adaptation reflects the broader principle, well-established in the mHealth ethics literature, that digital health interventions in contexts of stigmatised health conditions must be designed to prevent inadvertent diagnostic disclosure, even at the cost of some reduction in message specificity (Moodley et al., 2019; Stocks et al., 2022). The privacy protocol was reviewed and approved by the KNH Ethics Review Committee as part of the ethical clearance process and represents an important model for the ethical implementation of SMS-based mHealth interventions in oncology contexts across similar LMIC settings.

3.6.2.5. Risk Minimisation

Risk minimisation was addressed systematically across the physical, psychological, and informational domains of participant welfare. Physical risks associated with participation were minimal, as the intervention required only receipt of and optional response to SMS messages and attendance at clinically scheduled appointments that would have occurred regardless of trial participation. No invasive procedures, additional clinical investigations, or medication changes were introduced by the study protocol. Psychological risks were more carefully considered. Participants allocated to the control arm could not receive SMS reminders during the trial period, which might have generated a perception of receiving inferior care. This risk was mitigated through transparent communication at the point of consent: all participants were clearly informed that both arms received standard clinical care, that the control condition reflected current usual care at the clinic, and that SMS reminders would be made available to all participants at the conclusion of the trial regardless of arm allocation. A further psychological risk pertained to participants who might experience distress upon receiving a reminder for an appointment they were unable to attend due to financial or transport barriers. This risk was mitigated by ensuring that the two-way SMS functionality explicitly offered participants the option to reschedule without penalty, and by training the research assistant to respond to incoming messages with empathy and practical information about appointment rescheduling pathways. Throughout the research process, the researcher gave participants' safety and well-being top priority. This included minimizing any potential physical or psychological harm, making sure the right tools and support were accessible, and quickly addressing any unfavourable occurrences or unexpected findings. Researchers should have procedures in place to deal with participant discomfort or unforeseen outcomes. This ensures that participants in the study are not exposed to risks that are higher than or in addition to those they would normally face on a regular basis.

3.6.2.6. Safety

The safety of participants was considered across clinical, operational, and psychological dimensions of the trial. Clinically, the study protocol included a stopping rule: if any participant experienced acute clinical deterioration or was admitted to a ward during the trial period, their participation in the SMS reminder component was suspended and their care was managed entirely within the standard clinical pathway without research-related interruption. This provision ensured that the study's operational requirements never competed with or delayed clinical care. Participants who were admitted or whose clinical status changed significantly were retained in the intention-to-treat analysis using their last available attendance record, ensuring that their data contributed to the study without imposing an additional burden during a period of clinical vulnerability. Operationally, safety protocols were in place for the management of distressing disclosures during the qualitative components of the study. Focus group discussions and key informant interviews were conducted by a trained moderator with experience in sensitive health research, and referral pathways to the KNH counselling and social work departments were established in advance should any participant require psychological support during or after a session. Participants were reminded at the start of each qualitative session that they could withdraw at any time without consequence, and the moderator was briefed to monitor for signs of distress and to close exploratory lines of questioning sensitively if needed. A written safeguarding protocol was maintained throughout the trial and made available to all members of the research team.

3.6.2.7. Researcher Reflexivity

Reflexivity was a critical component of this study, ensuring that the researcher's positionality, professional background, and potential biases were explicitly acknowledged and systematically managed throughout the research process (Braun & Clarke, 2022). As a trained nurse working within the Healthcare Quality Department at KNH, the researcher brought

professional expertise in patient care, health systems processes, and digital health interventions. However, she was not directly embedded in the oncology department, which reduced the risk of role conflict but also required careful reflection on how her institutional affiliation and professional identity might shape interactions with participants and interpretations of findings.

The ethical duty of the researcher extended beyond compliance with formal approval processes to the accurate and transparent presentation of findings. This involved reporting data honestly, avoiding selective disclosure, and acknowledging any biases that could influence interpretation. Transparency was essential to safeguarding the validity and reliability of the study, particularly given the sensitive nature of gynaecological cancer research. Participants' privacy and confidentiality were prioritised to shield them from emotional, social, and potential legal risks.

Potential conflicts of interest were proactively minimised. The researcher disclosed any personal or professional interests that could affect objectivity, including her affiliation with KNH and her broader involvement in healthcare quality improvement initiatives. While these experiences provided valuable contextual understanding, they also carried the risk of shaping expectations about patient behaviour or system performance. Transparent disclosure of these positionalities helped maintain research integrity and reassured participants that the study was conducted impartially. As noted in ethical scholarship, conflicts of interest can jeopardise reputations, erode public confidence, and compromise the moral standing of research; hence, explicit disclosure was essential to mitigate these risks.

To actively manage reflexivity, several practices were employed. The researcher maintained a reflective journal throughout the study, documenting personal reactions, assumptions, and decision-making processes during recruitment, data collection, and analysis. This journal served as a tool for self-monitoring and critical self-evaluation, ensuring that personal experiences did not unduly influence the interpretation of participant responses. Peer

debriefing sessions with academic supervisors were also conducted, providing external perspectives on methodological choices and analytical interpretations. These sessions functioned as a safeguard against unconscious bias and reinforced the credibility of the findings.

The researcher's dual role as a healthcare professional and academic investigator required balancing empathy with analytical detachment. While professional training in patient care facilitated rapport and sensitivity during interactions, reflexive awareness ensured that empathy did not compromise objectivity or lead to overinterpretation of participant narratives. By explicitly acknowledging her positionality and embedding reflexive practices into the research design, the researcher upheld the ethical responsibility to produce findings that were both trustworthy and contextually grounded.

3.7. Data Collection and Analysis

3.7.1. Data Collection

Data collection was conducted using a structured, multi-source approach consistent with the pilot randomised controlled trial design with embedded qualitative and exploratory cost components. Quantitative, qualitative, and cost-related data were collected concurrently over the study period to generate complementary evidence on intervention effectiveness, feasibility, acceptability, and implementation requirements within KNH Gynae-oncology Clinic.

Following confirmation of eligibility and written informed consent, each participant was assigned a unique study identification number. This identifier was used on all study instruments and databases to ensure participant anonymity and prevent the inclusion of directly identifiable information in analytical datasets. A secure linkage log connecting study identification numbers to patient hospital identifiers was maintained separately and was

accessible only to the research administrator and the statistical controller. This process ensured data traceability for verification purposes while preserving confidentiality.

Eligible patients attending the KNH Gynae-oncology clinic were referred to the researcher by clinic nursing staff. The researcher conducted eligibility screening using predefined inclusion and exclusion criteria and subsequently administered baseline data collection instruments prior to intervention exposure. The full questionnaire was administered in English by trained research assistants, with Swahili translation available for participants who required it. This was interviewer-administered face-to-face in a private clinic setting to ensure confidentiality and minimise response bias. Average completion time was approximately 20 minutes per participant.

The baseline questionnaire collected information on sociodemographic characteristics, including age, marital status, educational attainment, and employment status, as well as clinical characteristics such as cancer diagnosis and disease stage. Information regarding previous clinic attendance history was also collected to contextualise subsequent attendance outcomes. Additionally, indicators related to mobile phone access and SMS usability were documented to confirm participants' ability to receive and engage with the intervention.

For participants allocated to the intervention arm, additional information was collected to facilitate delivery of the SMS reminders. These included the primary mobile phone number, preferred language of communication (English or Kiswahili), preferred timing for receipt of reminder messages, and contact details for an alternative caregiver or substitute contact person where applicable. These data enabled standardised yet context-sensitive implementation of the SMS reminder system.

Participants randomised to the intervention group received automated two-way SMS reminders prior to each of four scheduled monthly clinic appointments during the follow-up period. Reminder messages were issued one week before the scheduled appointment date. Each

message included the appointment date and time, as well as specific documentation or investigation requirements, such as laboratory tests or imaging results that were required before clinic review. The two-way functionality of the system allowed participants to confirm attendance, request clarification, or notify clinic staff if they anticipated difficulty attending. All outgoing messages, delivery confirmations, and incoming participant responses were recorded within the SMS platform database. Monitoring of message dispatch logs ensured fidelity of intervention delivery. On the other hand, participants in the control arm received standard care, in which appointment dates for the four scheduled clinic visits were recorded on clinic-issued appointment cards without SMS reminders. No additional digital communication was provided to this group.

The primary outcome variable, timely clinic attendance, was measured using secondary administrative data extracted from the KNH clinic records. Attendance data were collected for each participant across four scheduled clinic appointments during the study period. A standardised data extraction form was developed to capture the scheduled appointment date and the corresponding actual attendance date as documented in hospital records. Attendance information was retrieved using the unique study identification number to ensure accurate linkage while maintaining confidentiality. Because attendance outcomes were obtained from administrative records rather than self-report, measurement error due to recall bias or social desirability bias was minimised. Complete attendance data were available for all enrolled participants.

To complement the quantitative findings and provide contextual insight into intervention feasibility and acceptability, qualitative data were collected through FGDs and KIIs. Two FGD sessions were conducted, each comprising six purposively selected participants from the intervention arm, for a combined qualitative sample of twelve participants. Sessions were conducted in Swahili to ensure linguistic accessibility and natural

expression, with the moderator trained in facilitation principles of qualitative group research. Each session lasted approximately 30 to 45 minutes and was audio-recorded with participants' prior written consent. Sessions were conducted in a private room within the KNH Gynaecology Clinic to preserve confidentiality. No new major themes emerged in the second session, indicating that the qualitative data had reached informational adequacy within the defined sample size. The FGD explored experiences with receiving SMS reminders, perceived usefulness, clarity of message content, barriers to clinic attendance, and recommendations for improvement. In addition, four key informant interviews were conducted with clinic stakeholders, including a consultant oncologist, a clinic nurse, the nurse manager, and the health information officer. These interviews examined implementation processes, integration of the SMS system into routine clinic workflow, perceived operational feasibility, and sustainability considerations. The interviews were audio-recorded with participant consent. Additionally, detailed field notes were taken to supplement the recordings.

An exploratory micro-costing exercise was conducted to estimate the incremental costs associated with implementing the two-way SMS reminder system. Costing procedures were informed by the Reference Case for Global Health Costing developed by the Global Health Cost Consortium (Vassall et al., 2017). Cost data were collected prospectively throughout the study period from multiple sources, including budget records, expenditure documentation, staff interviews, and participant interviews. Costs were categorised into start-up and recurrent components. Start-up costs included microplanning, staff orientation and training, system configuration, and development of SMS message content. Recurrent costs included personnel time, SMS communication charges, equipment use, supplies, and overhead expenses. Personnel costs were aligned using KNH salary scales to ensure consistency with institutional standards. A time-in-motion assessment was conducted to estimate the duration of staff time required to retrieve appointment data, schedule SMS reminders, and respond to participant

communications, thereby enabling more accurate allocation of personnel costs to the intervention.

Through the integration of baseline survey data, administrative attendance records, qualitative interviews, and micro-costing data, the study employed a comprehensive and triangulated data collection strategy. This approach ensured methodological coherence with the mixed-methods pilot RCT design while maintaining precision in outcome measurement and implementation assessment.

3.7.2. Data Management and Quality Assurance

Data management procedures were implemented to ensure accuracy, completeness, confidentiality, and traceability of all quantitative, qualitative, and cost data generated during the study. Given the randomised controlled design and the use of multiple data sources, structured systems were established to maintain consistency and minimise the risk of error throughout the data lifecycle. Study participants' identifiers were used across baseline questionnaires, SMS platform records, attendance extraction forms, qualitative transcripts, and costing documentation to ensure consistent linkage of data while preserving anonymity. A separate, password-protected linkage file connecting study identification numbers to hospital identifiers was stored securely and accessible only to the principal investigator and designated data controller.

Quantitative data from baseline questionnaires were entered into a secure electronic database created in statistical software. Data entry followed a standardised coding framework developed prior to commencement of analysis. Variable labels, value labels, and coding schemes were predefined to ensure uniform interpretation. Categorical variables were numerically coded, and dichotomous variables were coded consistently with the operational definitions. Range checks and validation rules were applied during data entry to reduce entry errors.

To enhance data accuracy, completed questionnaires were reviewed daily for completeness and internal consistency before entry. Double-check verification was conducted by cross-referencing a random subset of entered records against original paper instruments. Any discrepancies identified were resolved through direct comparison with source documents. Because data collection was conducted by the principal investigator, standardisation in administration minimised interviewer variability.

Attendance outcome data were extracted from hospital administrative records using a structured data extraction tool. Extraction procedures were standardised to ensure uniform interpretation of appointment dates and attendance status. Extracted records were cross-verified against clinic registers to ensure accuracy of scheduled and actual attendance dates. Since attendance data were obtained directly from institutional records rather than self-reports, measurement reliability was strengthened. Complete attendance data were available for all enrolled participants, and no imputation procedures were required.

SMS intervention data, including message dispatch logs, delivery confirmations, and participant responses, were stored within the secure SMS platform database. Platform access was restricted through password authentication. Exported data were merged with the primary study database using study identification numbers, ensuring accurate integration of intervention delivery records.

Qualitative data from focus group discussions and key informant interviews were audio-recorded with participant consent and transcribed verbatim. Transcripts were reviewed alongside audio recordings to verify accuracy and completeness. Identifying details were removed during transcription to preserve confidentiality. Electronic transcript files were stored on password-protected devices, and backup copies were maintained on encrypted storage media. Field notes were digitised and stored within the same secure system.

Cost data collected for the micro-costing analysis were compiled from multiple sources, including budget documents, expenditure records, and time-in-motion assessments. Source documentation was retained to enable verification of cost calculations. Personnel time estimates derived from time-in-motion observations were cross-checked with staff interviews to ensure consistency. All cost components were categorised systematically into start-up and recurrent costs prior to analysis.

Data security measures were implemented to protect participant confidentiality and prevent unauthorised access. Electronic data files were stored on password-protected computers accessible only to the research team. Physical documents, including consent forms and baseline questionnaires, were stored in locked cabinets within secure office space. Regular backups of electronic data were performed to prevent data loss.

Given the randomised design and complete follow-up of all participants, there was no attrition-related missing data for the primary outcome variable. Baseline variables were assessed for completeness prior to analysis. Data cleaning procedures included checking for out-of-range values, logical inconsistencies, and duplicate entries. Any anomalies were resolved through reference to original data sources.

Collectively, these procedures ensured that data were collected, recorded, stored, and prepared for analysis in a manner consistent with principles of scientific rigour, confidentiality, and methodological transparency. The structured data management system supported the reliability of statistical analysis and safeguarded the integrity of both quantitative and qualitative findings.

3.7.3. Data Analysis

3.7.3.1. Quantitative Data Analysis

Quantitative data were analysed using IBM Statistical Package for the Social Sciences (SPSS), version 26.0. Statistical significance was assessed at a two-sided alpha level of 0.05.

All analyses followed a pre-specified analytical plan consistent with the randomised controlled trial design and the operational definitions outlined earlier.

Prior to inferential analysis, data cleaning procedures were conducted. This included verification of coding accuracy, examination of frequency distributions, and assessment of logical consistency across variables. Range checks were performed for categorical variables, and cross-tabulations were used to identify potential inconsistencies. Because attendance outcomes were obtained from administrative records and follow-up was complete for all enrolled participants, there were no missing data for the primary outcome variable.

Descriptive statistics were used to summarise baseline characteristics of participants by study arm. Categorical variables were presented as frequencies and percentages, while continuous variables were summarised using means and standard deviations where normally distributed. Baseline comparability between the intervention and control groups was assessed descriptively to confirm the effectiveness of randomisation in achieving balance across sociodemographic and clinical characteristics.

The primary outcome of interest was timely clinic attendance, operationalised as a dichotomous variable coded as “Yes” (attended all four scheduled appointments on the exact appointment date) or “No” (missed at least one scheduled appointment date). The primary independent variable was exposure to the two-way SMS reminder intervention (intervention arm versus control arm).

Bivariate analysis was conducted to compare the proportion of participants classified as having timely attendance between the intervention and control groups. The Pearson chi-square test was used to assess the association between study arm and timely clinic attendance. This test was appropriate given the categorical nature of both the independent and dependent variables.

To further quantify the magnitude of association between intervention exposure and timely attendance, binary logistic regression analysis was performed. Logistic regression is appropriate for modelling binary outcome variables and allows estimation of odds ratios representing the likelihood of timely attendance among participants receiving SMS reminders compared to those receiving standard care. Crude odds ratios and corresponding 95% confidence intervals were calculated.

Although randomisation minimises confounding by distributing both known and unknown confounders across study arms, adjusted logistic regression models were also estimated to account for selected baseline covariates where theoretically relevant. These included age, disease stage, and prior attendance history. Adjusted odds ratios were reported to assess whether the intervention effect remained consistent after controlling for these variables.

The primary null hypothesis tested was that there is no statistically significant difference in timely clinic attendance between participants receiving two-way SMS reminders and those receiving standard care. Hypothesis testing was conducted using the chi-square test and logistic regression model, with statistical significance determined at $p \leq 0.05$ at a 95% confidence interval.

Results were presented in tabular format, including frequency distributions, cross-tabulations, odds ratios, confidence intervals, and corresponding p-values. Effect estimates were interpreted in relation to both statistical significance and clinical relevance. Also, given the pilot nature of the study, analyses were primarily exploratory with respect to effect size estimation and feasibility of statistical procedures for future larger-scale trials. Interpretation of findings, therefore, considered both statistical outcomes and the broader implementation context.

3.7.3.2. Qualitative Data

Qualitative data were analysed to explore participants' and healthcare providers' experiences with the two-way SMS reminder system and to contextualise the quantitative findings from the randomised controlled trial. Analysis focused on perceptions of message clarity, timing, confidentiality, language appropriateness, usability, responsiveness, and perceived influence on clinic attendance.

Audio recordings from the focus group discussion and key informant interviews were transcribed verbatim. Transcripts in Kiswahili were translated into English before analysis. To ensure accuracy, each transcript was reviewed alongside the corresponding audio recording, and field notes were used to clarify contextual nuances. Identifying information was removed during transcription to preserve confidentiality. Transcripts were not returned to participants for member checking due to the logistical constraints of follow-up within a national referral setting where patients are referred from geographically dispersed regions and attend the clinic at irregular intervals. Instead, analytic credibility was strengthened through careful verification of transcripts against audio recordings and collaborative review within the research team.

Reflexive theme analysis was used to examine qualitative data. This method was chosen because of its adaptability and usefulness for finding recurring themes in participant narratives in applied health research settings (Braun & Clarke, 2006). The analysis followed Braun and Clarke's (2006) six-phase framework: becoming acquainted with the data, developing preliminary codes, looking for themes, evaluating themes, defining and labelling themes, and creating the analytical narrative. Familiarisation began with repeated reading of transcripts to immerse the researcher in the data. Initial codes were generated inductively to capture meaningful features relevant to feasibility, acceptability, and implementation processes. Coding was conducted using ATLAS.ti version 7.5.7 (ATLAS.ti GmbH, Berlin), which facilitated systematic organisation and retrieval of coded segments. A preliminary codebook

was developed to guide coding consistency while allowing flexibility for the emergence of new concepts.

Although coding and theme development were primarily undertaken by the principal researcher, an assistant researcher independently reviewed selected transcripts and coding outputs. Differences in interpretation were discussed to enhance analytical depth and reflexive awareness rather than to calculate statistical inter-coder agreement. This process strengthened credibility by ensuring that themes were grounded in the data rather than solely in a single interpretive lens (Braun & Clarke, 2022).

Codes were subsequently examined for patterns of shared meaning and organised into candidate subthemes. These subthemes were iteratively refined, merged, or separated to construct coherent overarching themes that captured central ideas reflected across participant accounts. Themes were defined through concise working descriptions that articulated their scope and boundaries. The final thematic structure reflected both convergent and divergent perspectives between patients and healthcare providers.

Findings were presented using a combination of descriptive and interpretive narrative. Verbatim excerpts from participant accounts were included to illustrate and substantiate identified themes. Sociodemographic characteristics of qualitative participants were summarised descriptively to contextualise thematic findings. Additionally, throughout the analytic process, reflexivity was maintained by documenting analytic decisions, theme evolution, and interpretive reflections. This enhanced transparency and ensured that interpretation remained grounded in the data while acknowledging the researcher's contextual understanding of the clinical environment.

3.7.3.3. Cost Analysis

An exploratory economic evaluation was conducted to estimate the incremental provider cost of integrating a two-way SMS reminder system into routine gynae-oncology

outpatient services at Kenyatta National Hospital. The analysis adopted a provider (hospital) perspective, as the objective was to assess the additional resources required by the institution to implement and sustain the intervention within routine practice. The Reference Case for Global Health Costing developed by the Global Health Cost Consortium served as a guidance for the costing strategy.

A bottom-up micro-costing methodology was employed to identify, measure, and value all resources directly attributable to the SMS intervention. Micro-costing was selected because it allows detailed estimation of individual resource inputs and is appropriate for pilot implementation studies where cost structures are being established for the first time. Costs were categorised into start-up and recurrent components. Start-up costs were defined as one-time expenditures necessary to initiate the intervention, while recurrent costs referred to ongoing expenses required to maintain the intervention throughout the study period. The total incremental cost of the intervention over the trial period was calculated as the sum of start-up and recurrent costs.

Start-up costs included personnel time for staff training and procurement of equipment required for SMS delivery. The opportunity cost of staff time was calculated by estimating the duration of training sessions and multiplying by the average hourly wage rate of clinic staff. Equipment costs included the purchase of mobile phones used for intervention implementation.

Recurrent costs comprised two main components: communication costs and personnel time associated with message preparation and dispatch. Communication costs were calculated based on the unit cost per SMS multiplied by the total number of reminders sent during the trial period. The total number of reminders was determined by the number of enrolled participants, the number of scheduled clinic appointments per participant, and the number of reminders issued per appointment. Additionally, personnel time costs were estimated using a time-in-motion approach. The average time required to draft and send each SMS reminder was recorded

and aggregated across all reminders sent during the study period. Total personnel time was then valued using the estimated hourly wage rate of clinic staff. This approach allowed the incorporation of the opportunity cost of staff labour into the total incremental cost.

To facilitate the interpretation of economic implications, two additional summary measures were specified. First, the cost per patient was calculated by dividing the total incremental cost by the number of participants receiving the SMS intervention. This provided an estimate of the average provider expenditure required to support one patient over the follow-up period.

Second, the incremental cost per additional timely clinic attendee was calculated to assess the economic efficiency of the intervention. This was derived by dividing the total incremental cost by the difference in the number of participants achieving timely clinic attendance between the intervention and control arms. This measure represents the additional provider cost required to achieve one additional fully adherent patient attributable to the SMS intervention.

Cost data were compiled and analysed using Microsoft Excel. All assumptions used in cost calculations were explicitly documented to ensure transparency and reproducibility. Costs were computed in United States Dollars (USD). Where applicable, costs denominated in Kenyan Shillings (KSh) were converted to USD using the prevailing exchange rate during the study period to ensure consistency. Given the pilot nature of the study, the cost analysis was exploratory and intended to generate preliminary estimates to inform future larger-scale economic evaluations rather than to produce definitive cost-effectiveness conclusions.

3.8. Summary

This chapter has presented the methodological framework adopted to evaluate the effectiveness, feasibility, acceptability, and incremental provider costs of a two-way SMS reminder system for gynae-oncology patients at Kenyatta National Hospital. The study was

situated within a pragmatic paradigm, which allowed the integration of quantitative and qualitative approaches to generate evidence that is both rigorous and contextually meaningful. By combining experimental measurement with interpretive inquiry, the study design was able to address not only whether the intervention improved clinic attendance, but also how it was experienced by patients and providers, and what resources were required for implementation.

The research approach was mixed-methods, reflecting the need to capture multiple dimensions of the intervention. A pilot parallel-arm randomised controlled trial formed the quantitative backbone, enabling causal inference regarding the effect of SMS reminders on timely clinic attendance. This was complemented by qualitative inquiry through focus group discussions and key informant interviews, which provided explanatory depth on feasibility and acceptability. An exploratory cost analysis further extended the design by estimating the incremental provider costs associated with integrating SMS reminders into routine service delivery. Together, these strands ensured methodological complementarity and strengthened the practical relevance of findings.

The study design was carefully structured to minimise bias and enhance validity. Randomisation was conducted using a computer-generated sequence with allocation concealment, ensuring comparability between groups. Although blinding was not feasible, outcome measurement relied on administrative records rather than self-report, reducing detection bias. The pilot nature of the trial allowed assessment of recruitment processes, intervention fidelity, and preliminary effect sizes, thereby informing the design of future larger-scale studies.

The study population comprised adult female patients diagnosed with gynaecological cancers and attending follow-up appointments at KNH. Eligibility criteria ensured that participants were clinically stable, able to consent, and had access to mobile phones. A total of 122 participants were randomised equally between intervention and control arms, with

complete follow-up achieved through reliance on hospital records. For the qualitative component, purposive sampling was used to select patients and healthcare providers to provide diverse perspectives on feasibility and acceptability. This sampling framework ensured that the study captured both patient experiences and institutional insights.

Multiple instruments were employed to capture data across strands. A structured patient questionnaire was developed to collect sociodemographic and clinical information, as well as perceptions of the SMS intervention. Focus group and interview guides were designed to elicit detailed narratives on feasibility and acceptability. Attendance extraction forms ensured objective measurement of the primary outcome, while the SMS platform itself served as the intervention instrument. Each tool was developed or adapted to align with study objectives and was subjected to expert and ethical review to ensure validity and contextual appropriateness.

Data analysis was tailored to each strand. Quantitative data were analysed using descriptive statistics, chi-square tests, and logistic regression to assess differences in timely attendance between groups and to estimate odds ratios. Qualitative data were analysed using reflexive thematic analysis, following Braun and Clarke's six-phase framework, to identify patterns of meaning across participant narratives. Cost analysis employed bottom-up micro-costing, categorising start-up and recurrent costs, and calculating incremental cost per patient and per additional timely attendance. Sensitivity analyses were conducted to test robustness under varying assumptions. Together, these analytic strategies ensured that findings were both statistically sound and contextually grounded.

The chapter demonstrated how the study's philosophical orientation, methodological approach, and research design were coherently aligned to address the research objectives. Embedding the randomised controlled trial within a mixed-methods framework and incorporating exploratory cost analysis allowed the study to generate evidence that is both internally valid and practically relevant. The methodological rigour, combined with contextual

sensitivity, provides a strong foundation for interpreting the results presented in the subsequent chapter.

CHAPTER 4: FINDINGS

4.1. Introduction

The results of the study examining the efficacy, feasibility, acceptability, and financial implications of a two-way SMS mHealth intervention intended to increase gynecological cancer patients' timely clinic attendance at Kenyatta National Hospital are presented in this chapter. Clearly stated research objectives and hypotheses derived from the randomized controlled trial methodology served as the study's compass. The chapter is organised systematically around the research objectives and corresponding hypotheses. It begins with an examination of the trustworthiness of the data, followed by an assessment of the reliability and validity of the measurement instruments and statistical assumptions. An overview of participants' socio-demographic characteristics is then presented to provide contextual understanding of the study sample.

Subsequently, results are reported in alignment with each research objective. Quantitative findings are presented using appropriate descriptive and inferential statistical analyses, including relevant test statistics and significance levels. Qualitative findings are presented through thematic analysis, supported by representative data extracts where appropriate. The chapter concludes with a brief evaluation of the findings, while detailed interpretation and integration with existing literature are reserved for Chapter 5.

4.2. Trustworthiness of Data

Trustworthiness of the data was ensured through the systematic application of established qualitative rigour criteria, alongside procedural safeguards implemented within the quantitative component of the trial. Given the mixed-methods design of this pilot randomised controlled trial, particular emphasis was placed on ensuring credibility, dependability, confirmability, and transferability within the qualitative strand, while maintaining transparency and integrity in the quantitative data collection processes.

Credibility was enhanced through methodological triangulation, as data were collected from two distinct participant groups: gynae-oncology patients participating in the intervention and healthcare professionals involved in service delivery. The use of both focus group discussions and key informant interviews enabled the exploration of converging and diverging perspectives regarding the feasibility, acceptability, and perceived effectiveness of the two-way SMS reminder system. Prolonged engagement with the data was achieved through iterative reading and re-reading of transcripts prior to coding, allowing for immersion in participants' narratives and careful interpretation of meanings embedded within the data. Verbatim quotations were retained and presented in the findings chapter to ensure that interpretations remained grounded in participants' own words.

Dependability was strengthened through the development and use of a structured codebook to guide analysis. Coding was initially conducted by the primary researcher and independently reviewed by an assistant researcher to enhance analytic consistency. Any discrepancies in coding were discussed and resolved through consensus, ensuring coherence in theme development. An audit trail was maintained documenting key analytic decisions, theme refinement processes, and modifications made during data interpretation. This procedural transparency enhances the replicability and methodological integrity of the qualitative component.

Confirmability was supported through reflexive practice. The researcher maintained reflexive notes throughout data collection and analysis to critically examine personal assumptions, professional positioning, and potential influences on interpretation. By explicitly acknowledging the researcher's role within the clinical and academic context of the study, efforts were made to minimise subjective bias and ensure that findings reflected participants' perspectives rather than researcher preconceptions. Data management and coding were

conducted using ATLAS.ti (version 7.5.7), providing systematic organisation and traceability of analytic steps.

Transferability was addressed through detailed contextual description of the study setting, participant characteristics, and intervention procedures. By providing a clear account of the hospital environment, clinic structure, and characteristics of gynae-oncology patients at the referral facility, readers are enabled to assess the applicability of findings to similar low- and middle-income healthcare contexts where mobile health interventions may be implemented.

Within the quantitative component, trustworthiness was supported through standardised data extraction procedures from hospital attendance records. Because outcome data were obtained directly from facility administrative records for all randomised participants, risks of recall bias and self-report inaccuracies were minimised. The absence of loss to follow-up further strengthened internal validity, as complete outcome data were available for all participants included in the intention-to-treat analysis.

Additional trustworthiness was supported by the rigorous application of randomisation procedures, which are described in full in Chapter 3. It is worth highlighting here that the use of a computer-generated random sequence and allocation concealment ensured that neither participants nor researchers could anticipate group assignment, thereby protecting the integrity of the pre-intervention comparability between arms. The balance observed across most baseline socio-demographic and clinical characteristics in the next chapter provides empirical confirmation that randomisation functioned as intended. Where modest imbalances were detected, notably in county of residence, marital status, and educational attainment, these were acknowledged and addressed through multivariable adjustment in the regression analyses presented in Section 4.4.5, further strengthening the trustworthiness of conclusions drawn regarding intervention effects.

Regarding blinding, the nature of the intervention precluded participant blinding, as those in the intervention arm were necessarily aware of receiving SMS reminders. However, outcome assessors extracted attendance data directly from hospital administrative records, independent of participant self-report, which minimised the risk of observer bias influencing outcome classification. The reliance on routinely collected, objectively defined attendance records, rather than researcher-assigned judgements, served as a structural safeguard against performance and detection bias. These procedural elements, while detailed in Chapter 3, are highlighted here because they directly underpin the credibility of the quantitative findings presented in this chapter.

4.3. Reliability and Validity of Data

Reliability and validity of the data were addressed through methodological standardisation, appropriate statistical procedures, and the use of established measurement approaches within the quantitative component of the study. Particular attention was paid to internal validity, measurement consistency, and procedural integrity given the randomised controlled design.

Internal validity was strengthened through the use of a parallel two-arm randomised controlled trial design. Random allocation of participants to intervention and control arms reduced the likelihood of systematic selection bias and enhanced comparability between groups at baseline. The use of equal allocation (1:1 ratio) further ensured balance across study arms. Moreover, outcome data were extracted directly from hospital administrative attendance records rather than self-reported measures, thereby reducing recall bias and social desirability bias. The absence of attrition, with complete follow-up data available for all 122 randomised participants, further minimised the risk of attrition bias and strengthened causal inference regarding the effect of the two-way SMS intervention on clinic attendance.

Measurement reliability was supported through the use of objective outcome definitions. Timely clinic attendance was operationalised using predefined criteria based on scheduled appointment dates recorded within the hospital system. Because attendance data were routinely captured as part of clinical workflow, measurement error associated with manual recording or participant recall was minimised. Data extraction procedures followed a consistent protocol to ensure uniformity in the identification and classification of attendance outcomes across both study arms.

Construct validity was addressed through careful alignment between study objectives, operational definitions, and analytic procedures. The primary outcome, timely clinic attendance, was directly linked to the intervention mechanism, namely SMS reminders intended to prompt attendance behaviour. Secondary measures assessing feasibility and acceptability were derived from structured instruments administered consistently across participants. Where applicable, items were adapted from previously validated tools used in mHealth and service utilisation research, ensuring conceptual coherence with existing literature.

Statistical conclusion validity was ensured through the application of appropriate inferential analyses consistent with the level of measurement and distribution of variables. Group comparisons were conducted using suitable parametric and non-parametric tests as indicated, and logistic regression modelling was employed to estimate the association between intervention exposure and timely attendance while controlling for potential confounders. Statistical significance thresholds were pre-specified, and effect estimates were reported with corresponding confidence intervals to enhance interpretability and precision.

External validity was considered within the contextual boundaries of a pilot randomised controlled trial conducted at a national referral hospital. While the single-site design may limit broad generalisability, the detailed reporting of participant characteristics and clinic context

enables informed judgement regarding applicability to similar tertiary healthcare settings in comparable resource-constrained environments.

These methodological safeguards enhance confidence in the accuracy, consistency, and interpretive integrity of the data presented in this chapter. The use of rigorous randomization processes, objective outcome assessment, and adequate statistical analysis supports the validity of the conclusions drawn about the two-way SMS intervention's effectiveness in promoting clinic attendance among gynaecology patients.

To strengthen the reliability of the qualitative component, inter-rater procedures were applied during the coding and theme development process. The primary researcher conducted an initial round of open coding independently, after which a second researcher reviewed the coded transcripts against the developing codebook. Where discrepancies arose in the assignment of codes to data segments, these were resolved through discussion and consensus rather than unilateral decision, thereby reducing the risk that any single researcher's perspective would unduly shape the thematic structure. This iterative, consensus-based approach to coding is consistent with established standards for qualitative rigour in mixed-methods health research and enhances the dependability and confirmability of the thematic findings. The structured codebook, maintained throughout the analysis and documented as part of the audit trail, provides a transparent record of analytic decisions and supports the replicability of the qualitative component should independent verification be undertaken.

The external validity of the findings must be understood within the contextual boundaries of the study. The single-site approach, which is ideal for a pilot randomised controlled trial, limits the quantitative data's direct generalizability to other situations. However, the deliberate choice of Kenyatta National Hospital, Kenya's largest national referral facility, as the study site carries its own form of representativeness: as a facility serving patients from across the country, it captures a socio-demographically and geographically diverse patient

population, as evidenced by the broad distribution of counties of residence reported in Section 4.4.1. This diversity strengthens the applicability of findings to tertiary gynaecological services in comparable urban referral settings in sub-Saharan Africa. The detailed reporting of participant characteristics, clinic context, cancer types, and stages of diagnosis further enables readers and implementers to make informed judgements regarding the transferability of findings to their own settings. The pilot nature of the study is also worth acknowledging in this regard: the findings are intended to inform the design of a larger, multi-site trial rather than to establish definitive population-level estimates, and conclusions are appropriately calibrated to reflect this scope.

4.4. Results

4.4.1. Baseline Characteristics of the Study Participants

Baseline socio-demographic and clinical characteristics of participants are presented in Table 1, stratified by study arm. The analysis aimed to assess comparability between the intervention and control groups following randomisation. Overall, the distribution of most characteristics appeared broadly similar across the two groups, although statistically significant differences were observed for selected variables.

The age distribution of participants showed some variation between the two groups, although this difference did not reach statistical significance ($p=0.061$). Participants in the intervention arm tended to be older, with a higher proportion aged 60 years and above (18.0%) compared to those in the control arm (6.6%). Conversely, younger participants below the age of 40 were more prevalent in the control group (36.1%) than in the intervention group (19.7%). Despite these differences, the overall age profile of the study population reflected a wide distribution across adult age categories.

County of residence demonstrated a statistically significant difference between the two arms ($p=0.022$). While the majority of participants in both groups resided outside Nairobi

County, this pattern was more pronounced in the intervention arm, where 83.6% of participants were from outside Nairobi compared to 65.6% in the control group. Participants residing within Nairobi constituted a smaller proportion overall (25.4%), particularly within the intervention group.

Marital status also differed significantly between the intervention and control arms ($p=0.028$). Participants in the intervention group were more frequently never married (52.5%) compared with those in the control group (32.8%). In contrast, a larger proportion of participants in the control arm were married (67.2%) relative to the intervention arm (47.5%). This pattern indicates a modest imbalance in marital status distribution across the two groups at baseline.

The religious affiliation of participants was largely homogeneous across both arms. Christianity constituted the predominant religion, accounting for 92.6% of the study participants. No statistically significant difference was observed between the intervention and control groups ($p=0.729$), where 91.8% and 93.4%, respectively were Christians. Similarly, ethnic distribution showed variation across categories but did not differ significantly between the two groups ($p=0.112$). Participants of Kikuyu ethnicity were more represented in the control arm (52.5%), whereas those of Kamba ethnicity were relatively more common in the intervention arm (34.4%). However, these differences were not statistically significant.

Educational attainment differed significantly between the two arms ($p=0.011$). Participants in the intervention group were more likely to report education levels below secondary school (65.6%) compared with participants in the control arm (42.6%). Conversely, secondary or higher levels of education were more common among control group participants (57.4%) relative to the intervention group (34.4%). This difference indicates a modest baseline imbalance in educational attainment between the two groups.

Employment status did not vary significantly between the study arms ($p=0.467$), with approximately half of the participants in each group reporting employment (control=50.8% and intervention=57.4%). This suggests a broadly similar distribution of economic engagement across both intervention and control participants.

Clinical characteristics were generally comparable across the two arms. The duration of receiving care at Kenyatta National Hospital did not differ significantly between groups ($p=0.376$), with the majority of participants reporting a duration of one to four years. Similarly, the distribution of cancer types was consistent across the intervention and control arms ($p=0.621$). Cervical cancer represented the most common diagnosis overall, accounting for 51.6% of the study population. This was followed by ovarian cancer with 26.2%.

The stage of cancer at diagnosis was also broadly similar between the two groups ($p=0.278$). Stage II disease was the most frequently reported stage, representing over half of the participants (52.5%). Although the intervention arm had a slightly higher proportion of Stage III cases (19.7%) compared to the control arm (9.6%), this difference was not statistically significant. The duration since diagnosis also showed comparable patterns across the two groups ($p=0.600$), with most participants reporting a diagnosis within the previous one to four years.

These findings show that at baseline, the intervention and control groups were generally equivalent in terms of most socio-demographic and clinical features. However, statistically significant differences were observed for county of residence, marital status, and education level. These variables were therefore considered in subsequent multivariable analyses to account for potential confounding effects when assessing the impact of the intervention on timely clinic attendance.

Table 1*Socio-Demographic and Clinical Characteristics of Quantitative Participants*

Variable	Control n(%)	Intervention n(%)	Total n(%)	p-value
Age				0.061
<40	22(36.1)	12(19.7)	34(27.9)	
40–49	18(29.5)	15(24.6)	33(27.0)	
50–59	17(27.9)	23(37.7)	40(32.8)	
60+	4(6.6)	11(18.0)	15(12.3)	
County of residence				0.022*
Nairobi	21(34.4)	10(16.4)	31(25.4)	
Outside Nairobi	40(65.6)	51(83.6)	91(74.6)	
Marital status				0.028*
Never married	20(32.8)	32(52.5)	52(42.6)	
Married	41(67.2)	29(47.5)	70(57.4)	
Religion				0.729
Christian	57(93.4)	56(91.8)	113(92.6)	
Muslim	4(6.6)	5(8.2)	9(7.4)	
Ethnicity				0.112
Kikuyu	32(52.5)	24(39.3)	56(45.9)	
Kamba	11(18.0)	21(34.4)	32(26.2)	
Other	18(29.5)	16(26.2)	34(27.9)	
Educational level				0.011*
Less than Secondary	26(42.6)	40(65.6)	66(54.1)	
Secondary or higher	35(57.4)	21(34.4)	56(45.9)	
Employment status				0.467

Unemployed	30(49.2)	26(42.6)	56(45.9)	
Employed	31(50.8)	35(57.4)	66(54.1)	
Duration at KNH (in years)				0.376
<1	22(36.1)	23(37.7)	45(36.9)	
1–4	32(52.5)	26(42.6)	58(47.5)	
5+	7(11.5)	12(19.7)	19(15.6)	
Type of cancer				0.621
Cervical cancer	29(47.5)	34(55.7)	63(51.6)	
Endometrial cancer	9(14.8)	4(6.6)	13(10.7)	
Ovarian cancer	16(26.2)	16(26.2)	32(26.2)	
Other malignant	3(4.9)	2(3.3)	5(4.1)	
Non-malignant	4(6.6)	5(8.2)	9(7.4)	
Stage of cancer				0.278
Stage I	20(32.8)	20(32.8)	40(32.8)	
Stage II	35(57.4)	29(47.5)	64(52.5)	
Stage III	6(9.6)	12(19.7)	18(14.8)	
Duration diagnosed with condition (in years)				0.600
<1	13(21.3)	10(16.4)	23(18.9)	
1–4	37(60.7)	36(59.0)	73(59.8)	
5+	11(18.0)	15(24.6)	26(21.3)	

Table 2 summarises the socio-demographic characteristics of participants recruited for the qualitative component of the study. Twelve patients participated across two focus group

discussions, each comprising 6 women each. All focus group participants were female who receive the two-way SMS intervention. Half (n=6) were aged 50 years and above, four were aged 31–49 years, and two were aged 30 years or younger. The majority (n=7) had been patients at KNH for less than one year, while three had been patients for five years or more. Four key informants were also interviewed, three of whom were male and one female. Two were aged 30–49 years and two were aged 50 years or older. Their professional experience in the gynae-oncology clinic varied: one had worked for less than a year, two for 1–5 years, and one for more than five years.

The composition of the qualitative sample was not incidental but reflected deliberate sampling decisions aimed at maximising the analytic richness of the data. Within the focus group discussions, the inclusion of participants across a broad age range, from women aged 30 years and below to those aged 50 and above, was intentional, as age has been identified in the literature as a potential moderator of mHealth acceptability and technology use. Capturing perspectives from both younger and older patients ensured that the thematic analysis could surface generational differences in attitudes toward SMS reminders, as well as any differential experiences of the intervention across the life course. Similarly, variation in duration as a patient at KNH, ranging from less than one year to five or more years, was sought to capture both newly diagnosed patients, who may have been encountering formal appointment systems for the first time, and longer-standing patients who had prior experience of managing clinic attendance without SMS support. This contrast provided a natural basis for examining whether the perceived utility of reminders differed according to familiarity with the clinic system. Among the key informants, diversity in professional role, spanning nursing, nurse leadership, health information management, and oncology, was equally deliberate. Each role occupies a distinct vantage point on the intervention: nurses experience its effect on day-to-day patient flow; nurse leaders assess its institutional implications; health information officers evaluate its

technical and data management dimensions; and oncologists consider its clinical relevance. The inclusion of all four perspectives ensured that feasibility and acceptability were examined from multiple system levels rather than from a single professional standpoint, strengthening the comprehensiveness and credibility of the qualitative findings.

Table 2

The qualitative study's patient background characteristics

Characteristic	Frequency
Patients (N=12)	
Age (in completed years)	
≤30	2
31–49	4
≥50 years	6
Duration as a patient at KNH (in years)	
≤1	7
2–4	2
≥ 5	3
Key Informants (N=4)	
Sex	
Male	3
Female	1
Age (in completed years)	
30–49	2
50+	2
Years worked in Gynae-oncology clinic	

<1	1
1–5	2
>5	1

4.4.2. Research Question 1: What is the Baseline Rate of Timely Clinic Attendance among Gynae-oncology Patients at KNH?

This subsection presents the baseline clinic attendance profile of gynae-oncology patients at KNH. The analysis begins with descriptive information on attendance patterns, reported causes of delays, obstacles to timely attendance, and satisfaction with clinic services (Table 3). This provides contextual understanding of patient experiences at baseline. The subsection then reports the baseline rate of timely clinic attendance, comparing control and intervention arms to establish whether the two groups were comparable prior to the intervention (Table 4).

Table 3 summarises patient-reported clinic attendance patterns, causes of delays, obstacles to timely attendance, and satisfaction with services at baseline. Attendance patterns varied: 36.1% of patients reported always being on time, 31.1% were primarily on time, 27.9% were occasionally late, and 4.9% were usually late. Among the 114 patients who reported causes of delays, personal factors were most common (67.5%), followed by transport-related issues (14.9%) and schedule or job conflicts (8.8%). Health problems (7.9%) and loss of clinic card (0.9%) were less frequently cited.

Obstacles to timely attendance were dominated by financial limitations, reported by 76.2% of patients. Forgetfulness (21.3%) and complications (9.0%) were also noted, while smaller proportions cited health problems (5.7%), family or work obligations (4.9%), or loss of card (0.8%).

Satisfaction with clinic services was generally high: 60.7% of patients were very satisfied, 33.6% satisfied, and 5.7% neutral. These findings indicate that while most patients expressed satisfaction with clinic services, financial and personal barriers were the predominant challenges to timely attendance.

Table 3

Baseline Clinic Attendance Information at the KNH

Variable	Frequency	Percentage (%)
Frequency of visits at gynae-oncology clinic		
Usually late,	6	4.9
Occasionally late	34	27.9
Primarily on time	38	31.1
Always on time	44	36.1
Causes of visit delays (n=114)		
Health problems	9	7.9
Lost my card	1	0.9
Personal factors	77	67.5
Schedule or job conflicts	10	8.8
Transport-related issues	17	14.9
Obstacles		
Financial limitations	93	76.2
Forgetfulness	26	21.3
Complications	11	9.0
Health problems	7	5.7

Family or work obligations	6	4.9
Lost my card	1	0.8
Level of satisfaction		
Very satisfied	74	60.7
Satisfied	41	33.6
Neutral	7	5.7

Baseline associations with timely clinic attendance were examined using chi-square tests (Table 4). At baseline, 38(31.1%) had timely clinic attendance. Timely attendance was similar between the control arm (29.5%) and the intervention arm (32.8%), with no statistically significant difference ($p=0.696$). Attendance did not differ significantly by age group ($\chi^2=1.90$, $p=0.388$), marital status ($\chi^2=0.75$, $p=0.385$), religion ($\chi^2=1.82$, $p=0.177$), ethnicity ($\chi^2=3.40$, $p=0.182$), education level ($\chi^2=1.01$, $p=0.316$), cancer type ($\chi^2=0.32$, $p=0.956$), cancer stage ($\chi^2=0.80$, $p=0.670$), or duration of diagnosis ($\chi^2=0.48$, $p=0.786$). In contrast, county of residence was significantly associated with timely attendance ($\chi^2=4.37$, $p=0.037$), with patients residing outside Nairobi more likely to attend on time (36.3%) compared to those within Nairobi (16.1%). Employment status also showed a significant association ($\chi^2=8.53$, $p=0.004$), with employed patients more likely to attend on time (42.4%) than unemployed patients (17.9%). Duration of follow-up at KNH showed a non-significant trend ($\chi^2=2.78$, $p=0.249$), with patients attending for five years or more reporting higher punctuality (47.4%) compared to those with shorter durations. No significant differences were observed between intervention and control groups at baseline ($\chi^2=0.15$, $p=0.696$).

These findings indicate that the two groups were comparable in terms of clinic attendance prior to the intervention, ensuring that subsequent differences can be attributed to the intervention rather than pre-existing imbalance. These sub-group patterns are analytically

relevant because they identify the structural and individual-level factors that may have moderated the intervention's effect, and they inform the covariates selected for adjustment in the multivariable regression model reported in the endline.

Table 4

Bivariate Distribution of Baseline Timely Clinic Attendance

Characteristics	Timely clinic attendance		Chi square	P-value
	Yes n(%)	No n(%)		
Total	38(31.1)	84(68.9)		
Age (in completed years)			1.90	0.388
<40	9(26.5)	25(73.5)		
40–59	26(35.6)	47(64.4)		
60+	3(20.0)	12(80.0)		
County of residence			4.37	0.037*
Nairobi	5(16.1)	26(83.9)		
Outside Nairobi	33(36.3)	58(63.7)		
Marital status			0.75	0.385
Single	14(26.9)	38(73.1)		
Married	24(34.3)	46(65.7)		
Religion			1.82	0.177
Christian	37(32.7)	76(67.3)		
Muslim	1(11.1)	8(88.9)		
Ethnicity			3.40	0.182

Kikuyu	14(25.0)	42(75.0)		
Kamba	14(43.8)	18(56.3)		
Other	10(29.4)	24(70.6)		
Education level			1.01	0.316
Less than secondary	18(27.3)	48(72.7)		
Secondary or higher	20(35.7)	36(64.3)		
Employment status			8.53	0.004**
Unemployed	10(17.9)	46(82.1)		
Employed	28(42.4)	38(57.6)		
Duration of patient at KNH (in years)			2.78	0.249
<1	13(28.9)	32(71.1)		
1–4	16(27.6)	42(72.4)		
5+	9(47.4)	10(52.6)		
Type of cancer			0.32	0.956
Cervical cancer	21(33.3)	42(66.7)		
Endometrial cancer	4(30.8)	9(69.2)		
Ovarian cancer	9(28.1)	23(71.9)		
Other	4(28.6)	10(71.4)		
Stage of cancer			0.80	0.670
Stage I	13(32.5)	27(67.5)		
Stage II	20(31.3)	44(68.8)		
Stage III	5(27.8)	13(72.2)		
Duration of diagnosis (in years)			0.48	0.786
<1	8(34.8)	15(65.2)		
1–4	21(28.8)	52(71.2)		

5+	9(34.6)	17(65.4)		
Participant type			0.15	0.696
Control	18(29.5)	43(70.5)		
Intervention	20(32.8)	41(67.2)		

4.4.3. Research Question 2: What is the Feasibility of Implementing Two-way SMS

Reminders to Improve Clinic Attendance among Gynae-oncology Patients at KNH?

To explore feasibility, this study drew on perspectives from four key informant interviews with providers representing diverse roles within KNH: a nurse, a nurse leader, a health information officer, and an oncologist. Their insights offered a system-level view of feasibility, focusing on infrastructure, cost, workflow integration, and scalability. The provider interviews highlighted the practical considerations necessary for implementation and sustainability. The analysis revealed both enabling factors and barriers, as well as resources required for scale-up, thereby providing a comprehensive understanding of feasibility within the KNH context (Table 5).

Table 5

Feasibility of Two-Way SMS Reminder Intervention

Theme	Sub-theme
1. Feasibility of 2-way SMS intervention	1. Infrastructure readiness
	2. Cost-effectiveness
	3. Workflow integration
2. Barriers to feasibility of 2-way SMS intervention	1. Patient access to phones
	2. Network connectivity issues
	3. Language diversity

4. Staffing needs

4.4.3.1. Feasibility of 2-way SMS intervention

The feasibility of implementing two-way SMS reminders at KNH was consistently affirmed by providers. They emphasized that the hospital already had the necessary technological infrastructure, making integration straightforward and practical. The intervention was described as cost-effective, with minimal expenses compared to the benefits of reduced missed appointments and decreased administrative burden. Providers also highlighted that SMS reminders fit seamlessly into existing workflows, improving punctuality and continuity of care while remaining unobtrusive and respectful of patient privacy.

Infrastructure readiness

Providers consistently reported that KNH already had the technological infrastructure to support SMS reminders, which made integration straightforward. The system was described as simple, unobtrusive, and easy to embed into existing workflows. However, scaling up would require server capacity expansion and stronger network capabilities to handle larger message volumes efficiently. They noted:

“KNH already had the necessary technological infrastructure in place, which made the integration of this system relatively straightforward. ...To scale up the SMS reminder system effectively, we would require substantial investments in infrastructure. This includes upgrading our servers and network capabilities to handle a larger volume of messages efficiently.” **(Key Informant – Nurse leader)**

“Our hospital already had the necessary technological infrastructure in place. ...It is a scalable solution that can be easily integrated into our existing

healthcare systems. ...First and foremost, we would need to invest in robust infrastructure to support the increased volume of SMS messages. This includes upgrading our servers, network capabilities, and message delivery platforms to handle a higher number of reminders efficiently.” **(Key Informant – Health Information Officer)**

Cost-effectiveness

Across interviews, SMS reminders were considered low-cost relative to their benefits. Sending text messages was described as inexpensive, while the intervention reduced the administrative burden of manual appointment follow-ups. Staff noted that the efficiency gains outweighed the minimal costs, making the system a feasible and sustainable solution. They opined:

“From a practical standpoint, the implementation of SMS reminders has been both feasible and cost-effective. ...The costs associated with sending SMS messages are minimal compared to the potential benefits, making it a feasible approach for enhancing patient healthcare outcomes.” **(Key Informant – Oncologist)**

“...Considering feasibility, implementing SMS reminders has been both practical and cost-effective. ...The costs associated with sending SMS messages are minimal compared to the potential benefits, making it a feasible approach for enhancing patient healthcare outcomes. The administrative burden related to appointment reminders and follow-ups has significantly decreased since the introduction of SMS reminders, which further underscores the feasibility of this solution.” **(Key Informant – Nurse leader)**

Workflow integration

Nurses and oncologists emphasized that SMS reminders reduced missed appointments and late arrivals, improving clinic flow and continuity of care. The reminders were seen as non-intrusive and respectful of patient privacy, while simultaneously fostering accountability and punctuality. Providers described them as “game-changing” in terms of embedding appointment management into routine care. These are their views:

“One of the strengths of SMS reminders is their simplicity and convenience. They provide patients with timely notifications about their upcoming appointments, reducing the likelihood of forgetfulness or scheduling conflicts.”

(Key Informant - Nurse)

“One of the most remarkable aspects of SMS reminders is their simplicity and convenience. They are unobtrusive, respectful of patient privacy, and accessible to a wide range of individuals regardless of their technological literacy. Patients can easily receive and understand these messages, making them highly appropriate for our diverse patient population.”

(Key Informant – Oncologist)

4.4.3.2. Barriers to feasibility of 2-way SMS intervention

Despite strong feasibility, providers identified several barriers that must be addressed for scale-up. Limited patient access to mobile phones, particularly among older or underserved groups, created disparities in reach, underscoring the need for patient education and outreach. Unreliable network connectivity occasionally delayed or prevented message delivery, pointing to the necessity of investing in stronger servers and delivery platforms. Language diversity also posed challenges, as English-only reminders excluded non-English speakers, prompting calls for multilingual formats. Finally, staffing constraints were noted: scaling up would require

additional administrative and IT personnel to manage message delivery, monitor system performance, and respond to patient concerns.

Patient access to phones

A recurring barrier was that not all patients own mobile phones, particularly older or underserved groups. This limited the reach of SMS reminders and created disparities in access. The providers thus highlighted the importance of developing educational materials and conducting outreach to explain the benefits of SMS reminders and address patient concerns. They explained:

“A significant barrier is that not all patients have access to mobile phones. While mobile phone penetration is relatively high, particularly in urban areas, some patients, especially those from underserved communities or older demographics, may not own a mobile phone or have a reliable network connection. This limits the reach of SMS reminders and can create disparities in healthcare access.” (Key Informant – Nurse leader)

“One notable barrier has been patient access to mobile phones and network connectivity. While mobile phone penetration is quite high in our region, not all patients have access to smartphones or reliable cellular networks. This can hinder the delivery of SMS reminders to certain individuals, creating disparities in healthcare access.” (Key Informant – Health Information Officer)

Network connectivity issues

Unreliable mobile networks sometimes delayed or prevented message delivery, undermining the consistency of reminders. Providers emphasized the need to invest in servers,

networks, and delivery platforms to handle increased message volumes reliably. These are their views:

“Patients may encounter technical challenges, such as not receiving SMS messages or experiencing delays in their delivery. Network connectivity issues can also affect message delivery reliability.” (Key Informant – Oncologist)

“One significant challenge is that not all patients have access to mobile phones, and even among those who do, there are cases of unreliable network connectivity. This limitation can hinder the consistent delivery of SMS reminders.” (Key Informant - Nurse)

Language diversity

The system currently delivers reminders in English, which can pose comprehension challenges for patients who speak other languages. Providers highlighted the need for multilingual options to ensure inclusivity. To overcome language barriers, providers recommended introducing translations or multilingual formats to ensure equitable access for diverse patient populations. One key informant said;

“Another challenge we’ve faced is language diversity. Our patient population is culturally diverse, and many speak languages other than English. The SMS reminders are currently provided in English, which can pose comprehension issues for non-English speakers. We are actively looking into providing message translations or multilingual options to ensure that language is not a barrier to understanding vital healthcare information.” (Key Informant – Health Information Officer)

Staffing needs

Scaling up the system would require additional administrative and IT staff to manage message delivery, monitor system performance, and provide patient support. Scaling up would require hiring additional IT support and administrative staff to manage the system and respond to patient inquiries.

“In addition to infrastructure upgrades, staffing would be essential. As we extend the system’s reach to a broader patient population, we would need to hire additional administrative and technical staff to manage the increased workload. This includes personnel responsible for sending messages, monitoring system performance, and providing support to patients.” **(Key Informant – Oncologist)**

“As the patient population receiving SMS reminders grows, we may need to expand our administrative and technical teams to manage the system effectively. This could include hiring additional IT support personnel and administrative staff to handle patient inquiries and concerns.” **(Key Informant – Health Information Officer)**

Overall, provider perspectives confirmed that two-way SMS reminders are a feasible intervention within KNH’s existing infrastructure, offering a cost-effective and workflow-compatible solution to reduce missed appointments and improve continuity of care. The enabling factors and barriers identified across interviews are not independent phenomena but operate in dynamic relationship with one another: the very infrastructure that makes the system immediately deployable is also the bottleneck that constrains its scalability. For instance, while the hospital’s existing server capacity was sufficient for the pilot’s message volumes, providers cautioned that this same infrastructure would require substantial upgrading before the system could absorb the load associated with hospital-wide implementation. Similarly, the simplicity

and unobtrusiveness of the system, identified as enabling factors, are partially undermined by barriers of language inaccessibility and phone ownership gaps, both of which reduce the proportion of the patient population who can benefit from those very attributes. This tension between current feasibility and scalable feasibility is a distinguishing feature of the findings and one that has direct implications for planning. The net feasibility picture that emerges, therefore, is one of strong proof-of-concept viability paired with a clearly defined investment agenda: server capacity expansion, multilingual messaging platforms, patient education and outreach, and expanded technical staffing are not optional enhancements but necessary conditions for equitable and sustainable scale-up. Importantly, these barriers were accompanied in provider accounts by concrete and actionable recommendations, suggesting a workforce that is not only ready to adopt the intervention but actively engaged in thinking through the conditions required for its success.

4.4.4. Research Question 3: What is the Acceptability of Two-way SMS Reminders for Improving Clinic Attendance among Gynae-oncology Patients at KNH?

Acceptability of the two-way SMS intervention was assessed among intervention participants (n=61) using six items in the quantitative phase (Table 6). Mean scores ranged from 3.34 (SD=1.47) for inconvenience/disruption to 4.85 (SD=0.44) for helpfulness in attending appointments. The highest ratings were observed for helpfulness (mean=4.85), satisfaction with receiving reminders (mean=4.82), and clarity/relevance of messages (mean=4.70). Ease of understanding was also rated highly (mean=4.62). Preference for continuing SMS reminders showed more variability (mean=4.23, SD=1.30), while inconvenience/disruption received the lowest mean score (3.34), indicating that most participants did not perceive the reminders as disruptive.

A closer examination of the variability in acceptability scores adds analytical depth beyond the mean-level patterns. Items reflecting core utility, helpfulness (SD=0.44) and

satisfaction with receiving reminders ($SD=0.39$), demonstrated very low standard deviations, indicating a high degree of consensus among participants on these dimensions. This uniformity suggests that the functional value of the intervention was experienced consistently across the sample, regardless of individual differences in age, education, or clinical profile. By contrast, the preference for continuing to receive SMS reminders showed considerably greater variability ($SD=1.30$), and the disruption item produced the widest spread ($SD=1.47$). The wider dispersion on the latter two items indicates that while most participants were untroubled by the reminders and wished to continue receiving them, a meaningful minority held divergent views. This pattern is analytically important: it suggests that acceptability is not a uniform experience but is differentiated across dimensions, with functional utility being near-universally endorsed while personal preferences regarding continuation and disruption varied more considerably. These sub-group variations provide a basis for the qualitative themes around personalisation and need for improvement discussed in Section 4.4.4.3, and they highlight the importance of designing scalable versions of the intervention with sufficient flexibility to accommodate individual preferences.

Table 6

Acceptability of Two-Way SMS Intervention

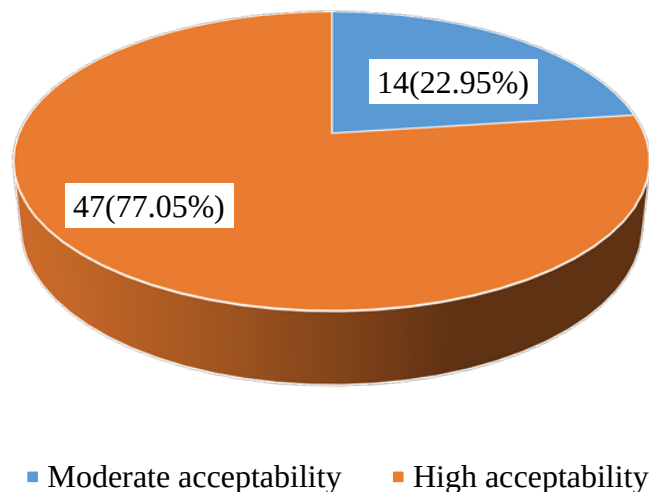
Acceptability item	Minimum	Maximum	Mean	Standard deviation
The SMS reminders were easy to understand	3	5	4.62	0.58
The messages were clear and relevant to my clinic appointments	3	5	4.70	0.53

The reminders helped me attend my clinic appointments on time	3	5	4.85	0.44
I was satisfied with receiving SMS reminders for my clinic visits	4	5	4.82	0.39
I would prefer to continue receiving SMS reminders for future appointments	1	5	4.23	1.30
Receiving SMS reminders was inconvenient or disruptive	1	5	3.34	1.47

Composite acceptability scores indicated that the majority of the intervention arm (88.5%) reported high acceptability (mean score >4), while 11.5% reported moderate acceptability (mean score $=3-4$). No participant reported low acceptability (mean score <3). Figure 8 illustrates the distribution of acceptability levels, showing that nearly four out of five participants expressed high acceptability of the SMS intervention.

Figure 8

Level of acceptability of two -way SMS intervention



The qualitative exploration of patient perspectives revealed high acceptability of the two-way SMS reminder system, with participants consistently describing it as convenient, motivating, and supportive of their clinic attendance. Thematic analysis generated five subthemes: positive attitude, embracing two-way reminders, motivation, convenience, and need for improvement (Table 7). These together illustrate both the strengths of the intervention and areas for refinement.

Table 7

Thematic Results for Feasibility of Using Two-Way SMS Reminders

Theme	Sub-theme
Patient acceptability of 2-way SMS Reminders	1. Positive attitude towards SMS reminders
	2. Embracing two-way SMS reminders
	3. Motivation
	4. Convenience
	5. Need for improvement

4.4.3.1. Positivity Regarding SMS Reminders

The study's findings revealed that the majority of patients had a positive attitude about using SMS reminders, which was critical for increasing clinic attendance. Participants said that SMS reminders helped them keep track of their appointments and allowed for early and successful planning. Their responses are summarized in the following quote;

“SMS reminders have definitely helped me remember my appointments. Before, I used to rely on my paper appointment card, but sometimes I misplaced it. Now,

I always have my phone with me, so it's much more convenient.” (FDG 2 Participant 5, 51 years)

According to a few participant individuals, SMS reminders have made it easier for people to plan their schedules and manage their clinic visits. Additionally, the reminders emphasize how convenient and successful they are at assisting patients in keeping their appointments. SMS reminders, according to one focus group participant, have simplified her planning process.

“SMS reminders have made it easier for me to plan my day around my clinic appointments. I can set reminders on my phone, which helps me organize my schedule. It also reduces the likelihood of last-minute cancellations because I forgot about an appointment.” (FGD 1 Participant 6, 44 years)

4.8.4.1.2. Accepting Two-Way Text Message Reminders

Overall adherence to this mHealth strategy was boosted by the SMS reminders' simplicity. The findings of the topic analysis also showed that the messages were easily understood. SMS reminders offer a dependable method of keeping track of impending clinic visits, which aids in the person's calendar organization. According to one of the participants, the SMS reminders were concise and easy to understand.

“There's something about receiving an SMS reminder that's different from the usual paper-based reminders. It feels more personal. It's like the clinic cares about me, not just as a patient but as a person. It might sound strange, but those messages gave me emotional support too, which was unexpected but greatly appreciated.” FGD 1, participant 2, 38 years)

4.4.3.3. Motivation

The additional context highlights the fact that SMS reminders acted as a motivation for patients, which is another important aspect of their influence on the attendance of medical appointments. Despite the long distance between the patient's home and the clinic, SMS reminders served as a motivator to maintain frequent attendance. One patient reported that SMS reminders made her feel as if the clinic was waiting for her, which pushed her to work more.

“The clinic is quite a distance from my home, and sometimes I’d think of skipping appointments to avoid the commute. However, with the SMS reminders, it became more of a motivation than a hassle. I knew the clinic was expecting me, and it encouraged me to keep going regularly.” (FGD 1 participant 3, 51 years)

4.4.3.4. Convenience

Additionally, according to one of the key informants, patients value the ease with which they may receive crucial medical information via text messages. This implies that SMS reminders work well with patients' communication preferences and lifestyles, making it easier for them to stay up to speed on their medical appointments and other important information.

“Most patients appreciate the convenience of receiving important healthcare information through text messages. It’s a familiar and accessible mode of communication for many, and they seem to have embraced it willingly.” (Key Informant - nurse, 36 years)

4.4.3.5. Need for Improvement

While overall acceptability was high, participants identified areas for refinement. Suggestions included greater personalization of messages to address individual needs,

investment in infrastructure to handle larger message volumes, and enhanced patient education and outreach to maximize the benefits of the system. One of the participants indicated that messaging needs to be more individualized.

“The only thing I’d suggest for improvement is to make the messages a bit more personalized. I mean, they were great, but it would be even better if they could address my specific needs and concerns. That would take it to the next level, in my opinion.” (FGD 1 Participant 3, 48 years)

The qualitative findings demonstrate that patients at KNH widely accepted the two-way SMS reminder system, describing it as convenient, motivating, and supportive of their clinic attendance. The reminders were perceived as reliable tools for organizing schedules, reducing forgetfulness, and fostering a sense of personal connection with the clinic. While overall attitudes were positive, participants also identified areas for refinement, including personalization of messages, multilingual options, and patient education to maximize impact. These insights highlight that acceptability is not only high but also dynamic, with patients actively suggesting ways to strengthen the intervention and ensure its continued relevance to diverse needs.

4.4.5. Research Question 4: What is the Effect of Two-way SMS Reminders on Timely Clinic Attendance among Gynae-oncology Patients at KNH?

This subsection presents the endline findings on timely clinic attendance, comparing intervention and control groups. The analysis begins with descriptive results (Table 8), followed by a visual trend across successive appointments (Figure 9). Statistical testing using chi-square analysis (Table 9) and adjusted logistic regression (Table 10) are then reported to establish the independent effect of the SMS intervention. Thematic findings supporting and explaining the quantitative results are presented in Table 11.

4.4.5.1. Endline and Trend of Timely Clinic Attendance Following Intervention

At endline, timely clinic attendance was significantly higher in the intervention arm compared to the control arm (67.2% vs. 26.2%, $p < 0.001$). Overall, 46.7% of participants reported timely attendance, but this was driven largely by the intervention group (Table 8). More patients in the intervention group thus had timely attendance than the control group.

Table 8

Endline Timely Clinic Attendance

Endline timely clinic attendance	Control n(%)	Intervention n(%)	Total n(%)	p-value
No	45(73.8)	20(32.8)	65(53.3)	<0.001
Yes	16(26.2)	41(67.2)	57(46.7)	

Figure 9 illustrates the trajectory of timely clinic attendance across successive appointments for both study arms. At baseline, attendance was similar between the intervention (32.8%) and control groups (29.3%). Over time, however, the intervention group demonstrated a steady increase in timely attendance, rising to 35.1% at the first appointment, 43.8% at the second, 55.7% at the third, and 67.2% by the fourth appointment. In contrast, the control group remained relatively stable, with attendance fluctuating slightly around 28–29% and declining to 26.2% at the fourth appointment.

These trends highlight a clear divergence between the two groups: while the control arm showed no meaningful improvement, the intervention arm exhibited progressive gains in timely attendance, culminating in more than double the baseline rate by the fourth appointment. This visual evidence reinforces the descriptive findings in Table 6 and suggests that the SMS reminders had a sustained positive effect on clinic attendance over time.

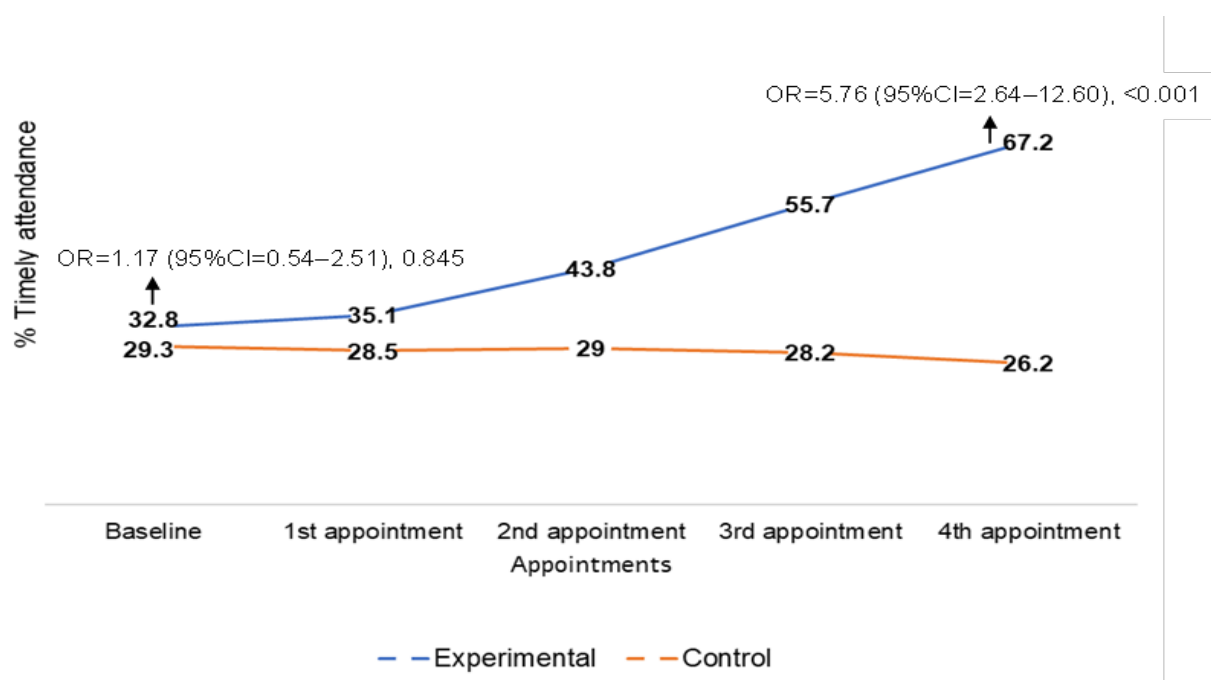
Figure 9*Trend of Timely Clinic Attendance***4.4.5.2. Factors Associated with Endline Timely Clinic Attendance**

Table 9 presents the bivariate associations between participant characteristics and endline timely clinic attendance. Several socio-demographic variables showed significant associations. Age was strongly related to attendance ($\chi^2=11.03$, $p=0.004$), with participants aged 60+ least likely to attend on time (6.7%) compared to those under 60 ($\approx 52\%$). Marital status was also significant ($\chi^2=5.34$, $p=0.021$), with married participants more likely to attend on time (55.7%) than single participants (34.6%). Employment status demonstrated a clear effect ($\chi^2=8.84$, $p=0.003$), as employed participants had higher timely attendance (59.1%) compared to unemployed participants (32.1%).

Other variables, including county of residence, religion, ethnicity, education level, duration at KNH, type of cancer, stage of cancer, and duration of diagnosis, were not significantly associated with timely attendance. Participant type (intervention vs. control) showed the strongest association ($\chi^2=20.58$, $p<0.001$), with intervention participants substantially more likely to attend on time (67.2%) compared to controls (26.2%).

These bivariate findings highlight that age, marital status, employment, and intervention exposure were the most influential factors associated with timely clinic attendance at endline. Several analytical observations merit attention beyond the headline associations. First, county of residence showed a statistically significant difference between groups at baseline ($p=0.022$), yet it did not demonstrate a significant bivariate association with endline timely attendance ($\chi^2=0.38$, $p=0.536$). This shift is analytically notable: it suggests that proximity to the clinic, while a source of baseline group imbalance, was not an independent determinant of attendance once the intervention was in place. The SMS reminder may have partially offset the disadvantage of distance by providing additional motivation and accountability for patients residing outside Nairobi — a pattern consistent with the qualitative reports of patients who described overcoming long commutes because the reminders made them feel expected at the clinic. Second, the pattern of non-significant associations across cancer type, stage, duration of diagnosis, and duration at KNH collectively suggests that clinical severity and illness chronicity did not determine attendance behaviour to the same degree as socio-economic and motivational factors. This finding has implications for targeting: it implies that the attendance challenge is not concentrated among the most clinically complex patients but is broadly distributed, reinforcing the case for a population-level rather than risk-stratified intervention approach. Third, it is noteworthy that marital status reached bivariate significance ($p=0.021$) but did not retain significance in the adjusted model, suggesting that its

apparent association with attendance was confounded by other variables, most likely employment status and intervention exposure.

Table 9

Bivariate Distribution of Endline Timely Clinic Attendance

Characteristics	Timely clinic attendance		Chi square	P-value
	Yes n(%)	No n(%)		
Age (in completed years)			11.03	0.004**
<40	18(52.9)	16(47.1)		
40–59	38(52.1)	35(47.9)		
60+	1(6.7)	14(93.3)		
County of residence			0.38	0.536
Nairobi	13(41.9)	18(58.1)		
Outside Nairobi	44(48.4)	47(51.6)		
Marital status			5.34	0.021*
Single	18(34.6)	34(65.4)		
Married	39(55.7)	31(44.3)		
Religion			0.70	0.403
Christian	59(47.8)	59(52.2)		
Muslim	3(33.3)	6(66.7)		
Ethnicity			0.23	0.890
Kikuyu	26(46.4)	30(53.6)		

Kamba	16(50.0)	16(50.0)		
Other	15(44.1)	19(55.9)		
Education level			0.45	0.504
Less than secondary	29(43.9)	37(56.1)		
Secondary or higher	28(50.0)	28(50.0)		
Employment status			8.84	0.003**
Unemployed	18(32.1)	38(67.9)		
Employed	39(59.1)	27(40.9)		
Duration of patient at KNH (in years)			0.25	0.883
<1	22(48.9)	23(51.1)		
1–4	27(46.6)	31(53.1)		
5+	8(42.1)	11(57.9)		
Type of cancer			4.48	0.214
Cervical cancer	35(55.6)	28(44.4)		
Endometrial cancer	4(30.8)	9(69.2)		
Ovarian cancer	12(37.5)	20(62.5)		
Other	6(42.9)	8(57.1)		
Stage of cancer			0.80	0.670
Stage I	21(52.5)	19(47.5)		
Stage II	28(43.8)	36(56.3)		
Stage III	8(44.4)	10(55.6)		
Duration of diagnosis (in years)			3.38	0.184
<1	14(60.9)	9(39.1)		
1–4	34(46.6)	39(53.4)		
5+	9(34.6)	17(65.4)		

Participant type		20.58	<0.001***
Control	16(26.2)	45(73.8)	
Intervention	41(67.2)	20(32.8)	

*p<0.05, **p<0.01, ***p<0.001

Table 10 presents both crude and adjusted logistic regression results for factors associated with endline timely clinic attendance. In the adjusted model, intervention participants had significantly higher odds of timely clinic attendance compared to controls (aOR=12.8, 95%CI=3.9–42.3, p<0.001), confirming the strong independent effect of the SMS reminders. Age was also significant: participants aged 60+ had markedly lower odds compared to those under 40 (aOR=0.05, 95%CI=0.00–0.78, p=0.032). Employment status was positively associated with timely attendance (aOR=5.6, 95%CI=1.7–18.4, p=0.005), indicating that employed participants were more likely to attend on time.

Type of cancer showed significant associations: endometrial ((aOR=0.09, 95%CI=0.01–0.61, p=0.014) and ovarian cancer patients (aOR=0.19, 95%CI=0.05–0.70, p=0.013) were less likely to attend on time compared to cervical cancer patients. Duration of diagnosis ≥ 5 years showed borderline significance (aOR 0.17, 95%CI=0.03–1.00, p=0.050), suggesting reduced likelihood of timely attendance among long-term patients.

Other variables, including stage of cancer, educational level, marital status, and county of residence were included in the model but were not significantly associated with timely attendance. The final model explained 55% of the variance in timely attendance (Nagelkerke $R^2=0.549$), indicating moderate explanatory power.

Table 10

Effect of Two-Way SMS Reminder on Timely Clinic Attendance

Variable	cOR (95%CI), p-value	aOR (95%CI), p-value
Age (in completed years)		
<40	Ref	Ref
40–59	0.97 (0.43–2.18), 0.932	1.79 (0.52–6.18), 0.357
60+	0.06 (0.01–0.54), 0.011*	0.05 (0.00–0.78), 0.032*
County of residence		
Nairobi	Ref	Ref
Outside Nairobi	1.30 (0.57–2.95), 0.537	1.72 (0.46–6.40), 0.417
Marital status		
Single	Ref	Ref
Married	2.38 (1.13–4.99), 0.022*	1.58 (0.55–4.52), 0.391
Religion		
Christian	Ref	
Muslim	0.55 (0.13–2.29), 0.409	
Ethnicity		
Kikuyu	Ref	
Kamba	1.15 (0.48–2.75), 0.747	
Other	0.91 (0.39–2.15), 0.831	
Education level		
Less than secondary	Ref	Ref
Secondary or higher	1.28 (0.62–2.61), 0.504	1.15 (0.38–3.46), 0.810
Employment status		
Unemployed	Ref	Ref
Employed	3.05 (1.45–6.42), 0.003**	5.58 (1.69–18.38), 0.005**

Duration of patient at**KNH (in years)**

<1	Ref
1–4	0.91 (0.42–1.99), 0.814
5+	0.76 (0.26–2.24), 0.620

Type of cancer

Cervical cancer	Ref	Ref
Endometrial cancer	0.36 (0.10–1.28), 0.113	0.09 (0.01–0.61), 0.014*
Ovarian cancer	0.48 (0.20–1.15), 0.099	0.19 (0.05–0.70), 0.013*
Other	0.60 (0.19–1.93), 0.392	0.58 (0.09–3.76), 0.570

Stage of cancer

Stage I	Ref	Ref
Stage II	0.70 (0.32–1.56), 0.385	0.52 (0.14–1.83), 0.305
Stage III	0.72 (0.24–2.21), 0.571	0.42 (0.07–2.63), 0.356

Duration of diagnosis**(in years)**

<1	Ref	Ref
1–4	0.56 (0.22–1.46), 0.235	0.48 (0.11–2.21), 0.348
5+	0.34 (0.11–1.09), 0.069	0.17 (0.03–1.00)0.050*

Participant type

Control	Ref	Ref
Intervention	5.77 (2.64–12.60), <0.001***	12.80 (3.87–42.31) <0.001***

*p<0.05, **p<0.01, ***p<0.001; cOR: crude Odds Ratio, aOR; adjusted Odds Ratio, CI: Confidence interval;

Ref: Reference Category

4.4.5.3. Effect of Two-Way SMS Reminders on Timely Clinic Attendance

In addition to the quantitative evidence of improved timely clinic attendance, qualitative insights from both patients and providers revealed the mechanisms through which the two-way SMS reminders influenced punctuality and adherence. Participants described how the reminders reduced forgetfulness and facilitated better planning, created a sense of motivation and accountability, and fostered emotional support by strengthening the connection between patients and the clinic (Table 11). These perspectives provide explanatory depth to the statistical improvements, highlighting the behavioural and relational pathways that patients and providers associated with timely attendance.

Table 11

Thematic Results of Effect of Two-Way SMS Reminders on Timely Clinic Attendance

Theme	Sub-theme
Effect of SMS reminder on timely clinic attendance	1. Reduced forgetfulness and improved planning
	2. Motivation and accountability
	3. Emotional support and connection to the clinic

Reduced forgetfulness and improved planning

Patients consistently reported that SMS reminders helped them overcome forgetfulness and improved their ability to plan ahead for clinic visits. The reminders provided timely prompts that replaced reliance on paper appointment cards, which were often misplaced.

“SMS reminders have definitely helped me remember my appointments. Before, I used to rely on my paper appointment card, but sometimes I misplaced it. Now,

I always have my phone with me, so it's much more convenient.” (FGD 2 Participant 5, 51 years)

“SMS reminders have made it easier for me to plan my day around my clinic appointments. I can set reminders on my phone, which helps me organize my schedule. It also reduces the likelihood of last-minute cancellations because I forgot about an appointment.” (FGD 1 Participant 6, 44 years)

These findings highlight that SMS reminders directly addressed forgetfulness and improved patient planning, thereby contributing to more timely and reliable clinic attendance. At a behavioural level, this mechanism is significant because forgetfulness and poor planning are not motivational failures but cognitive and logistical ones: addressing them requires external cueing systems rather than attitude change, which explains why reminders produced attendance improvements even among patients who already expressed high satisfaction with clinic services at baseline.

Motivation and accountability

Beyond convenience, SMS reminders acted as motivational cues, reinforcing patients' sense of responsibility and accountability to attend appointments. Patients described feeling expected by the clinic, which encouraged them to overcome barriers such as long travel distances.

“The clinic is quite a distance from my home, and sometimes I'd think of skipping appointments to avoid the commute. However, with the SMS reminders, it became more of a motivation than a hassle. I knew the clinic was expecting me, and it encouraged me to keep going regularly.” (FGD 1 Participant 3, 51 years)

“With the introduction of SMS reminders, we’ve seen a notable improvement in our patients’ punctuality and adherence to scheduled clinic visits.” **(Key Informant – Nurse, 36 years)**

SMS reminders not only reduced missed appointments but also fostered accountability, motivating patients to attend even when faced with logistical challenges. This accountability mechanism is behaviourally distinct from simple reminding: it activates social obligation as a driver of attendance, suggesting that the two-way nature of the SMS system, implying a clinic that both sends and expects a response, may have added motivational value beyond what a one-directional reminder alone would achieve.

Emotional support and connection to the clinic

Patients also described SMS reminders as more than logistical tools; they perceived them as signals of care and support from the clinic. The reminders created a sense of personal connection, making patients feel valued and emotionally supported.

“There’s something about receiving an SMS reminder that’s different from the usual paper-based reminders. It feels more personal. It’s like the clinic cares about me, not just as a patient but as a person. It might sound strange, but those messages gave me emotional support too, which was unexpected but greatly appreciated.” **(FGD 1 Participant 2, 38 years)**

These perspectives suggest that SMS reminders enhanced patient-provider relationships by fostering emotional support and connection, which in turn strengthened adherence and punctuality. While the functional mechanisms of reminders (reducing forgetfulness, enabling planning) operate primarily at the individual level, this relational mechanism operates at the interface between patient and provider, suggesting that the

intervention may have strengthened treatment engagement through a pathway that is rarely captured in quantitative attendance data alone.

The qualitative findings complement the quantitative evidence by revealing how SMS reminders improved timely clinic attendance through behavioral and relational mechanisms. Patients described the reminders as reducing forgetfulness and enabling better planning, while also motivating them to attend despite logistical barriers such as distance. Providers confirmed these improvements, noting enhanced punctuality and adherence. Importantly, patients also perceived the reminders as a source of emotional support, strengthening their connection to the clinic and reinforcing accountability. Together, these insights explain why attendance improved, demonstrating that the intervention was not only effective in measurable terms but also meaningful in shaping patient behavior and relationships with care providers.

4.4.6. Research Question 5: What is the Incremental Cost Associated with Integrating Two-way SMS Reminders into Routine Gynae-oncology Clinic Services at KNH?

An exploratory economic evaluation was undertaken to estimate the incremental provider costs of integrating the two-way SMS reminder system into routine gynae oncology outpatient services at Kenyatta National Hospital. Costs were categorized into start up and recurrent components (Table 12), consistent with the micro costing framework described in Chapter 3.

4.4.6.1. Incremental Cost of Two-Way SMS Reminder Intervention

Start-up costs reflected one-time expenditures required to initiate the intervention. These included staff training and procurement of mobile phones for SMS delivery. Four staff members attended a two-hour training session, resulting in a total of eight staff-hours. Valued at an average hourly wage of USD 3.33, the training cost was USD 26.64. Two mobile phones were purchased at USD 10 each, totaling USD 20.00. The combined start-up cost was therefore

USD 46.64. These modest expenditures highlight the relatively low resource requirements for initiating SMS-based communication in a referral hospital setting.

Recurrent costs comprised communication charges and personnel time associated with message preparation and dispatch. A total of 488 reminders were sent over the trial period (61 patients $\times$ 4 visits $\times$ 2 reminders per visit). At USD 0.20 per SMS, communication costs amounted to USD 97.60. Personnel time was estimated using a time-in-motion approach. Drafting and sending each reminder required approximately 10 minutes, resulting in 4,880 minutes (81.33 hours) across all reminders. Valued at USD 3.33 per hour, personnel costs totaled USD 270.84. The combined recurrent cost was USD 368.44. Staff time constituted the largest share of recurrent expenditure.

The total incremental cost of the intervention over the study period was USD 415.08, derived from the sum of start-up (USD 46.64) and recurrent costs (USD 368.44). This figure represents the additional resources required by the hospital to implement and sustain the SMS reminder system alongside standard care.

Table 12

Incremental Cost of Intervention Over 6 Months

Cost component	Quantity	Unit cost (USD)	Total cost (USD)
Start-up cost			
Staff training time	8 hours	3.33/hour	26.64
Mobile phones	2	10.00	20.00
<i>Subtotal start-up cost</i>			46.64
Recurrent costs			
SMS reminders	488	0.20	97.60
Staff time (81.33 hrs)	81.33 hrs	3.33/hr	270.84

<i>Subtotal recurrent cost</i>	368.44
Total incremental cost	415.08

4.4.6.2. Cost per Patient and Incremental Cost per Additional Timely Attendee

Dividing the total incremental cost by the 61 patients who received SMS reminders ($\$415.08 \div 61$) yielded an average provider cost of USD 6.81 per patient over the follow-up period. This measure illustrates the affordability of the intervention at the individual patient level, particularly when compared to the broader costs of oncology care.

To assess economic efficiency, the incremental cost per additional timely clinic attendee was calculated. Timely attendance was achieved by 41 patients in the intervention arm compared to 16 in the control arm, representing 25 additional timely attendances attributable to the SMS intervention. Dividing the total incremental cost by this difference ($\$415.08 \div 25$) yielded USD 16.60 per additional timely attendee. This measure indicates that the hospital incurred an additional cost of approximately USD 17 to secure one more patient's adherence to scheduled appointments. Table 13 presents the summary cost outcomes.

Table 13

Summary Cost Outcomes

Measure	Value (USD)
Total start-up cost	46.64
Total recurrent cost	368.44
Total incremental cost	415.08
Cost per patient	6.81
Additional timely attendees	25

Cost per additional timely attendee 16.60

To contextualise the cost findings further, a brief consideration of their robustness under varying assumptions is warranted. The SMS unit cost of USD 0.20 reflects prevailing rates at the time of the trial; however, mobile communication costs in Kenya have been subject to fluctuation, and tariff changes could affect recurrent expenditure. If the per-SMS cost were to double to USD 0.40, a conservative stress-test, the total communication cost would rise from USD 97.60 to USD 195.20, increasing total incremental costs to approximately USD 512.68 and the cost per additional timely attendee to approximately USD 20.51. Even under this scenario, the intervention would remain affordable relative to the broader costs of oncology care in a national referral setting. For additional context, outpatient consultation costs at KNH and comparable tertiary facilities in East Africa typically range from USD 5 to USD 20 per visit when staff time, consumables, and overhead are factored in. An additional cost of approximately USD 17 per extra timely attendee is therefore well within the range of routine outpatient expenditure and represents a proportionally modest investment to secure adherence to a scheduled appointment. Furthermore, the cost analysis presented here captures provider-side incremental costs only. Patient-side costs, including transport, time off work, and accompanying persons, were not formally quantified, representing a limitation of the economic evaluation. Future full economic analyses should incorporate these costs to generate a comprehensive cost-effectiveness ratio and support comparisons with alternative attendance-improvement strategies.

4.5. Evaluation of Findings

This section interprets the study's findings in light of the conceptual framework and relevant literature, organised around each of the five research questions: (1) baseline timely clinic attendance, (2) feasibility of two-way SMS reminders, (3) acceptability among patients,

(4) effectiveness in improving attendance, and (5) cost analysis of the intervention. The aim is not to restate the results but to assess what they mean: where they align with theoretical expectations, where they depart from them, and what contextual factors account for unexpected patterns.

4.5.1. Objective 1: Baseline Timely Clinic Attendance

The finding that only 31.1% of gynaecological oncology patients attended clinic on time at baseline, with no significant difference between intervention and control arms ($p=0.696$), establishes the magnitude of the attendance challenge that motivated this study and provides the pre-intervention benchmark against which the intervention's effect can be meaningfully evaluated. This result is largely consistent with expectations from the literature. Studies across sub-Saharan Africa have documented poor attendance continuity among cancer patients as a consequence of converging financial, logistical, and system-level barriers (Harsch et al., 2025; Lombe et al., 2023). In the Kenyan context specifically, Atun and colleagues (2018) identified out-of-pocket costs and transport challenges as primary barriers to cancer care access, patterns directly reflected in the baseline data here, where financial limitations were cited by 76.2% of participants as an obstacle to timely attendance and transport-related difficulties were among the leading reported causes of delay. That only approximately one in three patients was attending on time prior to the intervention confirms the clinical urgency of the problem and situates KNH within the broader sub-Saharan African pattern of constrained oncology attendance that the literature has characterised, though largely without population-specific data from Kenyan gynaecological oncology settings.

From a Theory of Planned Behaviour (TPB) perspective, a low baseline attendance rate does not necessarily indicate that patients held negative attitudes toward clinic attendance. The high satisfaction with clinic services reported at baseline, 60.7% very satisfied and 33.6% satisfied, confirms that attitudes toward the clinic and its care were broadly positive, as the

literature on patient satisfaction in Kenyan public healthcare would lead one to expect (Harsch et al., 2025). Rather, the data suggest that perceived behavioural control was critically undermined by structural barriers. TPB predicts that even strongly positive attitudes and intentions will fail to translate into behaviour when perceived control over that behaviour is low (Ajzen, 1991). In the present context, financial constraints, transport barriers, and competing work and family obligations collectively eroded patients' sense of control over whether they could arrive on time, regardless of how much they valued the appointment itself. This is not a failure of motivation but of structural enablement — a distinction that has direct consequences for intervention design. An intervention that targets motivational deficits (such as health education or attitude change campaigns) would be ill-matched to this population's barriers; an intervention that addresses the logistical-cognitive dimension of attendance, such as SMS reminders that support advance planning and reduce forgetfulness, is far better aligned.

Social Cognitive Theory (SCT) adds a complementary dimension. At baseline, the absence of external reinforcement mechanisms, patients relied on paper appointment cards that were often misplaced, meant that even patients with adequate self-efficacy to attend had no reliable cueing system to activate that self-efficacy at the appropriate time. SCT identifies cues to action and reinforcement as essential complements to self-efficacy in sustaining health behaviours (Bandura, 1986). The baseline data therefore reveal not only a structural problem (financial and transport barriers) but a behavioural architecture problem: the system provided no mechanism to prompt, remind, or reinforce attendance behaviour between the time of appointment booking and the appointment date itself. This absence of a cueing infrastructure is precisely the gap that SMS reminders are designed to fill, and it explains why the intervention would be expected to have a meaningful effect even in a population where attitudes toward the clinic are already positive.

The WHO Health Systems Building Blocks framework situates these individual-level patterns within their systemic context. The financing block is directly implicated: out-of-pocket costs remain the most pervasive barrier to timely attendance, reflecting a structural weakness in how cancer care is financed at the point of service in Kenya. The service delivery block is also relevant: the concentration of specialist oncology services at a national referral hospital creates access asymmetries for patients who must travel from outside Nairobi, which is the majority of the present sample (74.6% residing outside Nairobi County). The health information systems block reveals a gap at baseline: without a systematic appointment reminder mechanism, the information pathway between clinic and patient was essentially one-directional and episodic, relying on paper records that offered no active recall function. These systemic deficits reinforce that non-attendance is not a patient-level failure but a product of system design, a framing that is essential for interpreting both the scale of the baseline problem and the rationale for the intervention.

Two baseline findings diverge from initial expectations and warrant specific evaluation. First, health problems were cited by only 7.9% of participants as a cause of attendance delays, despite this population managing active gynaecological malignancies, some at advanced stages. One might anticipate that the physical and symptomatic burden of cancer would be a leading attendance barrier in an oncology cohort. The low prevalence of this response suggests that patients distinguished between disease severity and their capacity to manage clinic logistics, and that logistical and economic factors dominated their self-reported experience of non-attendance. This finding is clinically important: it signals that the attendance problem in this population is not primarily driven by clinical deterioration, which would warrant a different class of intervention, but by addressable logistical barriers.

A further observation worth drawing from the baseline data concerns the association between employment status and timely attendance ($\chi^2=8.53$, $p=0.004$ at baseline), which

emerged independently of intervention exposure and persisted as a significant predictor in the adjusted regression model at endline (aOR=5.58). The strength of this association warrants evaluative attention. Employment generates two competing dynamics for clinic attendance: it creates the financial resources that reduce economic barriers to attending, but simultaneously imposes scheduling conflicts that constrain the times at which attendance is possible. The baseline data suggest that the resource-generating dimension dominates in this population, with employed patients showing markedly higher timely attendance (42.4%) than unemployed patients (17.9%). This pattern is consistent with studies from analogous LMIC populations that identify poverty, rather than time constraints per se, as the more binding determinant of healthcare utilisation (Harsch et al., 2025; Lombe et al., 2023). The implication for intervention design is important: financial barrier mitigation strategies, transport subsidies, hospital-based social work support, or graduated payment schemes, would be expected to disproportionately benefit the unemployed subgroup, which constitutes 45.9% of the present sample. The SMS reminder intervention operates on the cognitive and motivational dimensions of the attendance problem, which it addressed effectively at the aggregate level, but it cannot address the economic dimension that appears to underlie the employment-attendance association. This reinforces the argument for a multi-component approach in which SMS reminders and financial enablement strategies are deployed in combination rather than treated as alternatives.

The WHO Building Blocks financing block is directly implicated by this pattern. The association between employment and timely attendance, operating independently of geography, cancer type, and educational level in the adjusted model, confirms that the economic cost of maintaining attendance is a proximate and significant determinant of who the health system is actually able to serve. An intervention that doubles timely attendance among employed patients but achieves more limited gains among unemployed patients would have the net effect of widening the socioeconomic attendance gap even as it improves the aggregate

rate. The evaluation of differential effectiveness by employment status in Section 4.5.4 directly addresses this equity concern and is one of the findings that most clearly demands complementary policy action at the financing and service delivery levels of the health system.

4.5.2. Objective 2: Feasibility of two-way SMS reminders

Provider accounts consistently affirmed the feasibility of implementing two-way SMS reminders at KNH, with all four key informants, spanning nursing, oncology, health information, and nurse leadership roles, endorsing the intervention as compatible with existing infrastructure, cost-effective, and integrable into existing workflows. This finding largely aligns with expectations generated by the Diffusion of Innovations (DoI) framework, which predicts that innovations characterised by high relative advantage, low complexity, and strong compatibility with existing practice are more readily adopted within health systems (Rogers, 2003). In the present study, all three of these attributes were empirically confirmed by providers: SMS reminders offered a clear advantage over paper appointment cards in reducing missed appointments and administrative burden; their operation required no new clinical skills or specialist training; and they were described as fitting naturally into existing appointment management routines without disrupting clinical workflows. Greenhalgh et al.'s (2005) systematic review of diffusion in service organisations similarly found that relative advantage and compatibility were the most consistently decisive adoption factors in healthcare settings, a pattern the present findings reinforce in the specific context of a Kenyan national referral oncology service.

The DoI attribute of trialability is also relevant here. The pilot RCT design inherently operationalised trialability: providers were able to experience the intervention over the trial period before any commitment to permanent adoption, observe its effects on attendance patterns and clinic flow, and form empirically grounded views about its feasibility. The fact that all four key informants endorsed feasibility following this direct experience, rather than in

response to a hypothetical proposal, strengthens the credibility of the feasibility assessment considerably. This is a methodological advantage of embedding feasibility evaluation within a trial rather than assessing it prospectively through staff surveys. The observability attribute is equally apparent: providers described visible improvements in punctuality and reductions in administrative workload as direct consequences of the intervention, confirming that its benefits were not abstract but immediately perceptible within the clinical environment.

The unanimous provider endorsement warrants critical reflection, however. In the feasibility literature, mixed or resistant provider views are common when new interventions impose additional workload or require workflow adaptation (Ødegård et al., 2022). The complete absence of such ambivalence here is notable and demands explanation rather than simple acceptance. Two interpretations are plausible. The first is that the intervention genuinely imposed minimal additional burden on clinical staff, consistent with the simple, low-technology nature of the SMS delivery approach employed and the modest personnel time requirements documented in the cost analysis. The second is that the acute clinical and operational pressure created by persistent non-attendance in a high-volume oncology service created a readiness for any credible solution, a contextual predisposition toward adoption that would not be equally present in settings with lower attendance pressures or greater existing system capacity. Both interpretations are plausible and non-mutually exclusive; the latter in particular limits the generalisability of the unanimity finding to other healthcare contexts where non-attendance may be a less visible operational problem.

The WHO Building Blocks framework reveals the multi-dimensional system footprint of the feasibility findings. At the service delivery level, providers described improvements in clinic punctuality and continuity of care as direct outcomes of the reminder system, consistent with the framework's prediction that effective health information systems support better service delivery (WHO, 2007). The health information systems block was directly

strengthened: SMS reminders represent a systematic digital communication channel between clinic and patient that replaces the passive, paper-based appointment record. At the financing level, providers across all four interviews characterised the cost of SMS messaging as minimal relative to its benefits, an assessment that anticipates and aligns with the formal cost analysis reported in cost analysis results. However, the workforce and infrastructure blocks emerged as sites of genuine vulnerability. The need for server capacity expansion, additional IT personnel, and administrative staff to manage message volumes at scale directly implicates both of these blocks. Rono et al.'s (2021) evaluation of SMS reminders in Kenyan eye health services identified precisely the same system-level constraints, workforce training and infrastructure financing, as the critical bottlenecks for sustainability, confirming that the present findings reflect a structural pattern in Kenyan public health digital innovation rather than site-specific limitations.

The barriers identified, limited patient phone access, unreliable network connectivity, language diversity, and staffing constraints, were not unexpected and are well-documented in the LMIC mHealth feasibility literature (Kruse et al., 2019; Demsash et al., 2022). However, the character of how these barriers were raised in provider accounts adds analytical value. They were not presented as objections to feasibility but as conditions attached to an otherwise positive assessment, a profile of constrained rather than blocked feasibility. Providers did not simply identify barriers; they paired each barrier with a concrete recommendation, creating what amounts to an implementation roadmap: multilingual messaging to address language diversity, infrastructure investment to address connectivity, patient education and outreach to address phone access gaps, and expanded technical staffing for scale-up management. This solution-oriented framing is analytically significant: it suggests a provider workforce that is not merely receptive but actively engaged in problem-solving for implementation, which the DoI framework identifies as a characteristic of early adopters whose endorsement drives

broader diffusion (Rogers, 2003). The equity implications of the identified barriers should not be minimised, however. Phone access gaps and language barriers disproportionately affect older patients, those from rural areas, and those with lower educational attainment, the very sub-groups who may most need effective appointment support. Feasibility at the system level does not therefore guarantee equitable reach at the patient level, and the equity implications require careful attention in any scale-up of the intervention.

4.5.3. Objective 3: Acceptability of Two-way SMS Reminders

The finding that 88.5% of intervention participants reported high composite acceptability, with no participant reporting low acceptability, is consistent with and in some respects stronger than the literature's expectations for SMS reminder interventions in gynaecological cancer contexts in sub-Saharan Africa. Moodley et al. (2019), in their mixed-methods study in Cape Town among women attending cervical cancer follow-up, found broad receptiveness to SMS appointment reminders, though acceptability was qualified by privacy concerns and network reliability worries. Mrémi et al. (2021) reported high willingness to receive SMS communications among women in rural Kilimanjaro, Tanzania, even for sensitive diagnostic information. The present findings corroborate this pattern and extend it to the distinct context of a national referral oncology hospital in East Africa, where the complexity of the patient population, geographically diverse, educationally heterogeneous, and managing serious malignancies, might have been expected to introduce greater variability in acceptability responses than was observed.

The Technology Acceptance Model (TAM) provides the primary theoretical lens for evaluating the acceptability data. TAM posits that perceived usefulness and perceived ease of use jointly determine attitudes toward technology adoption, which in turn predict behavioural intention to use the technology (Davis, 1989; Venkatesh & Davis, 2000). The pattern of mean scores in Table 6 maps directly onto these constructs. The highest-rated items, helpfulness in

attending appointments and satisfaction with receiving reminders, correspond to TAM's perceived usefulness: patients consistently perceived the reminders as instrumentally valuable in achieving the specific goal of attending their appointments on time. Items measuring ease of understanding and message clarity correspond to perceived ease of use: patients found the reminders cognitively accessible and straightforward to interpret. This alignment between the empirical acceptability profile and TAM's predicted structure of adoption, high usefulness and high ease of use producing high positive attitudes, provides convergent validity for the acceptability finding and suggests that TAM retains explanatory power for SMS-based mHealth interventions in LMIC oncology populations despite having been developed and primarily validated in organisational ICT contexts (Zaineldeen et al., 2020).

Granularity that TAM cannot offer on its own is added by the Theoretical Framework of Acceptability (TFA) (Sekhon et al., 2017). Affective attitude, burden, perceived effectiveness, ethicality, intervention coherence, opportunity costs, and self-efficacy are the seven components that make up the TFA's conceptualization of acceptability. It anticipates that these constructs will not necessarily covary consistently across all participants. This prediction is borne out in the variability pattern of the acceptability scores. Items reflecting core functional utility (helpfulness, satisfaction) showed very small standard deviations ($SD=0.44$ and $SD=0.39$ respectively), indicating near-consensus, the intervention's practical value was experienced consistently regardless of individual differences in age, education, or clinical profile. By contrast, the preference for continuation ($SD=1.30$) and the disruption/inconvenience item ($SD=1.47$) showed considerably greater spread. These divergent patterns are analytically meaningful: they suggest that while perceived effectiveness (a TFA construct) was universally endorsed, burden and ethicality, the dimensions that most depend on individual circumstances, privacy context, and personal communication preferences, were experienced much more variably. The qualitative themes of personalisation, privacy, and need

for improvement directly illuminate this variability, confirming that high aggregate acceptability coexists with subgroup-level divergence on dimensions that a quantitative mean score cannot capture.

The finding that patients perceived reminders as signals of personal care and emotional connection, beyond their logistical function, was not fully anticipated by the quantitative design and constitutes one of the most substantively novel contributions of the acceptability analysis. Aunon et al. (2023), in an mHealth acceptability study among women in HIV care in Mombasa, Kenya, similarly identified the relational dimension, feeling remembered and cared for by the health system, as a particularly salient driver of positive affective attitude. In the present study, patients described SMS reminders as making them feel that “the clinic cares about me, not just as a patient but as a person.” This affective-relational response carries theoretical significance that extends beyond TAM. TAM was developed to explain technology adoption in organisational and workplace contexts and does not incorporate the affective and relational dimensions of healthcare interactions (Ajibade, 2018). The present finding supports the critique that TAM requires augmentation, through SCT’s concept of self-efficacy reinforcement via social modelling and encouragement, or through the TPB’s subjective norm construct, whereby the patient’s perception of being expected and valued by the clinic strengthens behavioural intention, when applied to patient-facing health technologies in emotionally charged clinical settings. The psychological burden carried by gynae-oncology patients, for whom a clinic visit is not a routine administrative event but a consequential encounter with their cancer management system, means that relational cues embedded in an SMS reminder may carry disproportionate motivational weight. This insight is not derivable from the quantitative acceptability scores alone and is one of the clearest illustrations in this study of the value of the mixed-methods design.

A further unexpected dimension of the acceptability findings is the low perceived disruption score (mean=3.34) relative to what the literature might predict for a population managing serious illness with competing life demands. Studies in NCD mHealth contexts have documented messaging fatigue and perceived intrusiveness as meaningful acceptability barriers, particularly when reminder frequency is high (Schwebel & Larimer, 2018; Aboye et al., 2023). The relatively low disruption ratings here may reflect the modest message frequency employed in the intervention, two reminders per appointment, which appears to have remained below the threshold of perceived intrusiveness for most participants. It may also reflect the two-way design: the capacity to respond to a reminder, rather than simply receiving it passively, may have generated a sense of agency and control that reduced the sense of being managed or intruded upon. This distinction between one-way and two-way SMS acceptability is an area where the present findings add contextual texture to the more limited and mixed evidence base reviewed by Ødegård et al. (2022).

One dimension of acceptability that the quantitative survey could not capture and that the qualitative themes illuminate indirectly is the distinction between retrospective and prospective acceptability as theorised by Sekhon et al. (2017). The present study measured retrospective acceptability, grounded in actual lived experience of the intervention over four appointment cycles, which is methodologically stronger than the prospective willingness surveys that dominate the LMIC mHealth acceptability literature. This design choice produces an acceptability assessment that reflects what patients actually experienced when receiving and responding to reminders over time, including the habituation and fatigue that extended exposure might be expected to generate, rather than what they anticipated experiencing before the intervention began. The high retrospective acceptability scores, particularly on the continuation preference item (mean=4.23 despite the widest spread, SD=1.30), are therefore not simply expressions of willingness but of sustained positive experience across multiple

reminder cycles. This is a stronger evidential claim than prospective acceptability studies can support, and it distinguishes the present findings from the majority of the acceptability literature in the field.

The subset of intervention participants (11.5%) who reported moderate rather than high composite acceptability, while a minority, should not be analytically minimised. In a clinical context where the objective is equitable benefit, a tenth of the intervention population experiencing less than high acceptability represents a non-trivial proportion for whom the intervention in its current form was not fully effective at the acceptability level. The qualitative themes of personalisation and privacy, raised as areas for improvement, likely account for much of this moderate-acceptability subgroup: patients who found the generic message format insufficiently responsive to their individual circumstances, or who experienced privacy concerns about receiving clinic-related messages on a potentially shared device, would score the continuation preference and disruption items more variably, producing the elevated standard deviations observed on precisely those items. This analytically coherent pattern, where the source of variability in the quantitative scores maps directly onto the themes that the qualitative exploration surfaced as areas for improvement, is itself an illustration of the analytical complementarity that the mixed-methods design enables. It also provides a clear design target: addressing personalisation and privacy through the adaptations recommended in Section 5.3.3 would be expected to reduce the proportion of moderate-acceptability responders and narrow the standard deviations on the continuation preference and disruption items in future iterations.

4.5.4. Objective 4: Effectiveness of two-way SMS reminders

The finding that timely clinic attendance increased from 32.8% at baseline to 67.2% at endline in the intervention arm, against a slight decline from 29.5% to 26.2% in the control arm, with the difference statistically significant at $p < 0.001$, represents the primary

effectiveness outcome of this pilot trial. The adjusted logistic regression confirmed SMS intervention exposure as the strongest independent predictor of timely attendance at endline (aOR=12.8, 95%CI=3.87–42.31), an effect that persisted after controlling for all sociodemographic and clinical variables found to be associated with attendance in bivariate analysis. The progressive trajectory of improvement shown in Figure 9, where the intervention group's attendance rate rose steadily across four successive appointments while the control group remained flat, is consistent with a genuine and sustained behavioural effect rather than a transient novelty response, a distinction that is important for a pilot trial seeking to establish proof-of-concept for a longer-term intervention.

The magnitude of this effect warrants evaluation against the available literature. Wanyoro and Kabiru's (2017) RCT of SMS reminders for ovarian tumour rescreening at Thika Level 5 Hospital in Kenya found attendance rates of 67.1% versus 20.3% in intervention and control arms respectively, a pattern structurally similar to the present findings, though addressing a single-episode rescreening event rather than serial outpatient attendance across multiple appointments. Tang's (2022) meta-analysis of twelve oncology SMS notification studies found a pooled significant positive effect on attendance, with heterogeneity (approximately 32%) reflecting the strong context-dependence of SMS effects across settings. The present study's effect size falls at the higher end of the distribution reported in that meta-analysis, which is consistent with several contextual features that the literature identifies as moderators of SMS effectiveness. First, the low baseline attendance rate (31.1%) created substantial room for improvement, meaning the absolute magnitude of the effect is partially a function of the starting point. Second, the two-way design may have generated additional motivational value over and above the cueing function that one-way reminders provide. Njuguna et al.'s (2024) analysis of two-way SMS in HIV care in South Africa found that the interactive element enabled patients to communicate barriers and for providers to respond, a

feedback loop that one-way SMS cannot provide. Qualitatively, this mechanism was confirmed in the present study: patients reported that the sense of being expected by the clinic, activated by the interactive nature of the reminder system, motivated attendance even when logistical barriers such as distance made it tempting to stay home.

The TPB provides the most direct theoretical framework for interpreting the effectiveness mechanism. TPB predicts that behavioural intention, and therefore actual behaviour, is jointly determined by attitude, subjective norms, and perceived behavioural control (Ajzen, 1991). All three constructs appear to have been activated by the SMS intervention. Attitudes toward attending were already positive at baseline, as the high satisfaction data confirm; what changed was the perceived behavioural control (through advance planning and forgetfulness reduction) and the subjective norm (through the sense of being expected and accountable). The progressive accumulation of timely attendance across successive appointments, visible in Figure 9, is consistent with SCT's prediction that repeated reinforcement strengthens self-efficacy over time: each successful on-time attendance, facilitated by the reminder, may have reinforced patients' confidence in their capacity to manage their appointments, creating a positive feedback loop that sustained the behavioural improvement across the trial period. This temporal dimension — the progressive rather than plateau character of the improvement trajectory — is one of the most analytically interesting features of the effectiveness data and one that a cross-sectional endline measurement alone would have missed.

The regression findings revealed differential effectiveness by age and cancer type that require careful evaluation. The finding that participants aged 60 and above had markedly lower odds of timely attendance (aOR=0.05, 95%CI=0.00–0.78) after adjustment is consistent with the broader mHealth literature, which identifies older age as a consistent moderator of SMS intervention effectiveness in African populations due to lower device ownership, reduced

digital literacy, and greater difficulty in reading and responding to text messages (Zurovac et al., 2013; Kruse et al., 2019). However, because the qualitative phase included focus group participants aged 50 and above who reported positive experiences with the reminders, the age effect should not be interpreted as a blanket finding that older patients cannot benefit, rather, it suggests that the intervention in its current form may not sufficiently address the specific barriers faced by the oldest patient subgroup, and that targeted adaptations such as audio reminders or family-mediated notification would be needed to achieve equitable reach.

The significantly lower odds of timely attendance among patients with endometrial (aOR=0.09) and ovarian cancer (aOR=0.19) relative to cervical cancer patients is a more unexpected finding that the literature does not directly anticipate. Several explanatory pathways are plausible. Endometrial and ovarian cancers are typically managed with more intensive treatment regimens, surgery, chemotherapy, or combination modalities, that impose greater physical burden between appointments, potentially reducing patients' functional capacity to attend even when motivated to do so. Alternatively, the appointment structures for these cancer types at KNH may differ from those for cervical cancer in ways that create different attendance dynamics. The fact that this differential effect survived adjustment for stage and duration of diagnosis suggests it is not simply a proxy for disease severity.

The control group's slight decline in attendance from baseline to endline (29.5% to 26.2%) also merits interpretation. This trajectory is consistent with a natural drift pattern in the absence of active intervention, patients who are managing competing demands without external support may find it increasingly difficult to prioritise timely attendance over the course of multiple appointments. It is also consistent with a possible passive demoralisation effect in a control arm that received no additional support, though this interpretation is speculative.

4.5.5. Cost Analysis of Two-Way SMS Reminders

The total incremental cost of implementing the SMS reminder intervention over the study period was USD 415.08, yielding a cost per patient of USD 6.81 and a cost per additional timely attendee of USD 16.60. These figures occupy a credible position within the landscape of published microcosting benchmarks from comparable Kenyan and African LMIC mHealth studies. Chen et al.'s (2020) provider-perspective microcosting of a two-way SMS intervention for peripartum HIV care in Nairobi, the most methodologically proximate published benchmark identified in the literature review, estimated a cost per beneficiary of USD 62 for a semiautomated, purpose-built platform operating with dedicated research infrastructure. The substantially lower per-patient cost in the present study (USD 6.81) reflects two key structural differences: the absence of platform development costs, which accounted for 29.9% of total costs in Chen et al.'s analysis; and the smaller scale of the pilot, which distributes fixed start-up costs across a more limited denominator. Larsen-Cooper et al.'s (2016) evaluation of an mHealth community health worker intervention in Malawi reported a cost of USD 29.33 per user, again at a different scale and with different cost drivers, but confirming that the present study's per-patient figure is within a plausible range for similar interventions in comparable LMIC settings.

The cost composition findings are consistent with the most robust and consistent pattern in the mHealth microcosting literature: personnel time dominates total recurrent expenditure in two-way SMS interventions. In the present study, staff time accounted for USD 270.84 of USD 368.44 in recurrent costs, a 73.5% share that exceeds even Chen et al.'s (2020) finding of 48.2%, likely reflecting the manually managed nature of the present system, where each message required individual drafting and dispatch rather than automated scheduling. This personnel-intensity is both the intervention's primary cost driver and its most tractable cost-reduction opportunity at scale. The mHealth costing literature consistently identifies task-

shifting, to lower-cadre health workers, community health volunteers, or automated scheduling systems, as the most effective mechanism for reducing marginal labour costs without compromising delivery quality (Iribarren et al., 2017; Vassall et al., 2017). At the scale of a routine KNH gynae-oncology outpatient service, which processes substantially more patients than the 61 in the present intervention arm, the per-message labour cost would be further reduced through automation of the reminder scheduling function alone, even without replacing the human response capacity that the two-way design requires. The remaining communication costs — USD 97.60 for 488 messages at USD 0.20 per SMS, are modest and relatively stable at scale, given that Kenya’s competitive mobile telecommunications market keeps per-message tariffs among the lowest in the region (Chen et al., 2020).

The cost per additional timely attendee of USD 16.60 is the most policy-relevant output of the economic evaluation, as it directly answers the health manager’s question: what does it cost to produce one more patient who attends on time? Contextualising this figure against the downstream costs of non-attendance strengthens the economic case for the intervention. Missed oncology appointments at KNH generate multiple categories of waste: unrecoverable appointment slots in a clinic operating at or above capacity; clinical consequences of delayed monitoring, including delayed detection of recurrence or treatment side effects; and the downstream treatment costs that result when disease progresses unchecked between appointments (Davey et al., 2021; Chen, 2023). While a full cost-offset analysis requires longer follow-up and health outcome data that exceed the scope of a pilot evaluation, Fischer et al.’s (2017) evaluation of SMS reminders in a US safety-net health system found that the operational cost savings from recovered appointments substantially exceeded the cost of the reminder system itself, a finding that, while not directly transferable to the KNH context, provides a framework for the value interpretation. The pilot-scale figure of USD 16.60 should therefore be understood as a ceiling estimate: it reflects the per-unit cost of a manually managed system

operating at small scale, and the economics of scale-up, well-established in the mHealth costing literature (Chen et al., 2020; Larsen-Cooper et al., 2016), strongly predict that routine deployment would reduce this figure considerably.

A further dimension of the cost evaluation warranting interpretive attention is what the present analysis does not capture. The provider-perspective microcosting approach, while methodologically appropriate for a pilot-embedded economic evaluation (Eldridge et al., 2016; Drummond et al., 2015), excludes patient-side costs, transport to and from the clinic, time costs of attendance, and the costs borne by accompanying family members or carers. In the present study population, financial barriers and transport challenges were the most consistently cited obstacles to timely attendance, which means that the intervention addresses the scheduling and motivation dimensions of the attendance problem but does not directly reduce the out-of-pocket costs that patients incur when attending. Future economic evaluations of this intervention, if it proceeds to a definitive trial, should adopt a societal cost perspective that captures these patient-borne expenditures and enables a fuller assessment of the intervention's economic value from the perspective of those it is intended to serve.

One further cost dimension that the present analysis does not formally capture but that merits evaluative attention is the cost of administrative time currently consumed by the management of missed appointments under standard care in the control arm. The control arm's endline attendance rate of 26.2% means that 45 of 61 control patients failed to attend on time at the final measurement point. Each of these missed or late appointments generates downstream administrative activity: clinical staff time to reschedule, clinical notes prepared in advance but not used, and the disruption to clinic flow that late arrivals create. If the cost of managing each missed appointment were to be estimated, even conservatively, the incremental provider cost of the SMS intervention begins to look not merely affordable but actively cost-saving relative to the operational burden of the counterfactual. While a formal cost-offset

calculation would require data on KNH's actual per-appointment administrative costs that exceed the scope of this pilot study, this logic is well-established in the appointment reminder literature (Fischer et al., 2017; Davey et al., 2021) and warrants explicit acknowledgement in the economic evaluation narrative. Future studies should collect administrative cost data prospectively alongside the intervention cost data to enable this comparison and to present a more complete picture of the intervention's net economic impact from the health system perspective.

4.5.6. Integration of Quantitative and Qualitative Findings

The value of a mixed-methods design lies not merely in the parallel collection of quantitative and qualitative data, but in the analytical leverage that their integration generates, the ability to ask questions that neither strand alone could answer. This section synthesises the convergences, divergences, and complementarities between the quantitative and qualitative findings presented in this chapter, with the aim of producing an integrated understanding of the two-way SMS intervention that transcends what either method could yield independently.

4.5.6.1. Convergence: Confirming the Pattern of Improvement

The most direct convergence between the two strands lies in their shared confirmation that the SMS reminder intervention improved timely clinic attendance. Quantitatively, this was demonstrated through a statistically significant difference in endline attendance rates between the intervention and control arms (67.2% vs. 26.2%), a finding that was robust to adjustment for socio-demographic and clinical confounders (aOR=12.8, 95%CI=3.87–42.31). Qualitatively, patients in focus group discussions independently reported improvements in their ability to manage appointments, describing reduced forgetfulness, greater capacity to plan ahead, and a heightened sense of accountability to attend. Healthcare providers corroborated this pattern, noting observable reductions in late arrivals and improvements in clinic flow. This

three-source convergence, statistical data, patient voice, and provider observation, constitutes strong triangulated evidence that the intervention produced genuine and meaningful changes in attendance behaviour, rather than artefacts of measurement or expectation. The alignment between what the data recorded, what patients experienced, and what providers witnessed strengthens the internal validity of the effectiveness conclusion beyond what statistical analysis alone could support.

Similarly, the quantitative acceptability data (88.5% high acceptability; mean helpfulness score=4.85) converged with the qualitative themes of positive attitude, convenience, and motivation. The near-absence of low acceptability in the survey was reflected qualitatively in the tone of focus group discussions, where the dominant register was one of enthusiasm and endorsement rather than ambivalence or resistance. This convergence suggests that the high acceptability scores were not artefacts of social desirability bias in survey completion but were genuinely representative of patient experience, a conclusion that the quantitative data alone could not have supported.

4.5.6.2. Complementarity: Explaining the Mechanisms Behind the Numbers

While the quantitative strand established that attendance improved, it could not, by design, explain why. The qualitative strand fills this explanatory gap, revealing the behavioural and relational pathways through which the intervention operated. Three primary mechanisms emerged: the cognitive mechanism of forgetfulness reduction, which addressed a barrier that financial or logistical interventions would not have reached; the motivational mechanism of accountability, which converted awareness of an appointment into a felt obligation to attend; and the relational mechanism of perceived care, whereby receiving a reminder was interpreted as a signal of institutional concern for the patient as a person. These three mechanisms operate at different levels of the patient-provider relationship and correspond to distinct constructs

across the conceptual frameworks employed, perceived behavioural control (TPB), self-efficacy and reinforcement (SCT), and perceived usefulness (TAM), respectively.

The complementarity of the strands is particularly evident in explaining the role of the two-way design. The quantitative data captured attendance outcomes but did not differentiate whether the two-way feature, enabling patients to respond to reminders, contributed independently to the effect. The qualitative data suggest that it did: patients described feeling expected by the clinic, a perception that would be consistent with the interactive rather than passive nature of the system. This relational accountability, which the two-way format makes possible, appears to have added motivational value beyond what a unidirectional reminder would have achieved. This insight, which could only have emerged from qualitative inquiry, has direct implications for intervention design: it suggests that the two-way architecture is not merely a technical feature but a therapeutic one, and that simplifying the system to a one-way format for the sake of cost reduction might attenuate the motivational effect.

The qualitative data also provided complementary insight into the cost findings. The quantitative cost analysis estimated a provider-side incremental cost of USD 6.81 per patient and USD 16.60 per additional timely attendee. These figures, while modest, are abstract without contextualisation. Qualitative provider accounts added concrete meaning: the reduction in administrative burden of manual appointment follow-ups, the improvement in clinic scheduling efficiency, and the release of staff time for clinical tasks represent real-world efficiency gains that are not captured in the incremental cost figure but nonetheless contribute to the overall value proposition of the intervention. The qualitative strand thus enriches the economic analysis by surfacing non-financial benefits that a cost-only lens would miss.

4.5.6.3. Divergence and Productive Tension

Not all findings converged, and the points of divergence are analytically instructive. The quantitative data identified older age (60+ years) as significantly associated with lower

odds of timely attendance, yet this age-related differential was not prominently reflected in the qualitative accounts. Focus group participants did not discuss age as a self-perceived barrier, and providers did not specifically flag older patients as a group for whom the intervention was less effective. This divergence may reflect a methodological boundary: the focus group sample, while age-diverse, was composed entirely of intervention participants who had received and engaged with the reminders, and therefore may not have captured the perspectives of those who struggled most to use or benefit from the system. The quantitative finding of reduced effectiveness among older patients is therefore a signal that the qualitative component, by design, was not positioned to explore. This gap represents a direction for future inquiry: qualitative research with older or less phone-literate patients, including those who may have been excluded from or underserved by the intervention, would provide richer understanding of the mechanisms underlying age-related attendance differentials.

A second divergence concerns the feasibility findings. Provider accounts were unanimously positive regarding the practicality of the system, with all four key informants affirming its integration into workflows and its cost-effectiveness. However, the quantitative acceptability data noted that approximately 11.5% of patients reported moderate rather than high acceptability, and the disruption item showed the widest variability of any acceptability measure. While this level of concern was modest in absolute terms, it suggests a small but non-negligible minority whose experience of the intervention was less straightforwardly positive than provider accounts implied. This tension between provider-level assessment and patient-level experience is a classic feature of mixed-methods health research, and it highlights the importance of centering patient voice alongside provider perspective when evaluating digital health interventions.

4.5.6.4. Integration: What the Combined Evidence Establishes

Taken together, the quantitative and qualitative strands establish a coherent and mutually reinforcing evidence base that supports several integrative conclusions. First, the effectiveness of the intervention is not simply a statistical finding but a socially situated phenomenon: it operated through specific behavioural and relational mechanisms that were experienced differently across patients, and its magnitude was shaped by individual-level factors including age, employment, and cancer type. Second, acceptability was high but not uniform, and its variability was more apparent in qualitative nuance, around timing, personalisation, and privacy, than in mean scores alone. This suggests that acceptability should be understood as a distribution rather than a consensus, and that future iterations of the intervention should incorporate mechanisms for patient customisation. Third, feasibility was affirmed across both provider accounts and the smooth implementation observed during the trial, but was accompanied by a clearly articulated set of resource and equity conditions that must be met for scale-up to preserve the benefits observed at pilot stage. The integration of these conditions (infrastructure investment, multilingual capacity, patient education, and staffing) into any scaling plan is not a recommendation derived from the qualitative strand alone but an integrated inference drawn from the convergence of provider testimony, patient feedback, and the patterns visible in the quantitative subgroup analyses.

Finally, the integration of findings within the conceptual framework reveals that no single theory fully accounts for the observed outcomes. TPB explains the behavioural intention pathway; SCT explains the reinforcement and self-efficacy pathway; TAM explains technology adoption; DOI explains diffusion potential; and the WHO Building Blocks framework captures the system-level implications. Each theoretical lens illuminates a dimension that the others leave in partial shadow, reinforcing the value of a multi-framework approach and the necessity of mixed-methods evidence to populate it. The integrated picture

that emerges is of an intervention that is behaviourally credible, technically feasible, socially acceptable, statistically effective, and economically sustainable, but which operates within a context that demands ongoing attention to equity, infrastructure, and patient-centred design to fulfil its potential at scale.

4.6. Summary

The results of a mixed methods randomized controlled experiment that assessed the effectiveness of two-way SMS reminders in enhancing gynae oncology patients' timely clinic attendance at Kenyatta National Hospital were provided in this chapter. The results were organized around five objectives, each addressing a distinct dimension of the intervention: baseline attendance, feasibility, acceptability, effectiveness, and cost analysis. The chapter also established the trustworthiness, reliability, and validity of the data, ensuring that the conclusions drawn were grounded in rigorous methodological safeguards.

The assessment of trustworthiness demonstrated that both qualitative and quantitative strands were conducted with credibility and transparency. Triangulation of patient and provider perspectives, use of verbatim quotations, and reflexive practice enhanced the integrity of qualitative findings, while randomization, objective outcome definitions, and appropriate statistical modelling strengthened the quantitative strand. Together, these safeguards provided confidence in the accuracy and interpretive validity of the results.

Baseline characteristics revealed that the intervention and control groups were broadly comparable, though modest imbalances were observed in county of residence, marital status, and education level. Cervical cancer was the most common diagnosis, Stage II disease predominated, and employment status was evenly distributed. These contextual details provided a foundation for interpreting subsequent findings and were accounted for in multivariable analyses to minimize confounding.

The first research objective established that timely clinic attendance at baseline was low, with less than a third of patients attending appointments on schedule. Financial limitations, forgetfulness, and transport difficulties were the most frequently cited barriers, while satisfaction with clinic services was high. This highlighted a paradox: patients valued the care they received but struggled to access it consistently, underscoring the need for supportive interventions.

The second objective examined feasibility. Providers affirmed that KNH possessed the infrastructure to support SMS reminders and emphasized their cost-effectiveness and seamless integration into workflows. However, barriers such as limited patient phone access, unreliable network connectivity, language diversity, and staffing needs were identified. Recommendations included server upgrades, multilingual messaging, and expanded technical teams. Thus, feasibility was strong but contingent on targeted investments to ensure sustainability and equity. The findings demonstrated that feasibility is not static but dynamic, requiring ongoing adaptation to address infrastructural and equity challenges.

The third objective assessed acceptability among patients. Quantitative ratings demonstrated high satisfaction, clarity, and perceived usefulness of reminders, with nearly nine out of ten participants reporting high acceptability. Qualitative themes reinforced these findings, highlighting motivation, convenience, and emotional support, while also identifying areas for refinement such as rescheduling options and confidentiality. Acceptability therefore extended beyond functionality to relational dimensions, with patients describing reminders as supportive and caring. Concerns about timing of alerts and privacy highlighted the importance of tailoring interventions to patient preferences. Overall, acceptability was high, with patients viewing SMS reminders as a valuable and supportive resource.

The fourth objective evaluated effectiveness. Timely attendance improved significantly in the intervention group, rising from one-third at baseline to more than two-thirds at end-line,

compared to 26.2% in the control group. Logistic regression confirmed SMS reminders as an independent predictor of timely attendance, controlling for confounders. Patients reported reduced forgetfulness and improved planning, while providers observed smoother clinic flow and fewer late arrivals. Effectiveness was demonstrated quantitatively and qualitatively, though technical issues such as delayed message delivery highlighted infrastructure challenges. Importantly, effectiveness extended beyond logistics to relational benefits, with patients feeling valued and connected to the clinic. These findings demonstrated that SMS reminders were effective in improving attendance and enhancing patient engagement.

The fifth objective analyzed cost implications. SMS reminders were inexpensive relative to their benefits, reducing administrative burden and improving attendance without imposing financial strain. Providers emphasized cost-effectiveness, while patients reported no disruption to household finances. Scaling up would require investment in servers and staffing, but ongoing costs remain low. Relational benefits added intangible value, reinforcing the sustainability of the intervention. Cost analysis confirmed that SMS reminders are financially sustainable, balancing immediate affordability with long-term resource requirements. The findings demonstrated that SMS reminders are not only effective and acceptable but also financially sustainable, providing a strong foundation for broader adoption.

The findings together demonstrate that two-way SMS reminders are feasible, acceptable, effective, and cost-effective in improving timely clinic attendance among gynae-oncology patients at KNH. Baseline attendance was low, underscoring the need for intervention. Feasibility was affirmed but requires infrastructural and staffing investments. Acceptability was high, with patients valuing both functional and relational aspects. Effectiveness was demonstrated through significant improvements in attendance and clinic flow. Cost analysis confirmed sustainability, balancing immediate affordability with long-term resource requirements. These findings provide comprehensive evidence base for integrating

SMS reminders into oncology care in Kenya, while highlighting areas for refinement such as infrastructure reliability, multilingual messaging, and patient privacy.

CHAPTER 5: IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

5.1. Introduction

Missed clinic appointments among gynae-oncology patients constitute a clinically consequential and structurally embedded challenge that compromises treatment continuity, delays recurrence detection, and contributes to excess mortality in a patient population already facing disproportionate cancer burden. In Kenya, where gynaecological malignancies, including cervical, ovarian, and endometrial cancers, represent some of the most prevalent and lethal cancers among women, the ability of patients to maintain consistent attendance at scheduled outpatient appointments is not a peripheral administrative concern but a foundational determinant of whether oncological treatment can achieve its clinical purpose (Harsch et al., 2025; Zhu et al., 2024). Yet despite the urgency of this problem, no study prior to this one had directly examined the prevalence of missed appointments among gynae-oncology patients in Kenya, nor rigorously tested a scalable, contextually adapted intervention to address it within a national referral hospital setting.

This study was designed to respond directly to that gap. The overarching purpose was to evaluate the effectiveness, feasibility, acceptability, and cost implications of a two-way SMS mHealth intervention in improving timely clinic attendance among gynae-oncology patients at Kenyatta National Hospital (KNH), Kenya's largest public teaching and referral facility, and the principal site of specialist oncology care for patients drawn from across the country. The study was guided by five research questions addressing each of these evaluation dimensions: the baseline rate of timely attendance, the feasibility of implementing two-way SMS reminders within the KNH clinical environment, patient acceptability of the intervention, its effectiveness in improving timely attendance, and the incremental cost of integrating SMS reminders into routine outpatient services.

To address these questions, the study employed a parallel two-arm mixed-methods randomised controlled trial (RCT) design. One hundred and twenty-two gynae-oncology patients were randomly allocated to an intervention arm, which received two-way SMS appointment reminders, or a control arm, which received standard care without reminders. Quantitative data were collected through structured baseline and endline surveys, hospital attendance records, and an exploratory microcosting analysis. Qualitative data were gathered through two focus group discussions with twelve intervention patients and four key informant interviews with healthcare providers at KNH. Thematic analysis of the qualitative data was conducted using ATLAS.ti (version 7.5.7), and quantitative analyses employed chi-square tests, logistic regression, and descriptive statistics. The mixed-methods design enabled both the measurement of attendance outcomes and the exploration of the mechanisms, contexts, and relational dynamics through which the intervention operated, a combination that single-method designs could not have achieved.

The study was conducted under rigorous ethical oversight. Ethical clearance was obtained from the relevant institutional review boards, including the KNH-University of Nairobi Ethics and Research Committee. Informed consent was obtained from all participants prior to enrolment, with assurances of voluntary participation, the right to withdraw without consequence, and the protection of participant confidentiality. Given the sensitivity of gynae-oncology as a clinical context, where diagnosis carries significant psychosocial stigma and privacy around health status is particularly valued in Kenyan social contexts, specific safeguards were implemented to ensure that SMS messages used non-diagnostic language that would not inadvertently disclose a participant's condition to third parties accessing a shared device. Reflexive practice was maintained throughout data collection and analysis, with the researcher documenting assumptions and positional influences that could shape interpretation.

The study is grounded in a multi-layered conceptual framework that integrates individual, provider, and system-level theoretical perspectives to explain the mechanisms through which two-way SMS reminders may influence clinic attendance behaviour. At the individual level, the Technology Acceptance Model, the Theory of Planned Behaviour, and Social Cognitive Theory provide complementary lenses for understanding how patients' perceptions of the intervention, their behavioural intentions, and the external reinforcement mechanisms the system provides interact to shape attendance outcomes. At the provider and organisational level, the Diffusion of Innovations framework explains how healthcare workers assess the relative advantage, compatibility, and complexity of the intervention in relation to their existing workflows and institutional context. At the system level, the WHO Health Systems Building Blocks framework situates the intervention within the broader structural and infrastructural context that determines whether a digital health innovation can be implemented, sustained, and scaled. This multi-level, multi-framework architecture was not merely organizing, it was analytically generative, enabling findings at each level of the study to be interpreted through a theoretically coherent lens rather than descriptively reported. The extent to which each framework proved productive, and the points at which their explanatory reach required supplementation, are themselves findings of the research that contribute to the theoretical literature on mHealth adoption in LMIC oncology contexts.

Several limitations of the study must be acknowledged as context for interpreting its findings and the implications discussed in this chapter. First, the single-site design at KNH, while methodologically appropriate for a pilot RCT and well-justified by KNH's role as Kenya's primary national referral oncology facility, limits the direct generalisability of findings to other hospital types, rural settings, or county-level facilities where infrastructure, patient demographics, and workflow contexts may differ substantially. KNH serves a patient population that is, by definition, self-selected for the capacity to access a national referral

facility, a population that may differ in important ways from those who present at lower-level health facilities or who never present at any facility at all. The 74.6% of participants residing outside Nairobi County confirms geographic diversity within the study sample, but county hospital settings with more constrained network infrastructure, lower staffing ratios, and greater patient poverty would likely present a more challenging implementation environment than what the KNH context represents.

Second, the study's follow-up period, spanning four clinic appointments over approximately six months, does not permit conclusions about the long-term sustainability of the intervention's attendance effect beyond the trial period, nor about whether improved attendance translated into downstream clinical outcomes such as earlier recurrence detection, reduced treatment discontinuity, or improved survival. The progressive attendance trajectory observed across successive appointments suggests that the intervention's effect was still accumulating at the point the trial ended, making the six-month follow-up window both insufficient for capturing the full effect and insufficient for assessing whether that effect would be maintained, dissipated, or strengthened over a longer observation period.

Third, the sample size of 122 participants, appropriate for a pilot trial establishing a proof-of-concept effectiveness signal, was insufficient to detect differential effects within patient subgroups (defined by age category, cancer type, educational attainment, county of residence, or employment status) with adequate statistical power. The subgroup findings reported, including the attenuated effectiveness among patients aged 60 and above and those with endometrial or ovarian cancer, are therefore hypothesis-generating rather than definitive, and they should be interpreted with appropriate caution rather than as conclusive evidence of subgroup-specific intervention effects.

Fourth, the economic evaluation adopted a provider-side perspective only, excluding patient-borne costs such as transport, time, and accompanying carer expenditures, a limitation

that is particularly significant given that financial constraints were the most commonly cited attendance barrier in this population (76.2%). A provider-side cost analysis that shows affordability to the health system does not address whether the intervention reduces the total economic burden of attending care for patients who are themselves financially constrained. Future evaluations must adopt a societal perspective to generate the complete economic evidence base that equity-sensitive policy requires.

Fifth, the qualitative component, while rich, purposively sampled, and methodologically rigorous, was limited to twelve patients across two focus group discussions and four provider key informant interviews. The perspectives of patients who were not in the intervention arm, patients who disengaged from care entirely, older patients who may have experienced the intervention differently, and the families and carers who play important roles in supporting cancer patients' clinic attendance were not systematically captured. These perspectives would add important dimensions to the understanding of acceptability and feasibility that the present qualitative data, inevitably, cannot fully provide. These limitations are acknowledged throughout the discussion that follows and are elaborated in the context of each research question where they bear directly on the interpretation of findings.

Situating this study within the broader global policy context for digital health reinforces the urgency and timeliness of its contribution. The WHO Global Strategy on Digital Health 2020–2025 explicitly identifies mHealth as a priority mechanism for strengthening health system resilience, improving health service access in underserved populations, and advancing UHC, particularly in LMICs where geographic and financial barriers limit the reach of facility-based care (WHO, 2021). Kenya's own National eHealth Policy and Strategic Plan positions digital health as a cross-cutting enabler of the health system goals articulated in the Big Four Agenda and the Kenya Health Sector Strategic Plan, with mobile health technologies specifically identified as tools for improving community health worker performance and

patient engagement. The Sustainable Development Goals, specifically SDG 3 (Good Health and Well-Being) and SDG 5 (Gender Equality), create further normative context: a disease burden dominated by cervical cancer, which is preventable through vaccination and treatable when detected early, falling disproportionately on women in LMICs represents both a health equity failure and a direct impediment to SDG progress. An intervention that improves access to the oncological care pathway for women managing gynaecological cancers in Kenya therefore contributes not only to clinical outcomes at KNH but to the structural policy commitments that Kenya and the international community have made to health equity, universal coverage, and gender justice. This policy context does not merely provide rhetorical framing; it creates the institutional landscape within which the study's recommendations in Section 5.3 are actionable and within which its evidence can most productively be translated into practice.

This chapter is organised into four main sections. The implications of the findings are first discussed in relation to each research question, situating results within the broader literature, the integrated conceptual framework, and the study's theoretical foundations. Second, recommendations for application are presented, offering evidence-grounded, practically actionable guidance for integrating SMS reminders into oncology and broader chronic care services. Third, recommendations for future research are outlined, identifying specific methodological and substantive gaps that the present findings have brought into view. The chapter concludes with a comprehensive synthesis of the study's contributions to theory, practice, and policy, emphasising the significance of the findings for oncology care delivery in Kenya and comparable LMIC settings.

5.2. Implications of the Study

Assessing the implication of the findings helps understand the importance of the current results with a specific focus on the underlying needs and study objectives. The study's findings

have significant implications for enhancing healthcare delivery, particularly in managing gynae-oncological oncology patients. The success of two-way SMS reminders in improving clinic attendance highlights the potential for mHealth technologies to address common barriers like forgetfulness, thereby improving patient outcomes through timely care. Given the high acceptability and feasibility demonstrated, healthcare systems could consider integrating SMS reminders as a cost-effective tool to reduce missed appointments and improve patient engagement. Additionally, the study's design and methodology provide a framework for future research to explore further the impact of digital innovations on other patient populations. However, limitations such as the exclusion of caregivers and the limited number of focus group discussions suggest that future studies could incorporate broader perspectives for a more comprehensive understanding of the intervention's effectiveness. Implementing such innovations could lead to more efficient healthcare delivery, reducing delays in treatment and overall healthcare costs.

5.2.1. Research Question 1: Baseline Rate of Timely Clinic Attendance

The finding that only 31.1% of gynae-oncology patients attended their scheduled clinic appointments on time at baseline, with no significant difference between arms prior to randomisation ($p=0.696$), documents the scale of a problem that has been largely invisible in the Kenyan oncology literature. This result directly responds to the study problem: it establishes, with empirical precision and from a randomised cohort, that missed and late appointments are the norm rather than the exception among this population at KNH. The significance of this finding extends well beyond the immediate study setting. With 44,726 new cancer cases recorded in Kenya in 2022 and a five-year cancer prevalence exceeding 100,000 (Harsch et al., 2025), the oncology service system is under substantial demand pressure. A baseline timely attendance rate of 31.1% means that, under standard care conditions, nearly seven in ten patients are not arriving at scheduled appointments on time, generating cascading

consequences for clinic scheduling, treatment sequencing, disease monitoring, and ultimately patient survival.

The conceptual framework positions this finding within its multi-level context with particular clarity. At the individual level, the Theory of Planned Behaviour explains that behaviour is jointly shaped by attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991). The baseline data reveal a population in which attitudes were broadly positive, 94.3% of participants reported being satisfied or very satisfied with clinic services, but perceived behavioural control was severely constrained by structural barriers. Financial limitations were cited by 76.2% of patients as an obstacle to timely attendance, and transport difficulties were among the leading reported causes of delay. SCT similarly predicts that even patients with adequate motivation and self-efficacy require external cueing and reinforcement mechanisms to sustain health behaviours over time (Bandura, 1986); the reliance on paper appointment cards that were frequently misplaced reflects the complete absence of such a reinforcement infrastructure at baseline. At the system level, the WHO Building Blocks framework identifies weak health information systems, limited financing for patient-level costs, and geographic concentration of specialist services as structural deficits that collectively suppress timely attendance regardless of patient motivation. That 74.6% of the study sample resided outside Nairobi County confirms that geographic access constraints were not marginal but central to the attendance problem at this facility.

When placed against the broader literature, the KNH baseline rate is consistent with, though at the lower end of, patterns documented in comparable LMIC settings. Linde et al. (2020) reported low cervical cancer screening attendance in Tanzania prior to the introduction of SMS reminders, while Rono et al. (2021) described analogous attendance challenges in Kenyan eye health services. Studies from sub-Saharan Africa consistently document that cancer patients face compound barriers, financial, geographic, informational, and psychosocial,

that produce low adherence to scheduled care even when patients express positive attitudes toward that care (Lombe et al., 2023; Harsch et al., 2025). The KNH baseline confirms this pattern and extends it specifically to the gynae-oncology outpatient context, for which population-specific data from Kenya were previously absent. In high-income settings, the contrast is stark: Coats and Chaudhry (2022) documented timely attendance rates approaching 90% in UK oncology services supported by diversified, automated reminder systems and flexible appointment modalities, a disparity that illustrates precisely the system-level gap in health information infrastructure that the present intervention sought to begin to close.

One finding that diverges from what the literature might predict is the coexistence of very high patient satisfaction with poor attendance. Prior studies have sometimes treated patient satisfaction as a predictor of adherence, implying that improving satisfaction would improve attendance (McLean et al., 2016). The baseline data here challenge this assumption directly: patients were highly satisfied with the care they received, yet the majority were not arriving on time. This dissociation between satisfaction and punctuality demonstrates that satisfaction reflects the quality of the clinical encounter itself, the care experienced once present, rather than patients' capacity to access that encounter on schedule. The implication is theoretically important: interventions targeting service quality to improve attendance will be misdirected in this context, where the binding constraints are logistical and financial rather than experiential. This finding extends prior literature by establishing that the satisfaction-adherence relationship is context-dependent, and that in resource-constrained oncology settings, structural enablement rather than attitudinal improvement is the lever that matters.

The limitation most relevant to interpreting the baseline finding is the facility-based survey design, which captured only patients present at the clinic on the survey day. Patients who were most severely constrained by financial or health barriers, and therefore most likely to be absent, are systematically underrepresented in the baseline data. The 7.9% figure for

health problems as a cause of delay may therefore underestimate the clinical burden barrier among the most disadvantaged patients. This caveat does not undermine the baseline finding but contextualises it: the 31.1% timely attendance rate likely represents a ceiling estimate among those who are able to present at all, suggesting the true population-level figure may be even lower among the full registered caseload.

5.2.2. Research Question 2: Feasibility of Implementing Two-Way SMS Reminders

The unanimous provider endorsement of feasibility across all four key informants, representing nursing, oncology, health information, and nurse leadership roles, is a substantively important finding that goes beyond technical confirmation. It signals institutional readiness: an organisational disposition toward adoption grounded in direct experience of the pilot intervention rather than prospective opinion. Within the Diffusion of Innovations framework, this readiness profile maps precisely onto the early adopter category, clinicians who have assessed the intervention's relative advantage, compatibility, and simplicity through direct experience and concluded that its adoption is both warranted and achievable (Rogers, 2003). Greenhalgh et al.'s (2005) systematic review found that innovations perceived as simultaneously advantageous, compatible, and simple were consistently adopted more rapidly and durably in healthcare settings than those meeting only one or two of these criteria. In the present study, all three attributes were empirically confirmed: SMS reminders offered clear advantage over paper appointment cards; their operation required no new clinical skills; and they fitted naturally into existing appointment management routines.

The WHO Building Blocks framework reveals that feasibility operates simultaneously across multiple system dimensions. Service delivery was strengthened through reduced missed appointments and improved clinic flow, outcomes providers described as immediately visible and practically significant. Health information systems were enhanced through the introduction of a systematic digital communication channel replacing passive paper records. The financing

dimension was confirmed as manageable, with SMS messaging costs characterised as proportionally minor relative to operational benefits. However, the workforce and infrastructure blocks emerged as genuine vulnerabilities. The need for server capacity expansion, additional IT and administrative personnel, and stronger network infrastructure for message delivery at scale are necessary preconditions for moving from a pilot of 61 intervention patients to system-wide deployment. Rono et al.'s (2021) evaluation of SMS reminders in Kenyan eye health services identified the identical structural constraints, workforce training and infrastructure financing, as the critical bottlenecks for sustainability, confirming that these represent systemic patterns in Kenyan public health digital innovation rather than KNH-specific limitations.

The language diversity barrier identified by the Health Information Officer, the current delivery of reminders in English in a linguistically diverse patient population, reveals a structural equity gap in the intervention's current design that the feasibility data are not adequate to quantify. Within the study sample, 45.9% of participants self-identified as Kikuyu and 26.2% as Kamba by ethnicity; while Swahili serves as a national lingua franca in Kenya, its use as a primary language for healthcare communication cannot be assumed uniformly across all patient subgroups, particularly among older patients, rural patients, and those with below-secondary education (54.1% of the sample). The key informant's recommendation for multilingual message templates is therefore not a refinement but a foundational equity requirement. The feasibility literature from East Africa consistently identifies language-appropriate communication as a non-negotiable design principle for mHealth interventions in linguistically diverse populations (Demsash et al., 2022; Aboye et al., 2023), and the present study's single-language delivery represents a feasibility gap that would become more pronounced as the intervention scales to a more geographically and linguistically diverse patient caseload.

Staffing needs, the fourth barrier category, introduce a practical constraint that the cost analysis data allow to be contextualised precisely. The time-in-motion estimate of ten minutes per reminder, yielding 81.33 hours of personnel time for 488 reminders across 61 patients over the study period, translates to approximately 1.33 hours per patient over the entire six-month follow-up, or approximately 20 minutes per clinic cycle. This burden is manageable within a pilot of 61 patients but scales linearly without automation. A clinic serving 300 gynae-oncology outpatients monthly, a conservative estimate for a facility at KNH's scale, would require approximately 100 hours of staff time per month for manual reminder management at the same ratio, equivalent to more than two full working days for a dedicated staff member. This projection confirms that the transition from pilot to routine deployment is not simply a matter of extending the same protocol to more patients; it is an infrastructure and staffing design challenge that requires substantively different operational solutions, specifically automation of the scheduling and dispatch functions that currently dominate the personnel cost profile. The feasibility finding of strong provider endorsement therefore applies to the pilot-scale system that providers experienced; its applicability to a routine-deployment system operating at full institutional scale is conditional on the infrastructure investments that providers themselves identified as necessary preconditions.

What is particularly significant in the KNH feasibility findings is the character of how providers engaged with barriers. Rather than treating them as objections, providers paired each barrier with a concrete and actionable recommendation: multilingual messaging for language diversity, infrastructure investment for connectivity, patient education for phone access gaps, and expanded technical staffing for scale-up. This solution-oriented framing reflects implementation intelligence that goes beyond passive acceptance. The DoI constructs of trialability and observability are both in evidence: providers had experienced the pilot, observed its effects on attendance patterns and clinic flow, and were already projecting the

conditions required for its success at scale. This is a finding that standard pre-implementation feasibility assessments, which ask clinicians to predict rather than report, cannot generate. It is one of the methodological advantages of a pilot trial design over a prospective feasibility study.

Comparison with prior literature reinforces and extends these insights. In South Africa, Cele and Archary (2019) found SMS reminders feasible among HIV-positive adolescents even in under-resourced settings, while Mchidi (2024) confirmed feasibility of SMS support for chemotherapy adherence among cancer patients in Kenya, emphasising that system-level factors were significant determinants of sustained feasibility. Linde et al. (2020) in Tanzania similarly documented feasibility of SMS-based cervical cancer screening reminders but underscored that scaling required investment in message delivery platforms and multilingual adaptation, a pattern precisely replicated in the present findings. The relational value providers attributed to the intervention, describing SMS reminders as “unobtrusive and respectful of patient privacy” and as tools that “fostered accountability”, adds a dimension to the feasibility literature that prior studies rarely capture, suggesting that relational appropriateness is a meaningful feasibility criterion in oncology contexts where patient-provider trust is foundational to care engagement.

The equity dimension of feasibility must be emphasised. Phone access gaps and language barriers disproportionately affect older patients, those from rural counties, and those with lower educational attainment, profiles that characterise a substantial proportion of the study population. Feasibility at the system level does not therefore guarantee equitable reach at the patient level. An intervention that is technically deployable at KNH but fails to reach its most vulnerable patient subgroups is not fully feasible in the sense that matters most clinically. This equity dimension connects directly to the targeted adaptation recommendations presented in the next section.

5.2.3. Research Question 3: Acceptability of Two-Way SMS Reminders

The finding that 88.5% of intervention participants reported high composite acceptability, with no participant reporting low acceptability, places the KNH intervention among the most positively received SMS mHealth interventions documented in the sub-Saharan African gynaecological health literature. The alignment with findings from Moodley et al. (2019) in Cape Town and Mrémi et al. (2021) in rural Tanzania, both reporting high receptiveness among women engaged with gynaecological health services, confirms that this acceptability profile is not unique to KNH but reflects a broader pattern of receptiveness in the region. The present findings extend this evidence specifically to an active oncology treatment context in a national referral hospital, where the complexity of the patient population, educationally diverse, geographically dispersed, managing malignancies, might have been expected to produce greater heterogeneity.

The Technology Acceptance Model provides the primary interpretive framework. The highest-rated items, helpfulness and satisfaction, reflect TAM's perceived usefulness construct, while ease of understanding and message clarity reflect perceived ease of use (Davis, 1989; Venkatesh & Davis, 2000). This alignment between the empirical acceptability profile and TAM's predicted structure of adoption provides convergent validity for both the acceptability finding and the theoretical framework. That acceptability was high even among participants with below-secondary education (65.6% of the intervention arm) confirms that the low cognitive burden of short, clear, action-oriented SMS reminders produced high perceived ease of use even among participants with limited formal literacy, addressing one of the most commonly raised critiques of TAM's applicability to low-literacy LMIC populations (Ajibade, 2018).

The Theoretical Framework of Acceptability (Sekhon et al., 2017) deepens the analysis beyond TAM. The tight clustering of helpfulness and satisfaction scores against the wider

spread on disruption/inconvenience and continuation preference reveals that perceived effectiveness was experienced near-universally, while burden and ethicality were more variably experienced. The qualitative themes of personalisation and privacy illuminate this variability: concerns about message timing, confidentiality, and the desire for rescheduling options were raised by a minority whose experiences the aggregate mean scores do not capture. Farooqi et al. (2017), studying SMS reminders in tuberculosis care in Pakistan, found that dissatisfaction arose specifically when messages were perceived as ill-timed or insufficiently personalized, a pattern replicated in the KNH minority experience across a very different clinical context, suggesting a cross-contextual pattern in the dimensions of SMS acceptability most susceptible to individual variation.

The finding that 68.9% of patients preferred confidentiality and 63.9% expressed discomfort regarding message timing warrants particular attention in the context of privacy research in LMIC oncology mHealth. Stocks et al. (2022) identified privacy as the primary sociocultural concern in East African mHealth contexts, noting that phone-sharing practices, prevalent in Kenya, where 58% of those without personal devices share a household member's phone, create genuine risks of inadvertent diagnostic disclosure. In the gynae-oncology context, where cancer carries significant psychosocial stigma in Kenyan society (Harsch et al., 2025), this risk is not merely theoretical. The non-diagnostic language protocol used in the present study was a necessary first-order safeguard, but the proportion of patients raising privacy concerns confirms that more nuanced design, including consent to specific message content and timing, and opt-in rather than opt-out approaches to different communication parameters, is required for any scale-up.

The most analytically significant and unexpected finding within the acceptability domain was the relational dimension of patient experience. Patients described receiving a reminder as feeling “like the clinic cares about me, not just as a patient but as a person”, an

effective response that interpreted a logistical prompt as an expression of institutional care. This dimension was not predicted by the quantitative acceptability instrument and emerged exclusively from the qualitative exploration. Aunon et al. (2023), in their mHealth acceptability study in Kenyan HIV care, identified the same phenomenon: feeling remembered and valued by the health system was a driver of sustained engagement that functional considerations alone did not explain. In oncology, where patients manage serious illness within a high-volume impersonal tertiary facility, this relational meaning may carry disproportionate motivational weight. This finding suggests that TAM's explanatory scope is incomplete for patient-facing health technologies in emotionally charged oncology settings, where the affective and relational dimensions of digital communication carry meaning that perceived usefulness and ease of use alone do not capture. This is an empirical contribution to the mHealth acceptability literature with theoretical implications that extend beyond the present study context.

5.2.4. Research Question 4: Effectiveness of Two-Way SMS Reminders on Timely Clinic Attendance

The improvement in timely clinic attendance from 32.8% at baseline to 67.2% at endline in the intervention arm, against a slight decline from 29.5% to 26.2% in the control arm, with the difference statistically significant, constitutes the primary effectiveness evidence of this pilot trial and directly responds to the study's core research question. The adjusted logistic regression confirmed SMS intervention exposure as the strongest independent predictor of timely attendance (aOR=12.8), an effect that persisted after controlling for all sociodemographic and clinical covariates found to be associated with attendance in bivariate analysis. The progressive attendance trajectory, rising across four successive appointments in the intervention arm while the control arm remained flat, is consistent with a genuine and sustained behavioural effect rather than a novelty response, and it suggests that the intervention's impact accumulated over time through repeated reinforcement.

Within the conceptual framework, the effectiveness mechanism operates simultaneously at multiple levels. TPB's three determinants of behavioural intention were all activated. Attitudes toward attendance were already positive; the intervention's primary role was reinforcing perceived behavioural control by enabling advance planning, and reinforcing subjective norms through the accountability mechanism the two-way design created. SCT predicts that repeated external cueing strengthens self-efficacy over time (Bandura, 1986): each successfully attended appointment, facilitated by the reminder, may have increased patients' confidence in their capacity to attend future appointments, explaining the progressive rather than plateau character of the attendance trajectory. At the system level, the DoI framework is validated: the intervention demonstrated the relative advantage, compatibility, and observability that Rogers (2003) identifies as the core predictors of sustained adoption, and the progressive attendance improvement is consistent with a behavioural diffusion process within the intervention arm.

The effectiveness finding is consistent with, though at the higher end of, available comparators in the literature. Wanyoro and Kabiru's (2017) RCT at Thika Level 5 Hospital found compliance ratios of 67.1% versus 20.3% in a structurally parallel design; Karanja (2015) found that SMS reminders produced an eightfold increase in cervical cancer rescreening adherence (OR=8.02); and Tang's (2022) meta-analysis of twelve oncology studies found a consistent, if heterogeneous, positive effect of SMS notifications on attendance. The KNH effect size falls at the more robust end of the published distribution, which several contextual factors may explain. The low baseline rate created substantial room for improvement. The two-way design may have generated accountability effects beyond what one-way reminders produce. And the population's reported barriers, dominated by forgetfulness and planning difficulties rather than immovable structural constraints, were well-matched to the specific mechanisms the intervention activates. Njuguna et al.'s (2024) analysis of two-way SMS in

South African HIV care confirmed that the interactive element enables a feedback loop that one-way reminders cannot provide; the qualitative evidence from the present study, patients reporting that they felt expected by the clinic, directly instantiates this accountability mechanism.

The regression model's identification of attenuated effectiveness for patients aged 60 and above (aOR=0.05) and those with endometrial (aOR=0.09) and ovarian cancer (aOR=0.19) introduces important equity considerations. The age effect is consistent with the mHealth literature's identification of older populations as less likely to benefit from SMS interventions due to lower device ownership and digital literacy (Zurovac et al., 2013; Kruse et al., 2019). The cancer-type differential is less clearly anticipated and warrants careful interpretation without overstatement: it may reflect disease-specific clinical burdens imposing greater physical obstacles to attendance, differential appointment structures at KNH, or sociodemographic compositional differences between cancer-type subgroups. What is clear is that the intervention's aggregate effectiveness was not uniformly distributed, a finding with direct equity implications for intervention design and a priority question for future research.

The control group's slight attendance declines from 29.5% to 26.2% across the trial period is itself analytically meaningful. It demonstrates that the observed improvement in the intervention arm was not driven by temporal trends, seasonal variation, or Hawthorne effects operating across both arms, and that the natural direction of attendance behaviour in the absence of intervention is toward gradual erosion rather than maintenance. This contextualises the intervention's effect as not merely improving attendance but reversing a deteriorating trend, a finding with greater clinical significance than a simple difference in endline rates alone conveys.

A further analytical observation concerns what the effectiveness data reveal about the specific contribution of the two-way design relative to a hypothetical one-way alternative. The

quantitative data cannot isolate the two-way mechanism from the broader effect of receiving any reminder, since there was no one-way SMS comparison arm in the study design. However, the qualitative mechanism data allow a theoretically grounded inference. The TPB's subjective norm construct provides the key: patients consistently described not merely being reminded but feeling expected at the clinic, a normative social signal that a one-way broadcast reminder is not designed to create and that a two-way interaction specifically enables. When a patient can respond to a reminder, and a clinic can acknowledge that response, the transaction is transformed from information delivery into social commitment, creating a bidirectional expectation that the unidirectional reminder does not generate. This distinction maps directly onto the SCT construct of social reinforcement: the confirmation that the clinic has received and registered the patient's response functions as an external reinforcement event that strengthens attendance self-efficacy in a way that a passively received reminder cannot. The practical implication, that the two-way design should be preserved rather than simplified to one-way in future implementations, is supported not only by the qualitative mechanism data but by the meta-analytic pattern in the literature, where two-way designs consistently show numerical advantages over one-way approaches on appointment attendance outcomes, even where those advantages do not always reach statistical significance at underpowered pilot scale (Ødegård et al., 2022).

The magnitude of the observed effect size (aOR=12.8, 95%CI=3.9–42.3), while clinically significant, must be interpreted with the caution appropriate to a pilot trial context. Pilot RCTs are not powered to provide definitive effect estimates, and the confidence interval spanning from 3.9 to 42.3 reflects the substantial uncertainty inherent in an estimate derived from 61 participants per arm. The lower bound of the confidence interval, an adjusted odds ratio of 3.9, remains clinically meaningful and would, if confirmed in a larger trial, constitute sufficient evidence to support policy adoption. However, the effect size observed in this pilot

is likely upwardly biased relative to what would be observed in a larger definitive trial, for two reasons well-established in the pilot trial literature. First, the Hawthorne effect (the tendency for participants to modify their behaviour due to awareness of being observed) is more pronounced in pilot trials than in larger trials where the intensity of individual participant monitoring is lower. Second, the small sample size makes the estimate sensitive to individual participant-level variation, and regression to the mean in a larger trial is expected. The definitive trial whose design is informed by this pilot should incorporate an adequate sample size to detect an adjusted odds ratio of 3.0 or above as the clinically meaningful threshold, which remains a substantial and practically significant effect even at the conservative bound. This interpretive framing ensures that the enthusiasm warranted by the pilot findings is tempered by appropriate methodological realism, and that policy recommendations are calibrated to the strength of evidence currently available.

The Nagelkerke R^2 of 0.549 in the adjusted logistic regression model indicates that the covariates included explain approximately 55% of the variance in endline timely attendance, leaving 45% unexplained. This unexplained variance is analytically informative rather than merely residual. It confirms that timely clinic attendance is not a simple function of demographic and clinical characteristics, even when combined with intervention exposure, but is also shaped by factors that the present study's measures did not capture: day-to-day variation in transport availability, acute household demands, weather conditions and their effect on commute feasibility from outside Nairobi, and clinic-side factors such as wait times and scheduling delays that affect patients' experience of attending on time once they arrive. These unmeasured factors are not merely statistical noise; they represent a genuine component of the attendance problem that neither the SMS reminder nor any other purely digital intervention can address. The gap between the explained 55% and the full picture of what determines timely attendance in this population is therefore an implicit argument for the multi-component

intervention approach recommended in Section 5.3.5, where SMS reminders address the cognitive and motivational variance while complementary structural interventions address the practical and financial variance that this study's model confirms remains significant.

5.2.5. Research Question 5: Incremental Cost of Two-Way SMS Reminders

The total incremental provider cost of USD 415.08, yielding a cost per patient of USD 6.81 and a cost per additional timely attendee of USD 16.60, positions the SMS reminder intervention at the affordable end of the LMIC mHealth cost spectrum. Chen et al.'s (2020) Mobile WACHX evaluation, the most methodologically proximate benchmark, estimated a per-beneficiary cost of USD 62 for a semiautomated two-way SMS system in Nairobi. The substantially lower per-patient cost in the present study (USD 6.81) reflects the absence of platform development costs and the manually managed nature of delivery, confirming that a simpler deployment can achieve substantial attendance improvements at considerably lower cost than a bespoke automated platform. This is a practically important finding: it demonstrates that the investment required for initial implementation is within reach of standard public hospital operational budgets without requiring external development grants or specialist digital health infrastructure.

The dominance of personnel costs (73.5% of recurrent expenditure) is the most analytically significant feature of the cost profile. Staff time constituted USD 270.84 of USD 368.44 in recurrent costs, a share that exceeds Chen et al.'s (2020) figure of 48.2% for a more automated system, directly reflecting the manual character of the present intervention. This has a dual implication. It confirms that the current cost structure is sustainable at pilot scale but would become operationally burdensome without automation at system-wide deployment scale. And it identifies automation of message scheduling and dispatch as the single most impactful cost-reduction lever available, one that would substantially reduce the marginal cost per patient without compromising clinical effectiveness. Larsen-Cooper et al.'s (2016)

demonstration that operating an mHealth intervention at full capacity reduces per-user costs by 48% provides a scalability benchmark directly applicable to KNH's deployment planning.

The cost per additional timely attendee of USD 16.60 must be understood as a ceiling estimate under pilot conditions, likely to fall substantially in routine deployment, and as an investment in a clinical opportunity, the appointment at which recurrence might be detected, treatment adjusted, or a patient's concerns addressed, rather than merely as an administrative cost. Downstream costs of non-attendance in oncology, delayed recurrence detection, emergency presentations, wasted appointment capacity, substantially exceed the cost of prevention (Davey et al., 2021; Chen, 2023; Fischer et al., 2017). This contextualisation is essential for the policy case: a USD 16.60 investment to secure one patient's timely attendance in a service where the alternative is the cascade of clinical and operational costs generated by a missed oncology appointment represents plausible value. While the present study cannot conduct a formal cost-offset analysis, the economic logic is well-grounded in the literature and provides a reasonable basis for a policy recommendation in favour of implementation pending the definitive economic evaluation that future research should provide.

The provider-side cost perspective adopted in this study introduces an important limitation that is not merely methodological but ethically significant. Financial barriers and transport costs were cited by 76.2% of participants as primary obstacles to attendance, yet these patient-borne expenditures are entirely excluded from the present economic evaluation. An intervention that is affordable to the health system but imposes continuing costs on patients whose structural poverty is itself the primary barrier to attendance has not achieved cost-effectiveness in the sense that most benefits the population it serves. Future economic evaluations must capture patient-side costs to generate a complete picture of the intervention's economic burden and value, and complementary structural interventions, transport subsidies,

flexible appointment scheduling, decentralised referral pathways, must be designed alongside the SMS system to address the financial constraints that the reminder alone cannot remove.

5.3. Recommendation for Application

The findings of this study provide a coherent, evidence-grounded basis for practical recommendations directed at healthcare managers, clinical staff, digital health implementers, and health policy actors within KNH and analogous LMIC oncology settings. Each recommendation is grounded in specific study findings, framed within the existing literature and the integrated conceptual framework, and calibrated to the contextual constraints of public sector oncology care in Kenya. The recommendations are organised to reflect the investment sequence that the evidence suggests: beginning with immediate institutionalisation of the proven intervention, proceeding through infrastructure and content improvements that increase equity and scalability, and culminating in the policy and structural changes that will determine whether the benefits observed at pilot scale are realised across the health system as a whole.

5.3.1. Formalise and Institutionalise the SMS Reminder Protocol Within KNH's Gynae-Oncology Service

The most immediate recommendation is that KNH should proceed from pilot to routine implementation of the SMS reminder intervention within its gynae-oncology outpatient service. The evidence base for this recommendation is strong and multidimensional: significant effectiveness (aOR=12.8), high acceptability (88.5% high composite scores with no participant reporting low acceptability), confirmed feasibility across all four provider accounts, and affordable incremental cost (USD 6.81 per patient). These four evidential pillars together constitute the proof of concept that pilot studies are designed to generate, and no further evidence is required to justify implementation within the study setting.

The transition from pilot to routine implementation requires three specific institutionalisation steps that the literature identifies as essential to sustainability. First, a formal

Standard Operating Procedure (SOP) should be developed, documenting the message scheduling protocol, patient consent processes for SMS receipt, non-diagnostic language requirements, message timing parameters informed by patient preference data (noting that 63.9% of participants expressed discomfort with message timing in the pilot), and escalation procedures for patients who do not respond across multiple reminder cycles. The SOP should specify the exact wording of messages in all supported languages, the interval between reminder and appointment at which messages are sent, and the procedure for updating patient contact details as phone numbers change, a practical issue that disproportionately affects the most mobile, least-resourced patients in the caseload.

Second, the intervention should be assigned to a designated staff member, ideally a clinical nurse or administrative officer with responsibility for appointment management, with protected time for SMS management built explicitly into their role description and workplan. The cost analysis established that staff time accounts for 73.5% of total recurrent costs, confirming that human resource allocation is the dominant operational requirement. Clarity of role ownership prevents the intervention from being treated as an add-on to existing duties rather than a funded component of the service model, which is the most common reason that effective pilot interventions fail to be sustained in routine implementation (Greenhalgh et al., 2005). The protected time allocation need not be large, the time-in-motion analysis estimated approximately 10 minutes per reminder, but it must be formally recognised in the staff member's workplan to prevent erosion under competing clinical demands.

Third, the system should be formally registered within KNH's health information management infrastructure so that SMS delivery is recorded alongside clinical attendance data in the hospital's administrative systems. This registration creates the data trail through which ongoing monitoring of reminder delivery rates and their relationship to attendance outcomes can be conducted, enabling the hospital to detect declining delivery rates, identify patients with

persistently unstable phone access, and monitor whether the attendance improvements observed in the pilot are maintained over time. Without this data infrastructure, the intervention cannot be managed or improved; it becomes an operational activity without an evidence base, vulnerable to discontinuation when leadership changes or operational priorities shift.

Mureithi et al. (2024) demonstrated in Malawian HIV care that co-designing the two-way SMS platform with healthcare workers and embedding it in formal workflow structures was critical to securing buy-in and ensuring operational sustainability beyond the initial implementation period. Their finding that providers who were involved in designing the system felt greater ownership and maintained higher fidelity to the protocol has direct relevance for KNH: the key informants who participated in this study have already demonstrated both strong endorsement and sophisticated operational understanding of the intervention's requirements. Involving them actively in the SOP development process would capitalise on this existing readiness and create the institutional ownership that sustains implementation through leadership transitions and budgetary pressures.

5.3.2. Invest in Automation Infrastructure to Reduce Personnel Cost and Enable Scale-Up

The cost analysis identified staff time as the dominant recurrent cost driver and the primary constraint on scale-up. Moving from a cohort of 61 intervention patients in the pilot to the full gynae-oncology outpatient caseload at KNH, which processes several hundred patients monthly across multiple cancer types and treatment phases, would increase the manual message management burden proportionally without automation, making the current protocol operationally unsustainable at scale. The single most impactful investment KNH can make to enable scale-up is in a basic automated SMS scheduling platform capable of batch-sending pre-timed reminders for all scheduled appointments without requiring individual staff action for each message.

Several practical options exist that are within reach of a public hospital budget in the Kenyan context. Open-source SMS gateway platforms such as RapidSMS and CommCare, and low-cost commercial services such as Africa's Talking, which operates specifically in the East African market and supports bulk SMS at commercial rates consistent with those used in this study, have been successfully deployed in comparable African health system contexts (Chen et al., 2020; Iribarren et al., 2017). Integration with KNH's existing appointment scheduling system, even at a basic level where appointment dates trigger automated message dispatch at a pre-specified interval, would eliminate the labour-intensive manual drafting and sending that currently drives the cost structure. The investment in such a platform constitutes a one-time start-up cost rather than a recurrent expenditure; once installed and integrated, the marginal cost of reaching each additional patient is reduced to the per-SMS communication charge alone.

The scalability economics are well-established in the literature. Chen et al. (2020) demonstrated that expanding a two-way SMS intervention from pilot scale to a larger denominator reduced the per-beneficiary cost by approximately 50% when standard health system wages replaced research-scale personnel costs. Larsen-Cooper et al. (2016) found that operating at full capacity could reduce per-user costs by 48%. Applied to the present study's cost structure, automation of message scheduling and dispatch, which would eliminate the majority of the USD 270.84 in personnel costs currently driven by manual message preparation, would reduce the per-patient cost from USD 6.81 toward a figure approximating the communication cost of USD 1.60 per patient ($\text{USD } 97.60 \div 61$) plus a modest automated system management overhead. This would represent one of the most dramatic cost-reduction outcomes achievable in the transition to scale, and it should be the first investment priority for any implementation plan.

Alongside automation of outgoing messages, KNH should consider how incoming patient responses, the two-way element of the system, are managed at scale. In the pilot, staff read and responded to patient messages manually, which contributed to the relational value patients described but also to the personnel cost burden. At scale, a triage system could be implemented in which automated responses handle the most common patient messages (appointment confirmation, standard rescheduling requests) while directing substantive queries or concerns to clinical staff. This hybrid approach would preserve the accountability and relational benefits of two-way interaction while limiting the labour required to sustain it.

5.3.3. Develop Multilingual, Personalised Message Content

The acceptability analysis identified language diversity and message personalisation as the dimensions of the intervention most susceptible to individual variability and most frequently raised as areas for improvement. KNH's patient population spans a wide range of linguistic backgrounds: the study sample included Kikuyu (45.9%), Kamba (26.2%), and other ethnic groups (27.9%), with Swahili serving as the national lingua franca across communities. A reminder delivered exclusively in English, as in the present pilot, cannot achieve equitable reach across this linguistically diverse population, particularly given that 54.1% of participants had below-secondary education, a profile associated with limited English literacy in Kenya (Harsch et al., 2025). Investment in multilingual message templates, at minimum in English, Swahili, Kikuyu, and Kamba, would substantially expand the effective reach of the intervention and align with the principles of inclusive digital health design consistently advocated in the sub-Saharan African mHealth literature (Rossman et al., 2021; Aboye et al., 2023; Demsash et al., 2022).

Personalisation should extend beyond language to include appointment-specific content that increases the message's perceived relevance and clinical salience. The literature distinguishes between bare reminders, which provide only date and time information, and

‘Reminder Plus’ formats, which include contextual content such as what to bring, where to report, and a brief statement of why the appointment matters clinically (McLean et al., 2016). The present study used a relatively basic message format; future implementation should incorporate: the patient’s name (within privacy constraints); the specific outpatient clinic location and consultation time; a brief prompt about what to bring (clinic card, any outstanding test results); and a contact number for the patient to call if they need to reschedule. This format aligns with patient preference data collected in the qualitative phase, where participants described wanting messages that addressed their specific circumstances rather than generic appointment notifications.

The privacy design principles established in the pilot must be strengthened for scale-up. Non-diagnostic language, framing reminders as generic hospital appointment notifications rather than identifying the clinical reason for the visit, was a necessary first-order safeguard that should be retained in all future message templates. However, given that 68.9% of participants preferred confidentiality and concerns about shared phone access were raised both in the acceptability survey and in qualitative discussions, future implementation should additionally offer patients a consent-based choice about the specificity of message content and the option to designate a preferred contact number that is different from their household’s shared device. Stocks et al. (2022) confirmed that patient-controlled privacy options are the most effective safeguard against inadvertent diagnostic disclosure in LMIC mHealth contexts where phone-sharing is prevalent. Building this choice into the registration process, rather than treating it as a post-enrolment modification, would proactively address the privacy concerns that a minority of patients experienced in the pilot.

5.3.4. Develop Targeted Adaptations for High-Risk Attendance Subgroups

The regression analysis identified two patient subgroups for whom the intervention’s effectiveness was significantly attenuated even after adjustment for confounders: patients aged

60 and above (aOR=0.05) and patients with endometrial (aOR=0.09) or ovarian cancer (aOR=0.19). These subgroups require targeted adaptations rather than the uniform protocol applied in the pilot. The principle that a single intervention design cannot achieve equitable impact across a heterogeneous patient population is well-established in the mHealth literature (Kruse et al., 2019; Boksmati et al., 2016), and the present differential effectiveness findings provide the empirical basis for designing stratified rather than one-size-fits-all approaches.

For older patients, the primary barriers to SMS reminder effectiveness are likely limited digital literacy, lower personal device ownership, and greater reliance on shared household phones. The Kenyan mobile phone literature confirms that these barriers are more pronounced among women aged 60 and above (Zurovac et al., 2013), and they would not have been apparent in the aggregate acceptability findings, which were dominated by the experience of the majority younger patient group. Targeted adaptations for older patients could include: audio reminders delivered via voice call rather than text, which require no literacy and no ability to navigate a text message interface; family-mediated notification through a designated carer's phone, registered with explicit consent from both the patient and the carer and using appropriately non-diagnostic language; and enhanced one-to-one support during the clinic registration process specifically for patients who indicate uncertainty about using SMS. These adaptations are low-cost additions to the existing protocol and would not require new technology, voice calls can be made from the same basic mobile phones used in the pilot study.

For patients with endometrial and ovarian cancer, the attendance differential requires careful investigation before definitive adaptive interventions can be recommended. Several explanatory pathways were identified in Chapter 4: disease-specific clinical burdens associated with more intensive treatment regimens, differential appointment structures at KNH that may create different attendance dynamics, or compositional differences in the sociodemographic profiles of patients with different cancer types. Until future research clarifies which of these

mechanisms is most operative, a prudent clinical recommendation is to implement a structured attendance risk assessment at the point of appointment scheduling for all patients, regardless of cancer type, that identifies those at elevated risk of non-attendance and triggers a proactive clinical response. This could involve a brief patient navigator conversation to identify specific barriers, coordination of transport support where needed, or the addition of a phone call reminder from a clinical staff member to complement the SMS for high-risk patients. Umar et al.'s (2025) evaluation of KNH's patient navigation programme provides evidence that navigator-supported outreach improves engagement among cancer patients facing compound barriers; integrating the SMS reminder with an enhanced navigation response for patients at elevated non-attendance risk would create a multi-component intervention with complementary mechanisms.

5.3.5. Complement SMS Reminders with Structural Interventions Addressing Financial and Transport Barriers

The baseline data established that financial limitations and transport difficulties were the primary obstacles to timely attendance, cited by 76.2% of participants. That the SMS intervention still achieved a doubling of timely attendance despite these barriers being unaddressed confirms that cognitive and motivational barriers were independently significant drivers of non-attendance. However, the 32.8% of intervention arm patients who still failed to attend on time at endline, across four appointment cycles, receiving reminders for each, likely represent the subset of patients for whom structural financial and logistical barriers remained binding even after motivational barriers were removed. An intervention that reaches a ceiling of approximately two-thirds timely attendance, however impressive by comparison with the control group, leaves a clinically meaningful minority unreached.

Addressing this residual non-attendance requires policy-level structural investments that operate alongside but well beyond the digital health intervention. Transport subsidies or

reimbursement vouchers for patients residing beyond a specified distance from KNH, modelled on the conditional cash transfer programmes that have demonstrated effectiveness in improving health service utilisation in sub-Saharan Africa, would directly address the cost barrier that 76.2% of patients identified (Harsch et al., 2025). Flexible appointment scheduling, offering early morning slots before work obligations begin, or Saturday clinics for patients who cannot take weekdays off, would address the schedule and work conflicts cited by 8.8% of patients as causes of delay, with disproportionate benefit for employed patients who currently face a direct conflict between income-generating work and clinic attendance. Decentralised chemotherapy or follow-up services at county-level hospitals, a development that Kenya's devolution of health services has made structurally feasible, would substantially reduce the distance barrier for patients travelling from outside Nairobi, who constituted 74.6% of the study sample.

The integrated conceptual framework directly supports the argument for this multi-level approach. The WHO Building Blocks framework identifies the financing and service delivery blocks as structural constraints that operate independently of the health information systems improvements that SMS reminders achieve. Strengthening one block without addressing the others produces partial improvement at best; the present finding, a doubling of timely attendance combined with a persistent 32.8% of patients still not attending on time, is precisely the outcome this structural prediction generates. McLean et al.'s (2016) meta-analysis confirmed that reminder systems achieve their greatest effectiveness when embedded within broader multi-component care support systems. The present study's design, SMS reminders as a standalone intervention, was appropriate for a pilot establishing proof of concept for the digital component, but the application recommendation for full implementation is explicitly multi-component.

5.3.6. Leverage the Relational Value of Reminders to Strengthen Patient-Provider Relationships

One of the most analytically striking and practically important findings of this study was that patients did not experience SMS reminders as merely logistical tools. They described them as signals of care, as evidence that the clinic remembered and valued them as individuals rather than simply managing their appointments. This relational dimension of the intervention's acceptability, confirmed across multiple qualitative accounts and corroborated by Aunon et al. (2023) in the Kenyan HIV care context, represents a dimension of therapeutic value that a logistical framing of SMS reminders entirely misses. In the specific psychosocial context of gynaecological care, where patients are managing fear, uncertainty, stigma, and the physical burden of cancer in a high-volume, impersonal tertiary facility, an intervention that simultaneously improves scheduling reliability and strengthens emotional connection to the care system provides compound value that neither function alone would achieve.

This finding should actively shape how the intervention is framed and implemented, not treated as an incidental by-product of message delivery. Message content should be written in warm, person-centred language: beginning with the patient's name where privacy allows, expressing genuine care for the patient's wellbeing alongside the appointment reminder, and including a contact channel for patients who have questions or concerns. Staff who manage the two-way interaction should be trained not merely in the technical protocol but in the relational significance of their responses, understanding that a timely, caring reply to a patient's message may carry therapeutic weight disproportionate to its operational simplicity. The patient navigation principles embedded in KNH's existing navigation programme (Umar et al., 2025) provide a relational care framework that SMS reminder management should explicitly align with.

The two-way interaction element, enabling patients to respond, confirm, cancel, or query, should be preserved and even strengthened in any scale-up, even if automation reduces the cost of outgoing message delivery. The qualitative evidence is unambiguous: it was the responsive, interactive character of the system, the sense of being expected and acknowledged, rather than merely the receipt of a reminder, that patients identified as generating their felt motivation to attend. Preserving this interactivity at scale, through a tiered response system that uses automation for routine confirmations while routing substantive queries to clinical staff, would maintain the relational value that distinguishes two-way from one-way SMS as a model of patient engagement.

5.3.7. Integrate Findings into Kenya's National Digital Health Strategy and Cancer

Control Policy

The present study's findings have implications that extend beyond KNH to Kenya's national health policy landscape, and the translation of this evidence into policy action is both a practical recommendation and an ethical responsibility. Kenya's National Cancer Control Strategy 2017–2022, the successor strategy currently under development, and the Kenya National eHealth Policy and Strategic Plan collectively provide policy vehicles through which the evidence generated by this study could be translated into system-wide standard-of-care requirements. The combination of demonstrated feasibility, acceptability, significant effectiveness, and affordable incremental cost, across a population representative of Kenya's gynaecological caseload at its largest referral facility, constitutes a strong and complete policy case for inclusion of SMS-based appointment support in the standard of care for oncology outpatients.

Specific policy engagement pathways include: submission of study findings to the Kenya Ministry of Health's Division of Non-Communicable Diseases and the National Cancer Institute of Kenya for consideration in the updated cancer control strategy; presentation of

results at the annual Kenya Society of Haematology and Oncology conference and regional oncology forums to build clinical community awareness and advocacy; engagement with the Kenya Medical Research Institute (KEMRI) and academic health centres to support replication of the study at additional sites as a precursor to national scale-up; and publication in high-impact international journals to generate the global evidence base that international health policy actors, including the WHO and the African Union's health architecture, require for recommending digital health interventions in LMIC oncology settings.

Dearing and Cox (2018) identify policy actor engagement as the factor that most consistently accelerates the diffusion of health innovations with demonstrated relative advantage. KNH, as the national referral hospital and a leading academic medical centre, occupies a unique institutional position to drive this policy translation, not merely as a site of evidence generation but as an institutional advocate for the evidence it has produced. The leadership and governance block of the WHO Building Blocks framework is directly implicated: without active institutional endorsement and policy alignment, even a highly effective and affordable intervention risks remaining a localised practice rather than a nationally adopted standard of care.

5.4. Recommendations for Future Research

The present pilot RCT has generated evidence sufficient to establish proof of concept, confirm feasibility and acceptability, and demonstrate a significant effectiveness signal in a specific, well-characterised clinical context. It has also, by the nature of a pilot study, surfaced the questions that a definitive trial, a full health economic evaluation, and an implementation science inquiry must now address. The following recommendations are directly motivated by specific gaps, limitations, and generative findings of the present study. They are ordered to reflect scientific priority, from the most immediately necessary study to those that address longer-term questions of sustainability, equity, and theoretical extension.

5.4.1. A Fully Powered Multi-Site Randomised Controlled Trial

The most pressing and scientifically necessary research priority is a fully powered, multi-site RCT designed to confirm the effectiveness of two-way SMS reminders on timely clinic attendance in gynae-oncology across diverse health system contexts, generate precise subgroup-specific effect estimates, and assess longer-term attendance sustainability. The present pilot was adequately powered for its primary purpose, establishing a significant overall effectiveness signal, but its sample of 122 participants was insufficient to detect differential effects within subgroups defined by age, cancer type, educational attainment, or county of residence with adequate statistical power. This limitation is not a failure of design but an inherent characteristic of pilot studies: they generate the effect size and variance data needed to power a definitive trial, which the present study has now done.

A definitive trial should be powered based on the pilot's adjusted odds ratio of 12.8, with a conservative estimate applied for the multi-site context where dilution effects are likely, to detect clinically meaningful subgroup differences within a prespecified subgroup analysis plan. It should be conducted across at least three to five sites representing the hierarchy of Kenya's public health system, a national referral hospital, regional referral hospitals, and county hospitals, with deliberate inclusion of at least two rural or peri-urban sites where network connectivity, patient demographics, and service infrastructure differ materially from the KNH urban context. This multi-level, multi-site design would directly address the generalisability limitation of the present study and generate the nationally applicable evidence base that Kenya's Ministry of Health requires to recommend the intervention for system-wide adoption.

The definitive trial should also extend the follow-up period to a minimum of 12 months and ideally 24 months, with attendance data collected at every scheduled appointment rather than at a fixed endline only. The progressive attendance trajectory observed in the pilot

suggests that the intervention's effect was still accumulating at the final measurement point (67.2% at the fourth appointment), making a longer observation window both scientifically necessary and ethically justified. A longer follow-up would also enable assessment of whether attendance improvements are sustained after the initial novelty of the intervention diminishes, a question that the pilot's six-month duration cannot answer and that is critical for understanding the intervention's long-term clinical value. Ødegård et al.'s (2022) systematic review identified the absence of multi-site, long-term oncology evidence as a critical gap in the two-way SMS literature; the present study's pilot data provide the foundation needed to close this gap.

5.4.2. Longitudinal Assessment of Downstream Clinical Outcomes

Timely clinic attendance is a process measure, an intermediate outcome on the pathway to the clinical endpoints that ultimately determine whether the intervention justifies continued investment. The logical and scientifically necessary next question is whether the attendance improvements demonstrated in this pilot translated into measurably better clinical outcomes: earlier detection of disease recurrence, reduced rates of treatment discontinuity, fewer emergency presentations driven by unmonitored disease progression, improved quality of life, and, ultimately, improved survival among gynae-oncology patients. These outcomes require longer follow-up than the present trial permitted, linkage to clinical records beyond attendance registers, and a sample size powered for clinical endpoint detection rather than attendance rate comparison.

A definitive trial incorporating these clinical outcomes should be designed with a minimum follow-up of 24 months, with clinical event data, recurrence detection, treatment completion rates, quality-of-life assessments using validated instruments, and survival data, extracted from medical records at pre-specified intervals and reported against the same intervention and control arm assignments used in the attendance analysis. Patient-reported

outcome measures, collected via brief surveys at each clinic visit, would add the patient-perspective dimension to the clinical outcome profile. Kennedy et al.'s (2022) feasibility study of electronic patient-reported outcomes in ovarian cancer follow-up in the UK demonstrated that digital symptom monitoring enabled earlier identification of clinical concerns; a comparable approach integrated within the SMS reminder system at KNH, where patients' responses to reminders could include a brief symptom check, would create a multi-function digital interface that simultaneously supports attendance, monitoring, and clinical triage.

The clinical outcome evidence would also strengthen the economic case for the intervention by enabling calculation of cost-effectiveness ratios with clinically meaningful denominators, cost per recurrence detected, cost per treatment course completed, cost per quality-adjusted life year, that go beyond the process-level cost per additional timely attendee reported in the present study. These are the metrics that health technology assessment bodies and national policymakers require to justify inclusion of an intervention in a national care standard, and they can only be generated through a definitive trial with longitudinal clinical follow-up.

5.4.3. Full Societal Cost-Effectiveness Analysis

The present economic evaluation adopted a provider-side perspective, which excluded the patient-borne costs that are most relevant to the equity and access dimensions of the attendance problem. While methodologically appropriate for a pilot-embedded exploratory analysis (Drummond et al., 2015; Eldridge et al., 2016), this limitation means that the present cost estimates do not capture the full economic burden of attendance for patients who must travel significant distances to KNH, often from outside Nairobi, and whose transport, time, and opportunity costs are substantial relative to household incomes. Financial barriers were the most frequently cited obstacle to attendance in this population (76.2%); an economic evaluation

that does not capture patient-borne costs is therefore silent on the very dimension of cost that matters most to the people the intervention is intended to serve.

Future research should conduct a full societal cost-effectiveness analysis using validated approaches to patient cost data collection, structured transport and time diaries, retrospective recall instruments at each clinic visit, and household expenditure surveys at baseline and follow-up, to generate comprehensive estimates of the total cost of attendance from the patient perspective. The analysis should calculate the incremental cost-effectiveness ratio from both provider and societal perspectives, using clinically meaningful denominators identified in Recommendation 5.4.2. It should also conduct sensitivity analyses across key cost drivers, SMS tariff variation, personnel cost assumptions, and patient transport cost estimates, to test the robustness of the findings to variations in input parameters. Drummond et al.'s (2015) CHEERS checklist should guide transparent reporting, and Vassall et al.'s (2017) methodology for health economic evaluations in LMIC settings should inform the data collection and valuation approach. Such an analysis would provide the economic evidence base that is currently missing from the LMIC oncology mHealth literature and that national policymakers require to make the investment case for system-wide implementation.

5.4.4. Comparative Effectiveness of One-Way Versus Two-Way SMS Designs

The specific contribution of the two-way functionality to attendance outcomes, over and above what a simpler, lower-cost one-way reminder would achieve, was not experimentally isolated in the present study. The qualitative evidence strongly suggests that the interactive element generated an accountability mechanism that one-way reminders cannot provide: patients described feeling expected by the clinic, a motivational cue directly linked to the responsive, two-way nature of the system. However, this interpretation is inferential rather than causal; it is impossible to conclude from the present data whether a one-way reminder

delivering the same message at the same time would have produced equivalent, greater, or lesser attendance improvements.

This question has substantial practical significance for scale-up decisions. Two-way SMS requires staff time to manage incoming patient responses, the dominant cost driver in the present study at 73.5% of recurrent expenditure. If one-way reminders achieve equivalent effectiveness, the labour cost advantage of fully automated one-way delivery would make that simpler system substantially more scalable without operational compromise. Conversely, if the two-way interaction generates meaningfully superior attendance outcomes, through the accountability mechanism identified qualitatively and the barrier-identification capacity documented by Njuguna et al. (2024), the additional cost would be justifiable, and automation approaches that preserve two-way interaction while reducing manual response management (through tiered automated-then-human response systems) would be the appropriate investment.

A three-arm RCT, comparing standard care, one-way SMS reminders, and two-way SMS reminders, would resolve this question definitively and provide the design evidence base that any large-scale implementation programme needs to make evidence-informed choices about which system architecture to deploy. The trial should include acceptability and patient experience assessments alongside attendance outcomes, since the relational dimension of two-way interaction may confer acceptability benefits that improve long-term engagement even if short-term attendance rates are comparable. Njuguna et al.'s (2024) RCT in South African HIV care, which found no significant difference in return-to-care rates overall between one-way and behaviourally enhanced two-way messages but identified rich barrier data from the two-way arm, provides a useful methodological precedent and a cautionary comparison.

5.4.5. Intervention Design Optimisation Studies

The acceptability analysis identified several intervention design parameters, message timing, frequency, language, content specificity, and personalisation level, where patient

preferences were clear but could not be systematically accommodated within the fixed protocol of the pilot. Future research should use optimisation designs to identify the combination of design parameters that maximises both attendance effectiveness and patient acceptability, before embedding the optimised protocol in the definitive effectiveness trial.

Multiphase Optimisation Strategy (MOST) or Sequential Multiple Assignment Randomised Trial designs, both established in the behavioural intervention optimisation literature (Collins, 2018), are well-suited to this purpose. They enable systematic testing of individual design components, message frequency (one versus two reminders per appointment cycle), timing (24 hours versus 48 hours before appointment), language (English versus vernacular), content (bare appointment detail versus Reminder Plus format), and personalisation level (generic versus patient-name-specific versus appointment-specific), to identify which components contribute independently to the outcome and which can be removed without loss of effectiveness, thereby enabling a more efficient and patient-centred intervention protocol. McLean et al.'s (2016) distinction between bare reminders and 'Reminder Plus' content, which includes the clinical rationale for attendance, provides a directly testable design parameter with strong theoretical grounding in the health belief model; the present study's protocol did not test this distinction, leaving open the question of whether adding clinical rationale to messages would further improve attendance.

Optimisation studies would also address the patient-preference data generated in the qualitative phase more systematically than the present pilot could do. Discrete choice experiments, a stated preference methodology well-established in health economics, could quantify patients' willingness to trade off different message attributes against each other and against the inconvenience of receiving reminders, generating a preference-weighted design specification that reflects the actual distribution of patient values in the target population (Drummond et al., 2015). This would move the intervention design from provider-driven to

patient-centred, increasing the likelihood that the optimised protocol achieves sustained acceptability and engagement at scale.

5.4.6. Equity-Focused Research on Vulnerable Subgroups

The differential effectiveness findings by age and cancer type, combined with the feasibility barriers related to phone access and literacy, identify patient subgroups whose relationship with the intervention requires dedicated investigation that the present study's design and sample size could not provide. Future research should explicitly oversample and specifically characterise the experiences of patients aged 60 and above, patients with limited literacy or no personal phone ownership, patients residing in rural counties more than 200 kilometres from KNH, patients with endometrial and ovarian cancer, and patients with Stage III disease, the subgroups for whom the present data suggest the intervention's reach and effectiveness are most constrained.

Mixed-methods designs are particularly productive for equity-focused investigation of this kind. Qualitative exploration of the specific mechanisms through which the intervention fails to reach or benefit these groups, conducted through purposively sampled focus groups or individual interviews, would generate the experiential data needed to design tailored adaptations that address the specific barriers each subgroup faces, rather than applying generic modifications based on demographic proxies. Quantitative assessment of modification effectiveness, through a stratified sub-study embedded within the definitive trial, would provide the statistical evidence needed to confirm that adaptations actually improve outcomes for the groups they target.

The equity lens should also extend to the economic dimension. A patient-perspective cost analysis (Recommendation 5.4.3) stratified by distance from KNH, employment status, household income, and cancer type would reveal whether the intervention reduces absolute costs for the most financially constrained patients, through improved appointment efficiency

that reduces wasted trips, or whether the transport costs of attending KNH remain a prohibitive barrier even for patients who receive and respond to reminders. Lombe et al.'s (2023) systematic review established that the populations most at risk of poor cancer outcomes in sub-Saharan Africa are consistently those least well served by standard-of-care interventions; future mHealth research must treat equity measurement as a primary rather than secondary outcome if it is to address the health disparities that drive the region's disproportionate cancer burden.

5.4.7. Implementation Science Research on Scale-Up and Sustainability

The transition from a successful pilot to a sustained, system-integrated, and fidelity-maintained intervention is itself a research question that the mHealth literature has insufficiently addressed. Studies that demonstrate effectiveness in controlled trial conditions frequently fail to produce equivalent outcomes when deployed in routine operational environments, a phenomenon known as the 'efficacy-effectiveness gap' (Greenhalgh et al., 2005), because the conditions that made the trial successful (dedicated research staff, heightened monitoring, protocol adherence incentives) are not reproducible in ordinary clinical operations. Understanding how to bridge this gap for the SMS reminder intervention at KNH requires a formal implementation science inquiry conducted alongside and after routine implementation.

The Consolidated Framework for Implementation Research (CFIR) provides a comprehensive set of constructs for examining the multilevel factors that determine implementation success, including intervention characteristics, inner setting (organisational culture, leadership support, resource availability), outer setting (policy environment, patient needs), individuals (providers' knowledge, self-efficacy, and engagement), and implementation process (planning, engaging, executing, reflecting) (Dearing & Cox, 2018). An implementation science study using the CFIR as its analytical framework would systematically assess how these factors interact to determine fidelity to the intervention protocol, patient reach,

and sustained attendance outcomes over a 24-month routine implementation period, generating actionable knowledge about the conditions under which the intervention succeeds or deteriorates over time.

Specifically, the study should track: protocol fidelity rates (percentage of scheduled patients who receive reminders as specified); system-level factors that facilitate or impede sustained implementation (leadership commitment, financing stability, staff turnover, technology reliability); patient-level reach (proportion of the eligible caseload enrolled and actively receiving reminders, stratified by subgroup); and the cost trajectory as automation is introduced and patient volumes increase from pilot scale to routine operations. Rogers' (2003) DoI framework, specifically the stages of implementation, confirmation, and institutionalization, provides complementary theoretical scaffolding for understanding how the innovation moves from novelty to embedded practice. The present study's feasibility and acceptability data provide the baseline against which implementation fidelity and patient experience can be prospectively assessed, creating a longitudinal evidence stream that would be of significant value to Kenya's national digital health implementation programme and to the international LMIC mHealth literature more broadly.

5.4.8. Research on Patient-Provider Communication Quality as a Mediator of Intervention Effectiveness

The present study's qualitative findings generated one of the most theoretically significant and practically actionable insights to emerge from this research: patients experienced SMS reminders not merely as logistical prompts but as affective communications that signalled institutional care. This relational dimension of digital health communication has been identified in at least one other Kenyan mHealth study (Aunon et al., 2023) and warrants systematic investigation as a potential mediator of intervention effectiveness in its own right,

rather than as a qualitative side-finding that enriches but does not formally inform the quantitative analysis.

Future research should investigate whether the quality and warmth of provider responses to patient messages in two-way SMS systems, ranging from brief, generic acknowledgements to personalised, empathetic replies, moderates attendance outcomes, acceptability, and treatment engagement over time. A within-arm experimental study in which different response quality protocols are randomly assigned to patients who reply to two-way reminders would enable a controlled assessment of whether response quality independently predicts subsequent attendance, controlling for reminder receipt. Such a study would directly test the theoretical mechanism that the present study identified qualitatively but could not formally isolate experimentally: that the relational accountability generated by an acknowledging, personalised provider response, as opposed to an automated acknowledgement or no response, produces differential motivational effects on attendance behaviour.

This research question has substantial practical implications. If the warmth and personalisation of provider responses to patient messages prove to be significant moderators of the intervention's effectiveness, the design and training requirements for the clinical staff who manage two-way interactions will need to go well beyond technical protocol adherence to include relational communication skills explicitly. Healthcare worker communication training, grounded in person-centred care principles and specifically adapted to the brief, constrained format of SMS interaction, would then become a necessary component of implementation. Conversely, if response quality proves not to moderate outcomes, automated response functions could be deployed without concern that reducing the human element of the two-way interaction would attenuate its motivational effect. Either finding would be practically significant, enabling better-informed decisions about the staffing, training, and design investments required to optimise the system for clinical impact and equity of reach.

The theoretical contribution of such research would extend to the broader mHealth literature. Current models of SMS reminder effectiveness, grounded in TAM, TPB, and SCT, emphasise the individual patient's cognitive and motivational responses to the reminder itself, treating the provider's response as an operational process detail rather than an independent therapeutic variable. If provider response quality proves to moderate outcomes, it would constitute empirical evidence that patient-provider communication, even in the attenuated format of brief text exchange, carries independent therapeutic agency. This would advance the theoretical literature toward a more genuinely relational model of mHealth effectiveness, one that recognises digital health communications not only as information delivery mechanisms but as relational acts whose quality shapes their clinical impact, a conceptual shift with implications extending well beyond SMS reminders to the broader field of digital health communication design.

5.6. Conclusion

This study set out to address a clearly defined and clinically urgent problem: the unacceptably low rate of timely clinic attendance among gynae-oncology patients at Kenyatta National Hospital, and the absence of any evidence-tested, contextually appropriate intervention to address it in Kenya. The study has achieved its purpose. Across five research questions, baseline attendance, feasibility, acceptability, effectiveness, and cost, the findings converge on a coherent and actionable conclusion: two-way SMS reminders constitute a feasible, highly acceptable, significantly effective, and economically affordable intervention for improving timely clinic attendance in this population. The evidence base generated by this pilot RCT is sufficient to justify both immediate routine implementation within KNH and the design of a fully powered definitive trial that will establish the generalisability, long-term sustainability, and clinical outcome impact of the intervention.

The problem that motivated this study was not abstract. Gynae-oncology patients in Kenya, the majority managing cervical, ovarian, or endometrial cancers in an advanced public health system that is under-resourced relative to the burden it carries, attend their follow-up appointments unreliably, with consequences that are measurable and preventable. Missed appointments delay recurrence detection, interrupt treatment continuity, create wasted clinical capacity, and ultimately contribute to the excess mortality that characterises cancer outcomes in Kenya compared to high-income settings (Harsch et al., 2025; Lombe et al., 2023). The significance of the present study lies not only in what it demonstrated about SMS reminders but in what it established about the nature of the problem: that the dominant drivers of non-attendance in this population are not primarily motivational deficits or negative attitudes toward care, but cognitive and logistical constraints, forgetfulness, absence of planning support, the lack of any external cueing mechanism, operating against a background of structural financial hardship that an SMS intervention begins to address rather than fully resolves.

The baseline finding that only 31.1% of patients attended on time at baseline is, in itself, a contribution of significance. Prior to this study, no published data existed on the prevalence of timely attendance among gynae-oncology patients at KNH or at any comparable Kenyan national referral facility. The figure of 31.1%, established from a randomised cohort that was broadly representative of the facility's patient population in terms of cancer type, stage, age distribution, and geographic origin, provides a credible and internally valid benchmark against which the intervention's effect can be assessed and against which future improvements in service delivery can be measured. The coexistence of this low attendance rate with very high patient satisfaction (94.3%) is itself analytically important: it confirms that the challenge of improving clinic attendance in this setting is not one of improving service quality but of

improving access infrastructure, a distinction that has profound implications for where health system investment should be directed.

The effectiveness of the intervention is the study's central scientific contribution, and it must be understood at multiple levels of analysis simultaneously. At the statistical level, the adjusted odds ratio of 12.8 for intervention exposure as a predictor of timely attendance at endline, controlling for all sociodemographic and clinical covariates, establishes that the attendance improvement observed in the intervention arm was a genuine effect of the intervention rather than a product of pre-existing group differences. At the clinical level, a rise from 32.8% to 67.2% timely attendance in the intervention arm, against a slight decline from 29.5% to 26.2% in the control arm, represents a practically significant transformation in the care engagement of a population managing active malignancies in a resource-constrained setting. At the mechanistic level, the qualitative evidence revealed three complementary pathways through which this transformation was achieved: the cognitive pathway of forgetfulness reduction and improved planning; the motivational pathway of accountability and the felt expectation of the clinic; and the relational pathway of perceived care and emotional connection. Each of these pathways maps onto a different element of the conceptual framework, TPB's perceived behavioural control and subjective norms, SCT's reinforcement and self-efficacy, TAM's perceived usefulness, confirming that the intervention worked through theoretically coherent and empirically verifiable mechanisms.

The progressive trajectory of the effectiveness finding, rising from 35.1% at the first appointment after randomisation to 67.2% at the fourth, is one of the study's most theoretically significant outputs. It provides empirical evidence that the intervention's effect was not a transient novelty response but an accumulating behavioural change, consistent with SCT's prediction that repeated external reinforcement strengthens self-efficacy over time. Each successful on-time attendance facilitated by the reminder may have reinforced patients'

confidence in their capacity to manage their appointments, contributing to a positive feedback loop that produced the rising trajectory rather than a plateau. This temporal dimension of the effectiveness finding is one that an endline-only cross-sectional comparison would have entirely missed, a methodological argument for the value of measuring outcomes at multiple time points in intervention studies of this kind, and a finding that carries direct implications for how the intervention's long-term value is understood. The 67.2% endline rate is not a ceiling; it is a trajectory point that would have continued to rise had the trial extended further.

The feasibility findings establish that implementation within KNH's current operational environment is achievable without prohibitive infrastructure investment or disruptive workflow change. Provider unanimity, all four key informants across all relevant clinical roles endorsing the intervention as compatible, cost-effective, and integrable, provides an institutional readiness signal that goes well beyond technical feasibility confirmation. It reflects a workforce that has directly experienced the intervention, observed its effects on attendance patterns and clinic flow, and formed an evidence-based judgement that its adoption is both warranted and viable. The providers' ability to articulate not only what the intervention achieved but precisely what would be needed to scale it sustainably, server upgrades, multilingual messaging, expanded technical staffing, patient education, demonstrates an operational intelligence about implementation requirements that is rarely this well-developed at the pilot stage and that substantially de-risks the transition to routine deployment.

The acceptability findings, 88.5% high composite acceptability with no participant reporting low acceptability, confirm that patients in this population are not merely willing to receive SMS reminders but find them genuinely valuable, easy to use, and emotionally resonant in ways that extend well beyond their logistical function. The relational dimension of acceptability, patients describing reminders as evidence that "the clinic cares about me, not just as a patient but as a person", is a finding that enriches the literature in an important and

practically useful direction. It suggests that in the oncology context, where patients manage not only illness but the psychosocial burden of a cancer diagnosis within an impersonal large-scale health system, a simple text message can carry therapeutic relational meaning that amplifies its motivational impact beyond what its information content alone would predict. This finding challenges the prevailing logistical framing of SMS reminders in the mHealth literature, which treats them primarily as information delivery tools, and argues for a richer understanding of their function as relational communication acts that strengthen the patient-provider bond.

The economic findings confirm affordability at both patient and system levels. A total incremental cost of USD 415.08 over the study period, yielding USD 6.81 per patient and USD 16.60 per additional timely attendee, places the intervention at the affordable end of the LMIC mHealth cost spectrum. The dominant cost driver, personnel time at 73.5% of recurrent expenditure, is not a fixed constraint but a reducible one: automation of outgoing message scheduling would substantially lower the per-patient cost without compromising clinical effectiveness, and the scalability economics established in the literature predict that per-unit costs will decline further as deployment scales from a pilot of 61 to a routine caseload of several hundred patients per month. The cost per additional timely attendee of USD 16.60 should be understood in context: it is the cost of securing a clinical appointment that, in the oncology setting, may be the encounter at which recurrence is detected, treatment is adjusted, or a patient's fears are addressed. When set against the downstream costs of missed oncology appointments, delayed recurrence detection, emergency presentations, wasted clinic capacity, this cost represents a plausible and likely favourable investment even in the absence of a formal cost-offset analysis.

The multi-framework conceptual model, integrating TAM, TPB, SCT, DoI, and the WHO Building Blocks framework across individual, provider, and system levels, proved not merely theoretically organising but analytically generative throughout the study. Each

theoretical lens illuminated a dimension of the findings that the others left in shadow, and no single theory was sufficient to account for the full complexity of what was observed. TAM explained the acceptability structure but could not account for the relational-affective dimension that the qualitative data revealed. TPB explained the individual behavioural mechanism but required SCT to capture the accumulating self-efficacy dynamics visible in the attendance trajectory. DoI provided the most powerful framework for interpreting provider feasibility perceptions but, as the literature acknowledges, underestimates structural equity barriers at the patient level. The WHO Building Blocks framework mapped the system-level context but did not capture the interpersonal relational dimensions of care that proved central to patient experience. The empirical necessity of all five frameworks to account for the full range of findings is itself a methodological contribution, providing evidence that complex mHealth intervention studies in LMIC health systems require multi-level, multi-framework analytical approaches and that single-theory evaluations will systematically miss important dimensions of what these interventions do and why.

The study contributes to the existing literature in three distinct ways. First, it fills the specific evidential gap identified in the literature review: no prior study had tested a two-way SMS intervention for improving ongoing clinic attendance among gynae-oncology patients in Kenya or the broader East African LMIC region. The findings of Wanyoro and Kabiru (2017) and Karanja (2015), the most directly relevant prior evidence from Kenyan oncology-adjacent contexts, are now substantially extended by a more rigorous and comprehensive evaluation addressing ongoing outpatient attendance across multiple appointments. Second, the study contributes to the methodological literature on mixed-methods RCT design, demonstrating how systematic integration of qualitative and quantitative data enables mechanistic explanation, contextualisation of effect sizes, and identification of equity differentials that quantitative analysis alone cannot provide. Third, the study contributes to the economic

evidence base for mHealth in LMIC oncology settings, an area identified by Iribarren et al. (2017) as critically sparse, by providing the first published provider-side microcosting estimate for a two-way SMS reminder intervention in a gynae-oncology outpatient context in Kenya.

The study also makes a contribution to theory that extends beyond its empirical domain. The empirical identification of a relational dimension to SMS acceptability in an oncology context, whereby patients interpret reminder messages as expressions of institutional care rather than merely logistical prompts, challenges the adequacy of TAM as an explanatory framework for patient-facing digital health interventions. TAM was developed to explain technology adoption in organisational settings where the evaluative criteria are functional efficiency and cognitive ease; it does not incorporate the affective and relational meanings that digital communications carry in settings where illness, vulnerability, and the quality of the human relationship with care providers are central to the patient's experience. The present finding, corroborated by Aunon et al. (2023) in Kenyan HIV care, adds to a growing body of empirical evidence that mHealth adoption models require augmentation with constructs drawn from relational care theory and the patient experience literature to account adequately for the full range of factors that determine whether patients engage with digital health interventions over time.

A second theoretical contribution concerns the relationship between structural barriers and behavioural intervention effects. A common implicit assumption in the mHealth effectiveness literature is that interventions targeting behavioural and cognitive barriers will produce limited effects in populations whose non-attendance is primarily structurally determined by poverty, distance, and competing life demands. The present findings challenge this assumption empirically. In a population where 76.2% cited financial limitations as an attendance obstacle and 74.6% resided outside Nairobi, a profile that would conventionally predict limited responsiveness to a behavioural intervention, the SMS reminder produced a

34.4 percentage-point improvement in timely attendance. This finding suggests that the behavioural and structural determinants of non-attendance are more separable in their effects than is sometimes assumed, and that meaningful improvement in the behavioural dimension is achievable even when the structural dimension remains unaddressed. The theoretical implication is that TPB's construct of perceived behavioural control can be meaningfully strengthened through external technological cueing even when the structural constraints on that control, financial, logistical, geographic, have not changed, provided that forgetfulness and absence of planning support were independently significant contributors to the behavioural deficit. This is a refinement of how perceived behavioural control should be theorised in resource-constrained oncology settings, and it has implications for how researchers frame the mechanisms and scope of behavioural mHealth interventions in similar contexts.

A third dimension of the study's significance concerns equity, both what the study found and what it did not find, and what both observations mean for the field. The aggregate effectiveness finding (aOR=12.8) represents a powerful average effect that could mislead if treated as the complete story. The attenuated effects among older patients and those with endometrial and ovarian cancer confirm that this average conceals meaningful subgroup variation, variation that corresponds, at least partially, to dimensions of disadvantage that the intervention in its current form does not adequately reach. This is not a reason to be less optimistic about the intervention's potential; it is a reason to be more precise about who that potential is for, and to be unequivocal about the additional design work required to extend the benefit to those subgroups for whom the current protocol is least effective. A health intervention that substantially improves outcomes for the majority while leaving its most vulnerable subgroups relatively behind is not a failure, but it is an incomplete success, and recognising that incompleteness clearly is a necessary precondition for addressing it. The present study's differential effectiveness findings therefore serve not only as hypothesis-

generating signals for future research but as an equity accountability mechanism: they document the gap between the intervention's aggregate effect and its equitable effect, and they make both visible in the published record.

The significance of the study for nursing and health professional practice is equally direct. The intervention was designed, delivered, and managed primarily by nursing and health information staff at KNH, not by specialist digital health technologists or research teams with dedicated resources. This matters, because it confirms that the intervention is within the operational capacity of the clinical workforce that will sustain it beyond the research period. The key informant accounts from nursing and nurse leadership respondents in particular confirm that the clinical skills, institutional understanding, and relational intelligence required to implement the SMS reminder system effectively are already present within KNH's nursing workforce. The recommendations in Section 5.3, the SOP development, the multilingual content adaptation, the equity-focused protocol modifications, are all actionable by nursing and health information professionals without specialist digital health expertise. This is a finding of direct relevance to nursing practice and to the broader question of how digital health innovations can be embedded in health systems without creating new dependencies on specialised technical capacity that may be unavailable or unsustainable in resource-constrained environments. It affirms that nurse-led digital health implementation is not only possible but has been demonstrated to produce clinically meaningful outcomes in the specific context of gynaecological care in Kenya.

For KNH specifically, the study provides an unambiguous evidence-based mandate for action. The case for transitioning from pilot to routine implementation is made, not as an aspiration but as a recommendation grounded in demonstrated effectiveness, confirmed feasibility, high acceptability, and affordable cost. The institutionalisation steps, automation investments, multilingual content development, equity-targeted adaptations for older patients

and those with endometrial and ovarian cancer, and structural complementary measures for financial and transport barriers outlined in Section 5.3 provide a practical roadmap for that transition. The implementation will not be without challenges, network reliability, phone access equity, staff capacity, and the labour costs of managing two-way interaction remain genuine operational constraints. But none of these is insurmountable, and the provider accounts in this study demonstrate that the clinical workforce at KNH already understands these challenges and has articulated clear, actionable responses to each of them. The transition from pilot to routine implementation therefore does not require new evidence; it requires institutional decision-making that this evidence fully supports.

For Kenya's health system more broadly, the findings provide the policy foundation for integrating SMS-based appointment support into the national standard of care for oncology outpatients across public hospitals at Level 5 and above. The intervention is affordable at scale, achieves meaningful attendance improvements in a population for whom treatment continuity is clinically critical, and operates on the most widely available communication infrastructure in the country, basic mobile phones and SMS networks that reach 91% of Kenya's population (Kiburi et al., 2022). These attributes make it not merely a promising innovation but a mature, evidence-tested solution to a documented clinical problem, the category of evidence that Kenya's National Cancer Control Strategy and Digital Health Framework are explicitly designed to translate into operational policy. Active dissemination of this study's findings through the National Cancer Institute of Kenya, the Division of Non-Communicable Diseases, the Kenya Society of Haematology and Oncology, and international publication channels will build the advocacy base and scientific visibility needed to accelerate this policy translation.

For the global LMIC oncology research community, the study offers contributions that extend well beyond its immediate empirical context. Methodologically, it demonstrates that a pilot RCT with a systematically integrated mixed-methods component generates a richer, more

mechanistically complete, and more practically actionable evidence base than quantitative-only trials at equivalent scale and cost, a design argument that has particular relevance for resource-constrained research environments where full-scale trials must be justified by compelling pilot evidence. Substantively, it demonstrates that the seemingly intractable problem of poor oncology attendance in LMIC settings has a component that is genuinely tractable through low-cost intervention: the behavioural and cognitive barriers of forgetfulness, poor planning support, and absence of external accountability respond substantially to a well-designed, contextually appropriate SMS reminder. The residual 32.8% of patients who did not achieve timely attendance despite receiving reminders confirms that this tractable component does not account for the full problem, structural financial and logistical barriers remain binding for a substantial minority, and addressing them requires policy investments that digital health alone cannot substitute for. But the 34.4 percentage-point improvement achieved in the face of real structural constraints is evidence against the fatalism that has sometimes allowed the structural dimension of the attendance problem to become an excuse for inaction on the behavioural dimension. Both must be addressed; neither excuses failure to address the other.

The patients who participated in this study, managing active gynaecological malignancies while navigating the financial and logistical demands of attending a national referral hospital, in many cases from counties hundreds of kilometres away, were not passive recipients of a research intervention. They engaged thoughtfully, provided rich and reflective accounts of how reminders changed their clinic management and their sense of connection to the care system, and contributed evidence that will now inform decisions affecting thousands of Kenyan women managing gynaecological cancers in the years ahead. The finding that many of them experienced a simple text message as a signal that the clinic remembered and valued them as individuals, rather than merely as patients to be scheduled, is both a scientific observation about the relational dimension of digital communication and a human one about

what patients living with serious illness need from the health systems that serve them. It is a finding that should shape not only how SMS reminders are designed but how we think about the therapeutic potential of every form of digital health communication in chronic disease care.

In concluding, this study responds to a documented clinical problem with rigorous evidence, situates its findings within a theoretically coherent and empirically grounded multi-level framework, and generates a clear, specific, and implementable forward agenda. For KNH, the mandate is to act on the evidence now. For Kenya's national health policy, the mandate is to translate this evidence into a care standard that extends these benefits beyond a single facility. For the research community, the mandate is to design and execute the definitive trial that will establish the generalisability, long-term clinical outcomes, and full cost-effectiveness of the intervention that this pilot has proven. The scientific case is made. The practical pathway is defined. The ethical imperative, to act on evidence that could meaningfully improve the care of women managing gynaecological cancers in one of the world's most under-resourced oncology environments, is unambiguous.

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APPENDICES

Appendix A: Participant Consent Information

Section 1: Participant Debrief

Title of Research Project: Evaluating the Use of Mobile Health Technology to Improve Clinic Attendance Among Gynecologic Oncology Patients at Kenyatta National Hospital: A Randomized Controlled study.

The main aim of this study is to conduct a preliminary randomized study to determine whether SMS appointment reminders are useful and acceptable in improving attendance among gynecologic oncology patients attending clinics at Kenyatta National Hospital, Kenya. The patient's appointment date and any necessary pre-visit investigations will be included in custom text messages created by the researcher. Patients' forgetfulness, which may be brought on by the need for frequent visits for different tests, is one of the main reasons for missed appointments. Failure to attend scheduled visits increases costs, inconveniences patients, delays diagnosis, and interferes with timely initiation of treatment. Therefore, early detection and treatment are key to improved clinical outcomes for cancer patients. The purpose of this study is to assess how well SMS updates encourage patient happiness and facility involvement.

Student's Name: Agneta Kandie Chelimo

Student's E-mail Address: chelimoagneta120@gmail.com

Student ID #: A1801D4299711

Supervisor's Name: Dr. Hubert Amu

University Campus: Unicaf University Zambia (UUZ)

Program of Study: PHD in Community Health Nursing

Part 2 Certificate of consent.

The information regarding this study has either been read to me or I have read it. I have had the chance to talk about it and ask questions. I have gotten adequate information regarding this study and satisfactory responses to all of my inquiries. I am aware that I can leave this course at any moment, without providing a reason, and without facing any repercussions. I agree to the use of multimedia (such as audio and video recordings) in order to facilitate my involvement in this study. I am aware that, unless otherwise specified, my information will be kept private and anonymous. I willingly agree to take part in this investigation.

I've consented: Yes [☐] No [☐]

Gender..... Others..... Prefer not to say [☐]

If the participant is illiterate: I have seen the permission form accurately read to the prospective participant, and they have had a chance to ask questions. I certify that the aforementioned person willingly provided their consent.

Yes [☐] No [☐]

Gender.....Others..... Prefer not to say [☐]

Appendix B: Ridhara Ya Mshiriki

Historia ya Utafiti

Jina langu ni Agneta Chelimo, mhudumu wa afya katika Hospitali ya Kitaifa ya Kenyatta (KNH). Mimi ndiye mtafiti mkuu wa utafiti huu unaohusu matumizi ya teknolojia ya simu (m-Health) katika kuboresha mahudhurio ya wagonjwa wa saratani za wanawake kwenye kliniki. Utafiti huu unafanyika katika Hospitali ya Kitaifa ya Kenyatta nchini Kenya kwa mfumo wa jaribio la kitabibu lililodhibitiwa kwa nasibu. Umechaguliwa kushiriki katika utafiti huu, ambao unatarajiwa kuchukua takribani dakika 20 hadi 30 za muda wako.

Madhumuni ya Utafiti

Lengo la utafiti huu ni kuchunguza jinsi vikumbusho vya ujumbe mfupi wa simu (SMS) vinavyoweza kusaidia kuboresha mahudhurio ya wagonjwa katika kliniki pamoja na namna wagonjwa wanavyovipokea. Aidha, utafiti huu utatathmini matokeo yanayoripotiwa na wagonjwa wa saratani za wanawake wanaopata huduma katika Hospitali ya Kitaifa ya Kenyatta.

Utaratibu wa Utafiti

Utaulizwa maswali kuhusu matumizi ya ujumbe mfupi wa simu (SMS) kama njia ya vikumbusho vya miadi ya kliniki. Maswali hayo yatahusisha maoni yako kuhusu urahisi wa mfumo huo, usahihi wa taarifa zinazotumwa, pamoja na namna ujumbe huo unavyoweza kusaidia kuboresha mahudhurio yako ya kliniki na hali yako ya maisha ukiwa unapokea huduma katika KNH.

Hiari ya Kushiriki

Kushiriki katika utafiti huu ni kwa hiari yako mwenyewe. Una uhuru wa kuamua kushiriki au kutoshiriki, na uamuzi wako hautaathiri huduma unazopokea hospitalini kwa namna yoyote ile.

Faida wa Kushiriki

Taarifa utakazotoa zitatumika kwa madhumuni ya utafiti huu pekee. Jina lako halitaandikwa kwenye dodoso au ripoti yoyote ya utafiti. Badala yake, taarifa zako zitahifadhiwa kwa usiri mkubwa ili zisifikiwe na watu wasiohusika. Nyaraka zote za utafiti zitahifadhiwa mahali salama penye ulinzi wa kutosha. Ikiwa utahitaji ufafanuzi wowote kuhusu utafiti huu, utakuwa huru kuuliza wakati wowote.

Hatari zinazoweza kujitokeza

Hakuna madhara yoyote yanayotarajiwa kutokana na ushiriki wako katika utafiti huu au utaratibu utakaotumika wakati wa utafiti.

Uhuru wa kushiriki au kujiondoa

Una haki ya kuamua kushiriki au kutoshiriki katika utafiti huu. Pia unaweza kuacha kushiriki wakati wowote bila kulazimika kutoa sababu yoyote. Majibu yako ya kweli yatasaidia sana kufanikisha malengo ya utafiti huu. Unaweza kuuliza swali lolote kuhusu utafiti huu kabla ya kutoa ridhaa yako au wakati wowote katika kipindi cha utafiti. Tunathamini sana muda na ushirikiano wako katika kujaza hojaji hii.

Taarifa za mawasiliano

Mimi, niliyesaini hapa chini, nimemweleza mshiriki kwa lugha anayoifahamu kuhusu taratibu za utafiti huu pamoja na faida na changamoto zinazoweza kujitokeza kutokana na ushiriki wake.

Mchunguzi Mkuu: Agneta Kandie Chelimo

Nambari ya simu ya mawasiliano: + 254789010995 / + 254722689963

Barua pepe ya mawasiliano: chelimoagneta120@gmail.com

Saini ----- Tarehe -----

Appendix C: Questionnaire for Patients with Gynae-Oncology

A RANDOMIZED CONTROLLED TRIAL AT KENYATTA NATIONAL HOSPITAL, KENYA: AN m-HEALTH INTERVENTION TO IMPROVE CLINIC ATTENDANCE AMONG GYNAE-ONCOLOGY PATIENTS

You have been chosen at random to participate in this study, which aims to assess the viability and efficacy of SMS reminders for patients visiting the gynae-oncology clinic at Kenyatta National Hospital in Nairobi, Kenya. Please fill out this form. Filling out the form will take around ten minutes. Please answer the questions as truthfully as you can. Your participation would be greatly appreciated, and all information provided will be kept private. Never write your name. Please indicate your response to each question by checking the box (✓) next to your choice or by filling in the blank.

Section A: Socio-demographic and Baseline Information

Question	Response
1. How old are you?	[.....]
2. What is your religion?	1. Christian 2. Muslim 3. Other:
3. What is your ethnicity?	
4. What is your highest level of education?	1. Basic [] 2. Secondary education [] 3. Diploma [] 4. Undergraduate education [] 5. Postgraduate []

	6. None []
5. What is your marital status?	1. Never married [] 2. Married [] 3. Divorced/Separated [] 4. Widowed []
6. What is your occupation?	1. Employed [] 2. Unemployed [] 3. Business [] 4. Others specify:.....
7. Which county do you come from?	1. Nairobi [] 2. Nearest town:.....
8. For how long have you been a patient at the KNH?	[.....]
9. What did the doctor tell you is your illness?	
10. How long have you had this problem?	[.....]
11. Participant classification	1. Intervention 2. Control

Section B: Acceptance of SMS Reminders for Clinic Attendance

Acceptability Item	Response
12. The SMS reminders were easy to understand.	1. Strongly disagree 2. Disagree

	3. Neutral 4. Agree 5. Strongly agree
13. The messages were clear and relevant to my clinic appointments.	1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree
14. The reminders helped me attend my clinic appointments on time.	1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree
15. I was satisfied with receiving SMS reminders for my clinic visits.	1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree
16. I would prefer to continue receiving SMS reminders for future appointments.	1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree

17. Receiving SMS reminders was inconvenient or disruptive.	1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree
18. What did you like most/least about the SMS reminders?	

Section C: Baseline and Intervention Period Clinic Attendance

Baseline Clinic Attendance Attendance	Response
19. On average, how frequently do you show up for your visits at the gynae- oncology clinic?	1. Always on time [] 2. Primarily on time [] 3. Occasionally late [] 4. Usually late [] 5. Never attend []
20. What are the causes of any gynae- oncology clinic visit delays or missed appointments?	1. Personal factors [] 2. Transport-related issues [] 3. Schedule or job conflicts [] 4. Health problems [] 5. Other:

Timely Clinic Attendance during Intervention Period	Confirmed from attendance record
21. First appointment	1. Yes 2. No
22. Second appointment	1. Yes 2. No
23. Third appointment	1. Yes 2. No
24. Fourth appointment (endline)	1. Yes 2. No
25. Do you have any obstacles or hurdles that make it difficult for you to make it to gynae-oncology clinic appointments on time?	1. Financial limitations [] 2. Complications with transportation [] 3. Family or work obligations [] 4. Health problems [] 5. Other:.....

Thank you for taking your time to respond to this questionnaire. For any concerns, please call this number **0757633836**.

Appendix D: Gynae-Oncology Patients' Focus Group Discussions

In a pilot randomized clinical trial, this study aims to assess *the feasibility of SMS reminders on clinic attendance for gynae-oncology patients visiting the clinic at Kenyatta National Hospital in Kenya*. We respectfully ask that you take part in the discussion after being chosen at random. Please provide the most truthful answers to the questions. Your help would be greatly appreciated, and all information provided will be kept confidential.

Section A: Socio-demographic Characteristics

1. What is your gender? Other..... Prefer not to mention.....
2. How old are you?
3. How long have you been a patient at the KNH attending clinic/any admissions?

Section B: Acceptability of the SMS reminders

1. Have you ever received SMS reminders from the KNH after your clinic attendance?
2. Could you share your experience with receiving the SMS reminders?
3. What was your general experience with receiving SMS reminders?
4. Did you have any difficulties with receiving the SMS? (explain)
5. What areas can be improved?
6. What is your opinion on the length of the SMS in delivering the information required?
7. What are some of the things that made it easy or difficult to use the SMS? (Trying to get at barriers and facilitators of SMS implementation.
8. If you were to invite or recommend the services of KNH given the SMS reminders, what would you recommend about?

Thank you for your cooperation.

Appendix E: Key Informant Schedules

This study seeks to evaluate *feasibility of SMS reminders on clinic attendance of gynae-oncology patients attending gynae-oncology clinic in Kenyatta National Hospital, Kenya, in a pilot randomized clinical trial*. You have been randomly selected and are kindly requested to participate in the discussion. Kindly respond to the questions as honestly as possible. All information given will be treated with confidentiality and your kind cooperation will be highly appreciated.

Socio-demographic Characteristics

1. What is your gender? Other..... Prefer not to mention.....
2. How old are you?
3. How long have you worked in clinic 18(Gynae-oncology clinic)?

Acceptability of the SMS reminders

1. In your opinion, describe the effectiveness of the SMS reminders in improving clinic attendance of the Gynae-Oncology Patients at KNH.
2. What is your opinion on the acceptability, appropriateness and feasibility of the SMS reminders in improving patient healthcare outcomes at KNH?
3. What are some of the barriers experienced in the use of SMS reminders in improving patient health-care outcomes at KNH?
4. What resources would you need to scale this up?

Thank you for your cooperation.

Appendix F: UU_GL_Gatekeeper letter



UU_GL - Version 2.0



Gatekeeper letter

Address: The HOD Obs/ Gynae. KNH

Date: 30-Apr-2023

Subject: Request to carry out a study

Dear Dr.Owiti,

I am a doctoral student at Unicaf University - Zambia

As part of my degree I am carrying out a study on m-Health intervention to improve clinic attendance among gynae-oncology patients.

I am writing to enquire whether you would allow me permission to recruit patients who will be participants from gynae-oncology clinic and clinical staff from the same speciality in this research.

Subject to approval by Unicaf Research Ethics Committee (UREC) this study will be using an exit questionnaire tool for participants, focus group discussion and interviews for clinical team.

The overall objective of this study is to examine the feasibility and effectiveness of SMS reminders on clinic attendance of gynae-oncology patients attending gynaecology clinic in Kenyatta National Hospital, Kenya, in a pilot randomized clinical trial. This will be done using the developed text messages containing reminders on the date of the patients' scheduled appointment, documents and investigations required before the visit. My supervisor is Dr.Hubert Amu attached to UNICAF university.

After consenting and recruitment of the participants done, the person sending the sms will be required to know the clinic appointment dates and the clinician investigations request for the patient to come with during the next visit. Since it is a two way sms, participants need to acknowledge receiving the sms. Questionnaire engagement will be approximately 15 minutes and thereafter a selected focus group taking about 40 minutes. The interviews for the clinical staff will take about 5 minutes each for the 4 participants.

Thank you in advance for your time and for your consideration of this project. Kindly please let me know if you require any further information or need any further clarifications.

Yours Sincerely,

Student's Name: Agneta Kandle Chelimo

Student's E-mail: chelimoagneta120@gmail.com

Student's Address and Telephone: Box 55685-00200 +254 722689963

Supervisor's Title and Name: Dr.Hubert Amu

Supervisor's Position: Lecturer, University of Health and Allied Sciences

Supervisor's E-mail: h.amu@unicaf.org

Appendix G: ERC KNH-UoN



UNIVERSITY OF NAIROBI
FACULTY OF HEALTH SCIENCES
P O BOX 19476 Code 00202
Telegram: varsity
Tel (254-020) 2726300 Ext 44355



KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegram: MEDSUP, Nairobi

KNH-UoN ERC

Email: uonknh_erc@uonbi.ac.ke
Website: <http://www.erc.uonbi.ac.ke>
Facebook: <https://www.facebook.com/uonknh.erc>
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

Ref: KNH-ERC/A/258

Agneta Kandie Chelimo
Principal Investigator
Health Care Quality Unit
Dept. of Obstetrics and Gynecology
Kenyatta National Hospital

5th July, 2022



Dear Agneta,

RESEARCH PROPOSAL: AN M-HEALTH INTERVENTION TO IMPROVE CLINIC ATTENDANCE AMONG GYNÆ-ONCOLOGY PATIENTS; A RANDOMIZED CONTROLLED TRIAL IN KENYATTA NATIONAL HOSPITAL, KENYA (P874/11/2021)

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P874/11/2021**.

This approval is subject to compliance with the following requirements;

- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by KNH-UoN ERC.
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KNH-UoN ERC 72 hours of notification.
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH-UoN ERC within 72 hours.
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) <https://research-portal.nacosti.or.ke> and also obtain other clearances needed

Yours sincerely,



DR. BEATRICE K.M. AMUGUNE
SECRETARY, KNH-UoN ERC

c.c. The Dean, Faculty of Health Sciences, UoN
The Senior Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information Dept., KNH
Co-investigator, Monica Wamatha Karau, Nursing Manager, Clinic 18-KNH
Mentors: Dr. Sarah Masyuko, Research Scientist, KNH
Dr. Irene Njuguna, Research Scientist, KNH

Appendix H: Medical Research Study Registration Certificate

KNH/R&P/FORM/01 **35**



KENYATTA NATIONAL HOSPITAL
P.O. Box 20723-00202 Nairobi

Tel.: 2726300/2726450/2726565
Research & Programs: Ext. 44705
Fax: 2725272
Email: knhresearch@gmail.com

Study Registration Certificate

- Name of the Principal Investigator/Researcher
AGNETA KANDIE CHELIMO
- Email address: chelimagnet@120@gmail.com Tel No. 0722689963
- Contact person (if different from PI) N/A
- Email address: N/A Tel No. N/A
- Study Title
An Utheth Intervention to Improve Clinic Attendance Amongst Gynaec-Oncology Patients: A Randomized Controlled Trial in Kenyatta National Hospital Kenya
- Department where the study will be conducted Obstetrics & Gynaecology Department - CHICKS
(Please attach copy of Abstract)
- Endorsed by KNH Head of Department where study will be conducted.
Name: Dr. M. O. Ochi Signature: [Signature] Date: 03/11/2022
- KNH UoN Ethics Research Committee approved study number P874/11/2021
(Please attach copy of ERC approval)
- I, Agnetta Chelimo commit to submit a report of my study findings to the Department where the study will be conducted and to the Department of Medical Research.
Signature: [Signature] Date: 4/11/2022
- Study Registration number (Dept/Number/Year) Obs Gyn 1529 2022
(To be completed by Medical Research Department)
- Research and Program Stamp [Stamp]

All studies conducted at Kenyatta National Hospital must be registered with the Department of Medical Research and investigators must commit to share results with the hospital.

Appendix I: UREC Decision A



UREC Decision, Version 2.0



Unicaf University Research Ethics Committee Decision

Student's Name: Agneta Kandie Chelimo

Student's ID #: R1801D4299711

Supervisor's Name: Hubert Amu

Program of Study: UU-DOC-900-1-ZM

Offer ID /Group ID: O33823G35904

Dissertation Stage: DS 1

Research Project Title: AN m-HEALTH INTERVENTION TO IMPROVE CLINIC ATTENDANCE AMONG GYNAE-ONCOLOGY PATIENTS: A PILOT RANDOMIZED CONTROLLED TRIAL IN KENYATTA NATIONAL HOSPITAL, KENYA

Comments: No comments

Decision*: A. Provisionally approved without revision or comments

Date: 31-Mar-2022

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3. The student is allowed to proceed to data collection following the final approval.

Appendix J: UREC Decision DS3



UREC Decision, Version 2.0

Unicaf University Research Ethics Committee Decision

Student's Name: Agneta Kandie Chelimo

Student's ID #: R1801D4299711

Supervisor's Name: Dr Hubert Amu

Program of Study: UU-DOC-900-3-ZM

Offer ID /Group ID: O55882G62756

Dissertation Stage: DS3

Research Project Title:

**AN m-HEALTH INTERVENTION TO IMPROVE CLINIC ATTENDANCE AMONG
GYNAE-ONCOLOGY PATIENTS: A PILOT RANDOMIZED CONTROLLED TRIAL IN KENYATTA
NATIONAL HOSPITAL, KENYA**

Comments: No comments.

Decision*: A. Approved without revision or comments

Date: 12 May 2023

*Provisional approval provided at the Dissertation Stage 1, whereas the final approval is provided at the Dissertation stage 3.
The student is allowed to proceed to data collection following the final approval.