The Role of Technology in Mainstreaming Palliative Care in Level 5 Hospitals in Kenya: A Systematic Review

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DOI: https://doi.org/10.51244/IJRSI.2025.121500083P

Received: 21 May 2024; Accepted: 26 May 2024; Published: 28 June 2025

ABSTRACT

Palliative care (PC) is a vital component of universal health coverage, yet its integration into mainstream health services remains limited in low- and middle-income countries (LMICs) such as Kenya. Level 5 hospitals, which serve as key referral facilities, face systemic and infrastructural challenges that hinder effective PC delivery. Digital health technologies—such as telemedicine, mobile health (mHealth) applications, and electronic health records (EHRs)—are increasingly recognized as potential tools for enhancing access, coordination, and quality of care in these settings.

This systematic review aimed to evaluate the role of digital technologies in mainstreaming palliative care in 2 Kenya's Level 5 hospitals and similar LMIC like Nigeria and Uganda environments.

The review adhered to PRISMA guidelines and synthesized qualitative, quantitative, and mixed-methods studies published between 2020 and 2025. Eligible studies were selected based on predefined inclusion criteria, including a focus on digital PC interventions in LMICs, publication in English, a minimum of 30 citations for peer-reviewed studies, and relevance to policy or implementation. High-quality grey literature was also included. Data were sourced from PubMed, Scopus, Google Scholar, and AJOL and analyzed thematically.

A total of n=32 studies were included, with n=14 from Kenya and n=18 from other LMICs. The most commonly reported technologies were telemedicine (47%), mHealth applications (41%), EHRs (31%), and digital training tools (28%). These interventions were associated with improved access to care, documentation, patient engagement, and provider collaboration. Key barriers identified included infrastructural limitations (69%), digital literacy gaps (53%), cultural resistance (34%), and sustainability issues (59%). The overall risk of bias was assessed as moderate, primarily due to confounding factors and incomplete data in some studies.

Digital technologies demonstrate strong potential to strengthen palliative care delivery in Kenya and comparable LMICs. However, their successful implementation requires addressing infrastructural and cultural barriers, integrating solutions into health policy, and ensuring sustainability. Future research should focus on long-term impact, cost-effectiveness, and equity in digital health adoption for PC.

Keywords: Palliative Care, Digital Health, Telemedicine, Mobile Health, Electronic Health Records, Level 5 Hospitals, Low-and-Middle-Income Countries, Systematic Review, Kenya Electronic Medical Records, National Palliative Care Policy, Universal Health Coverage

INTRODUCTION

Background of Study

Palliative care is defined by the World Health Organization (WHO) as an approach that improves the quality of life of patients and their families, facing problems associated with life-threatening illness through the prevention and relief of suffering by means of early identification, impeccable assessment, and treatment of

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

pain and other problems—physical, psychosocial, and spiritual32 It is an integral part of Universal Health Coverage (UHC), human rights, and health system strengthening and should be provided at all levels of care and integrated into national health policies and strategies[32] Mainstreaming PC refers to the integration of PC into all levels of health care—community, primary, secondary, and tertiary—such that it is accessible to all individuals with life-threatening conditions, as part of Universal Health Coverage. This includes ensuring that PC is part of routine clinical services, with adequate policies, training, medicines, and referral systems in place32.

Globally, the need for PC is growing rapidly. According to WHO, more than 56.8 million people require PC each year, including 25.7 million in the last year of life, with nearly 78% of them living in low- and middle-income countries (LMICs) [19]. Despite this need, only about 14% of people who require PC currently receive it, and the majority of the global population does not have access to adequate services due to health system limitations, resource constraints, and low awareness 3.High-income countries have made substantial progress in integrating PC into their health systems, but LMICs face significant structural and systemic challenges.

Technology has emerged as a crucial enabler in improving access to and delivery of healthcare services, including PC. Globally, the use of digital tools such as electronic health records, telemedicine, mobile health applications, and remote monitoring devices has demonstrated potential to enhance communication between providers and patients, improve symptom management, and ensure continuity of care. For instance, digital platforms allow for remote consultations and triaging, especially in resource-constrained or geographically dispersed areas, thereby supporting the integration of PC into routine care and expanding its reach. Moreover, digital innovations support evidence-based decision-making by allowing real-time data collection and analytics [32]

Regionally, Africa carries a significant burden of diseases that require PC, yet access remains alarmingly low. The African PC Association (APCA) estimates that less than 10% of patients who need PC in Africa receive it [3].The continent faces challenges such as limited PC policies, lack of trained professionals, and weak integration into mainstream health services. Nonetheless, countries like Uganda and South Africa have made notable strides by incorporating PC into national health strategies and leveraging technology to extend services to underserved populations 3 .For example, telemedicine platforms have been piloted in Uganda to provide remote support to health workers and caregivers, showcasing the viability of tech-based models for PC delivery.

In Kenya, palliative care (PC) is gaining increasing attention as part of broader health policy reforms. The Kenya Health Policy (2014–2030) recognizes PC as a key service under the essential health packages, and the Ministry of Health (MoH) launched the National Palliative Care Policy in 2021 to support the mainstreaming of PC across all levels of the health system. Despite these policy advancements, there remain significant gaps in service availability. The Kenya Hospices and Palliative Care Association (KEHPCA) estimates that approximately 800,000 Kenyans require palliative care services annually, yet only a small fraction of this population receives adequate care due to a shortage of trained personnel, low public awareness, and limited infrastructural support (KEHPCA, 2021). As of 2024, only 11 out of the 47 county referral hospitals (Level 5 hospitals) have integrated palliative care services, highlighting the urgent need for broader service expansion and investment in PC infrastructure nationwide.

There is increasing recognition that technology can help bridge these gaps by providing platforms for training, remote consultation, patient monitoring, and data collection. However, the adoption of digital technologies in PC in Kenya remains limited and poorly documented. Existing efforts have largely been pilot projects, and little is known about the extent, effectiveness, and barriers of using technology in PC within Level 5 hospitals, which serve as key referral centers in the devolved healthcare system [31].

In light of this, a systematic review examining the role of technology in mainstreaming PC within selected Level 5 hospitals in Kenya is timely and necessary. This review aims to identify digital tools currently in use, evaluate their contribution to PC delivery, and provide evidence-based recommendations to guide policy and practice in the integration of technology into Kenya’s PC services.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

Research Objectives

Broad Objective

To assess the effect of a telemedicine-based intervention on the mainstreaming of PC services among healthcare providers in selected level 5 hospitals.

Specific Objectives

1. To determine individual factors influencing the mainstreaming of PC services among healthcare providers in selected level 5 hospitals
2. To establish the technological factors influencing the mainstreaming of PC services among health providers in selected level 5 Hospitals.
3. To establish the perceptions influencing mainstreaming of PC among health providers in selected level 5 hospitals.
4. To identify health system factors influencing the mainstreaming of PC services among healthcare providers in selected level 5 hospitals.

Research Questions

1. What individual factors influence the mainstreaming of PC services among healthcare providers in selected level 5 hospitals in Kenya?
2. What technological factors influence the mainstreaming of PC services among healthcare providers in selected level 5 hospitals in Kenya?
3. How do healthcare providers' perceptions influence the mainstreaming of PC services in selected level 5 hospitals in Kenya?
4. What is the effect of a telemedicine-based intervention on the mainstreaming of PC services among healthcare providers in selected level 5 hospitals in Kenya?
5. What health system factors influence the mainstreaming of PC services among healthcare providers in selected level 5 hospitals in Kenya?

Research Hypothesis

H_1: Individual factors significantly influence the mainstreaming of PC services among healthcare providers in selected level 5 hospitals in Kenya.

H_2: Technological factors significantly influence the mainstreaming of PC services among healthcare providers in selected level 5 hospitals in Kenya.

H_3: Healthcare providers' positive perceptions and attitudes significantly influence the mainstreaming of PC services in selected level 5 hospitals in Kenya.

H_4: Health system factors significantly influence the mainstreaming of PC services among healthcare providers in selected level 5 hospitals in Kenya.

LITERATURE REVIEW

Palliative care is defined by the World Health Organization (WHO) as an approach that improves the quality of life of patients and their families, facing problems associated with life-threatening illness through the prevention and relief of suffering by means of early identification, impeccable assessment, and treatment of pain and other problems—physical, psychosocial, and spiritual [32, 23]. It is an integral part of Universal Health Coverage (UHC), human rights, and health system strengthening and should be provided at all levels of care and integrated into national health policies and strategies [32]. Mainstreaming PC refers to the integration of PC into all levels of health care—community, primary, secondary, and tertiary—such that it is accessible to all individuals with life-threatening conditions, as part of UHC. This includes ensuring that PC is part of routine clinical services, with adequate policies, training, medicines, and referral systems in place [22].

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

Globally, the need for PC is growing rapidly. According to WHO, more than 56.8 million people require PC each year, including 25.7 million in the last year of life, with nearly 78% of them living in low- and middle-income countries [19]. Despite this need, only about 14% of people who require PC currently receive it, and the majority of the global population does not have access to adequate services due to health system limitations, resource constraints, and low awareness [3]. High-income countries have made substantial progress in integrating PC into their health systems, but LMICs face significant structural and systemic challenges [21].

Technology has emerged as a crucial enabler in improving access to and delivery of healthcare services, including PC. Globally, the use of digital tools such as electronic health records (EHRs), telemedicine, mobile health applications, and remote monitoring devices has demonstrated potential to enhance communication between providers and patients, improve symptom management, and ensure continuity of care [7];[18] . For instance, digital platforms allow for remote consultations and triaging, especially in resource-constrained or geographically dispersed areas, thereby supporting the integration of PC into routine care and expanding its reach [7]; [31]. Moreover, digital innovations support evidence-based decision-making by allowing real-time data collection and analytics [25]; [16].

Regionally, Africa carries a significant burden of diseases that require PC, yet access remains alarmingly low. The African Palliative Care Association (APCA) estimates that less than 10% of patients who need PC in Africa receive it [3]. The continent faces challenges such as limited PC policies, lack of trained professionals, and weak integration into mainstream health services [1];[10]. Nonetheless, countries like Uganda and South Africa have made notable strides by incorporating PC into national health strategies and leveraging technology to extend services to underserved populations[6]; [3]; [20]. For example, telemedicine platforms have been piloted in Uganda to provide remote support to health workers and caregivers, showcasing the viability of tech-based models for PC delivery [3]; [9].

In Kenya, PC is gaining increasing attention as part of the broader health policy reforms. The Kenya Health Policy (2014–2030) recognizes PC as a key service under essential health packages, and the Ministry of Health (MoH) launched the National PC Policy in 2021 to support mainstreaming of PC across all levels of the health system. Despite these advancements, there remain significant gaps in service availability, with only about 7 out of 47 county referral hospitals (Level 5 hospitals) having some form of established PC unit [11]. The Kenya Hospices and Palliative Care Association (KEHPCA) estimates that nearly 250,000 Kenyans need PC services annually, but most do not receive adequate care due to lack of trained personnel, low public awareness, and limited infrastructural support [5]; [4].

There is increasing recognition that technology can help bridge these gaps by providing platforms for training, remote consultation, patient monitoring, and data collection [25, 26]. However, the adoption of digital technologies in PC in Kenya remains limited and poorly documented [13, 45]. Existing efforts have largely been pilot projects, and little is known about the extent, effectiveness, and barriers of using technology in PC within Level 5 hospitals, which serve as key referral centers in the devolved healthcare system [15].

In light of this, a systematic review examining the role of technology in mainstreaming PC within selected Level 5 hospitals in Kenya is timely and necessary. This review aims to identify digital tools currently in use, evaluate their contribution to PC delivery, and provide evidence-based recommendations to guide policy and practice in the integration of technology into Kenya's PC services.

Comparative of Palliative Care in Kenya and Other LMICs

Understanding the similarities and distinctions between palliative care practices in Kenya and other LMICs is crucial in contextualizing the role of digital interventions. Many LMICs share common systemic challenges such as resource constraints, workforce shortages, and fragmented care systems [1]; [3]. However, the extent of integration of palliative care into national policies, as well as the degree of adoption of digital health technologies, varies significantly [26,25].

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

Palliative Care in Other LMICs

Several LMICs have made varying degrees of progress in integrating PC into their health systems, with notable examples including Uganda and India, where national policies support community-based and hospital-linked PC programs [6, 3]. These countries have leveraged public-private partnerships and donor funding to pilot and scale telehealth and mHealth solutions [7, 9]. In contrast, many LMICs still lack comprehensive PC strategies, and digital interventions are often fragmented or restricted to pilot phases without sustained institutional support [1]. This variability affects the scalability and long-term impact of technology in PC delivery across these settings.

In Kenya, PC services are unevenly distributed between urban and rural areas [11]. Urban Level 5 hospitals such as those in Nairobi, Kisumu, and Mombasa benefit from better infrastructure, including more reliable electricity, internet connectivity, and availability of digital devices. These factors facilitate the deployment of telemedicine, EHRs, and mobile applications [7]. In contrast, rural hospitals struggle with infrastructural deficiencies and staffing limitations, making it difficult to integrate and sustain digital PC interventions [26, 5]. Cultural misconceptions about PC, low literacy levels, and a lack of community-based support services further exacerbate disparities in rural access [27, 28]. As such, national strategies must prioritize equity in digital health investment to ensure rural populations benefit from emerging PC technologies [21].

Palliative Care in Rural and Urban Kenya

Kenya presents a unique internal contrast in the delivery of PC, particularly when comparing urban and rural settings. In urban areas such as Nairobi, Kisumu, and Mombasa, Level 5 hospitals benefit from relatively well-developed infrastructure, including stable electricity, internet connectivity, and access to digital devices [11]. These facilities are better positioned to adopt telemedicine platforms, integrate EHRs, and implement mHealth applications [7, 19]. Additionally, urban centers often have more trained personnel and institutional support to facilitate digital health interventions [29, 16].

In contrast, rural areas face pronounced challenges that hinder the integration of technology into PC. Poor internet connectivity, unreliable electricity supply, and limited digital literacy among both patients and providers reduce the feasibility of using digital tools [18]. Furthermore, rural health facilities are often understaffed, with limited exposure to specialized palliative care training or resources [15, 23]. Cultural misconceptions about PC, combined with lower health-seeking behavior, further complicate adoption efforts [27, 4].These disparities underscore the urgent need for tailored interventions and equitable resource allocation to bridge the digital divide and ensure rural populations are not left behind in Kenya's digital health transformation [21].

Meaning of the Study

This study provides critical insights into the evolving role of digital technology in mainstreaming PC within Kenya's Level 5 hospitals and comparable LMIC settings. By synthesizing data from diverse studies, it underscores both the potential and limitations of integrating digital health tools such as telemedicine, mHealth, and EHRs into resource-constrained health systems [7]. The findings affirm that while technology can bridge critical gaps in access and quality of care, its success is contingent upon addressing systemic barriers including infrastructure, training, cultural relevance, and long-term sustainability [1]. This review also emphasizes the need for context-sensitive implementation strategies that align digital innovation with health policy, community engagement, and capacity building to enhance PC services at all levels of the healthcare system [26].

Cost Effectiveness Discussion

Cost-effectiveness is a vital factor in assessing the scalability of digital health technologies in PC, especially in low-resource environments like Kenya. For example, implementing a full telemedicine setup in a rural health facility costs approximately KES 2.4 million to 6 million, with annual maintenance averaging KES 120,000 to 600,000 depending on usage and system complexity[26].

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

mHealth solutions, particularly SMS-based or basic mobile applications, are notably economical. Setting up a mobile EMR system can cost around KES 70,000 per clinic, with monthly maintenance fees of about KES 7,000. These tools are easy to deploy and maintain, making them well-suited for rural settings. Their low cost and flexibility contribute to strong user uptake and consistent engagement when well-integrated into care plans [18].

For larger facilities, the deployment of national electronic medical record in Kenya (KenyaEMR) or similar EHR systems can require a one-time investment of approximately KES 1.4 million per site. However, in facilities with over 700 patients, this cost falls below KES 2,800 per patient—highlighting the potential for economies of scale. Human resource support, travel for training, and ongoing technical assistance account for the bulk of operational expenses.

Despite initial capital demands, the long-term return on investment for digital tools in palliative care is promising, particularly when aligned with national health policy and institutional commitment[25]. However, sustainability remains a challenge where donor dependence limits program longevity [26].

Long-Term Cost Projections and Financial Modeling

Long-term financial modeling suggests that although the upfront costs of implementing digital health technologies in PC may appear high, they are offset by substantial savings over time[26]. For example, investment in telemedicine infrastructure—costing approximately KES 2.4 million to 6 million per site—yields reductions in recurring travel expenses, unnecessary referrals, and preventable hospital admissions.

Over a five-year period, facilities using telemedicine can save over KES 30 million in cumulative costs associated with provider transport and time efficiency, especially in remote regions. Similarly, mHealth platforms require relatively low maintenance costs (KES 7,000 per month per clinic) yet contribute to improved patient monitoring and adherence, which reduces emergency interventions [18]. EHR systems like KenyaEMR, with average implementation costs of KES 1.4 million per facility, show cost-efficiency improvements as patient volumes increase. When modeled at scale, facilities serving over 700 patients demonstrate per capita costs as low as KES 2,800, making EHRs economically viable in high-volume settings.

Financial sustainability hinges on the integration of these technologies into national and county health budgets. Modeling indicates that consistent investment in digital infrastructure can reduce total system burden by streamlining workflows and enhancing data-driven resource allocation. Therefore, long-term planning and financial commitment from both government and partners are critical for sustaining digital health gains in PC [26].

Health Regulations in Kenya and Global Comparisons

Kenya has made significant legislative progress in regulating digital health. The Health Act of 2017 laid the groundwork for health system coordination across national and county levels. More recently, the Digital Health Act No. 15 of 2023 aimed to establish a unified governance framework for digital health services. It created the Digital Health Agency to oversee implementation, ensure data security, and standardize practices. However, in July 2024, the Kenyan High Court ruled the Act unconstitutional due to inadequate public participation, highlighting the importance of inclusive policymaking [3].

Globally, countries are aligning their digital health strategies with frameworks such as the WHO Global Strategy on Digital Health 2020–2025 [24]. This strategy emphasizes integration, equity, and innovation in health services. In regions like the European Union, regulations such as the Digital Services Act and the European Health Data Space aim to standardize practices and protect patient data. These global models underscore the need for Kenya to align its regulatory landscape with international best practices to ensure secure, efficient, and interoperable digital health systems.

For PC, these regulations are particularly impactful. Standardized digital practices enhance service delivery by supporting remote consultations, secure data sharing, and continuity of care [7]. However, legal and

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

institutional uncertainties must be addressed to safeguard progress and foster trust in digital health platforms [25].

Scaling Strategies for Palliative Care in LMICs

Scaling digital health solutions for PC in LMICs requires a context-sensitive, stepwise approach that recognizes the unique systemic constraints and opportunities within these settings [3]. Integration into national health systems should begin by aligning digital tools with local clinical workflows and priorities. For example, embedding platforms such as KenyaEMR in district hospitals and training staff ensures that digital PC solutions are relevant and usable from the ground up[3].

Capacity building is critical and should include both pre-service and in-service training for healthcare workers in digital health competencies and PC principles [14]. Strengthening community health systems through task-shifting and digital toolkits can expand PC outreach, especially in underserved areas [10]. Investment in low-cost, scalable infrastructure (such as solar-powered internet and mobile platforms) also supports broader[3].

Scaling should be phased—starting with pilot projects in diverse regions (urban, rural, peri-urban), followed by iterative refinement, evaluation, and eventual expansion [26]. Local innovation hubs and academic partnerships can play a pivotal role in co-developing and evaluating scalable digital PC models [22].

At the policy level, integrating PC within national digital health strategies, ensuring stable funding channels, and incentivizing public-private partnerships are vital [26]. Engaging stakeholders—including patients, providers, and civil society—ensures that solutions are inclusive, acceptable, and sustainable [2]. Data from monitoring systems should feed back into policy and program adaptation to support continuous quality improvement [17].

At the policy level, incorporating digital palliative care strategies into county health implementation plans and leveraging community health units for outreach can facilitate equitable access [3]. Incentivizing digital innovation and interoperability across counties will also support long-term integration. Monitoring, evaluation, and iterative improvements based on patient and provider feedback are key to ensuring that scaling efforts lead to improved quality, access, and sustainability of palliative care services [8].

Unanswered questions and future research

Despite growing evidence on the role of digital health in PC, several critical gaps remain. Few studies have evaluated the long-term clinical outcomes of digital interventions on patient quality of life, symptom management, or caregiver support in LMIC contexts. There is also limited research on the cost-effectiveness of digital platforms across different population segments and care settings, particularly in rural areas. Moreover, the ethical and cultural implications of using technology in end-of-life care have not been sufficiently explored, especially with regard to informed consent, data security, and spiritual care needs.

Future research should focus on longitudinal studies that measure patient-centered outcomes, integration strategies across various health system levels, and the impact of digital tools on health equity. Additionally, implementation science approaches are needed to examine the scalability, sustainability, and real-world adaptability of digital PC models. Interdisciplinary research that incorporates perspectives from technology developers, clinicians, policy-makers, and community stakeholders will be vital in co-designing solutions that are effective, ethical, and context-appropriate.

Limitations

While this systematic review provides a comprehensive synthesis of the current landscape of digital technology in PC across LMICs, particularly Kenya, certain limitations must be acknowledged. First, the review was limited to English-language studies, which may have excluded relevant research published in other languages. Second, the reliance on available literature may have led to publication bias, as donor-funded or pilot studies with positive outcomes are more likely to be published than those reporting failures or challenges.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

Additionally, the review covered publications from 2020 to 2025, which may have excluded earlier foundational studies or the most recent innovations not yet indexed.

Moreover, heterogeneity in study design, populations, and outcome measures limited comparability and prevented meta-analysis. Some studies lacked rigorous methodology or sufficient sample sizes, leading to varying levels of bias. Finally, due to the scope and time constraints, this review may not fully reflect the rapidly evolving nature of digital health interventions in real-time healthcare environments.

METHODOLOGY

Study Design and Setting

This review followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency, replicability, and methodological rigor[24]. The review was designed to synthesize qualitative, quantitative, and mixed-methods studies that report on the application and impact of technology in the delivery of palliative care services. The focus was on empirical studies, program evaluations, and grey literature (including government and NGO reports) published between 2020 and 2025. The rationale for this period was to capture recent advancements in digital health aligned with Kenya's policy push towards UHC and the implementation of its NPCP [3].

The study design employed a structured and iterative screening process. Initially, titles and abstracts were assessed for relevance, followed by full-text reviews to determine eligibility based on pre-specified inclusion and exclusion criteria. The review was exploratory and thematic in nature, allowing for the identification of trends, patterns, and gaps in the deployment of digital tools in PC across LMICs, with a particular emphasis on Kenyan Level 5 hospitals [3]

In addition to academic articles, grey literature was included to ensure comprehensive coverage of ongoing pilot programs, donor-funded projects, and unpublished evaluations that are often absent from indexed databases [26]; [25]. The use of diverse data sources was essential in reflecting the real-world challenges and innovations in integrating technology into PC delivery in resource-limited settings [1, 7].

Participants and Materials

The participants in the studies reviewed comprised a wide range of stakeholders involved in the delivery or receipt of PC services. These included healthcare providers such as physicians, nurses, and clinical officers working in public hospitals—particularly Level 5 referral hospitals in Kenya—as well as palliative care patients and their family caregivers. Some studies also included policy-makers, IT specialists, and program implementers who played key roles in deploying and managing digital health tools.

The materials and tools used in the reviewed studies varied depending on the technological intervention being assessed. These included teleconsultation platforms, mobile health applications, EHR systems, digital symptom trackers, e-learning modules, and SMS-based communication tools. In studies assessing training interventions, educational content and learning management systems were part of the digital materials examined. Collectively, these materials reflected the breadth of technology-enabled strategies being implemented or piloted to improve access to and the quality of palliative care in Kenya and similar LMIC settings.

Interventions and Comparisons

The interventions examined across the reviewed studies were primarily focused on the application of digital technologies to enhance various aspects of PC delivery. These included telemedicine platforms used for virtual consultations between patients and healthcare providers, mHealth applications that facilitated symptom tracking and medication reminders, EHRs that improved documentation and coordination of care, and e-learning platforms used to train healthcare workers in palliative care principles [16]; [31]. Some interventions also included SMS-based communication systems designed to improve patient follow-up and engagement, particularly in rural or underserved areas [9]; [28].

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

Comparative elements within the studies often involved assessing outcomes between intervention groups using digital tools and control or baseline conditions where such technologies were absent. For instance, several studies compared provider confidence, patient satisfaction, or care continuity in settings where telehealth services were introduced versus traditional face-to-face models [12]; [7]. Others contrasted patient outcomes before and after the implementation of mHealth solutions, highlighting differences in symptom management and access to care [19]; [18]. While not all studies included direct comparators, many presented pre and post-intervention analyses that helped establish the added value of technology in palliative care delivery in LMIC contexts like Kenya.

Data Sources and Search Strategy

A comprehensive search strategy was developed to capture a wide range of relevant literature. The electronic databases searched included PubMed, Scopus, Google Scholar, and African Journals Online (AJOL), which together cover a substantial proportion of global and African health research publications. The search terms were selected to reflect the core focus areas of the review and included: "palliative care," "telemedicine," "digital health," "technology in healthcare," "mHealth," "electronic health records," "Kenya," "Level 5 hospitals," and "low-resource settings." Boolean operators (AND, OR) and truncation symbols were applied to maximize search sensitivity and retrieve studies that used varied terminologies for similar concepts.

Manual screening of reference lists of selected articles was also conducted to identify additional studies that might not have been captured during the initial search. All citations were exported into a reference management tool, and duplicates were removed prior to screening. The search process was iterative, and adjustments were made based on the relevance and volume of results obtained.

Data Extraction and Analysis

A structured data extraction template was used to capture key elements from each selected study. These elements included the study setting (country and healthcare level), the type of digital intervention deployed (e.g., telemedicine, mHealth, EHRs), targeted population (e.g., healthcare providers, patients, caregivers), reported outcomes (e.g., symptom relief, provider satisfaction, access improvement), and implementation challenges (e.g., infrastructure, cultural barriers, training gaps). Where applicable, the scalability and sustainability of the interventions were also documented.

Following data extraction, a narrative synthesis approach was adopted. This method was chosen due to the heterogeneity of study designs, outcomes, and contexts, which made meta-analysis impractical. The findings were analyzed thematically, allowing for the clustering of insights according to major technology categories (e.g., telehealth, mobile applications, digital training tools) and cross-cutting implementation themes (e.g., digital literacy, policy alignment, infrastructural readiness).

Risk of Bias Assessment

A thorough risk of bias assessment was carried out to evaluate the quality and reliability of this systematic review, which explored how technology is being used to support palliative care in Kenya’s Level 5 hospitals. Overall, the review followed a sound methodology, aligning with PRISMA guidelines and including a diverse mix of study designs. That said, the analysis revealed some important variations in bias across several key areas.

First, confounding was initially identified as a serious risk, as some studies did not fully account for external factors such as differences in infrastructure between urban and rural hospitals or varying levels of digital literacy among users. However, several measures were taken across the reviewed studies to mitigate this risk. Many studies employed random stratified analyses based on geographic or facility-level characteristics, while others used purposive sampling to ensure representation from diverse settings. Additionally, some studies incorporated mixed-methods approaches or triangulated data sources to contextualize findings and isolate the effects of technological interventions. These efforts helped reduce the influence of confounding variables and strengthened the validity of the reported outcomes. Missing data emerged as a moderate risk, particularly in

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

studies conducted in under-resourced or rural settings, where follow-up was sometimes incomplete. While this didn't drastically affect the overall findings, it did reduce the strength of evidence in some areas. However, reporting bias was rated as moderate. Several studies were donor-funded pilot projects, which may have been more likely to highlight positive results. This raises the possibility of selective reporting, especially since fewer studies reported neutral or negative outcomes.

Selection bias was assessed as low risk. The use of both peer-reviewed articles and grey literature helped ensure a wide and representative range of studies were considered. Classification bias was also low. The types of digital interventions—such as telemedicine, mHealth, EHRs, and digital training tools—were clearly defined and appropriately grouped, making it easier to analyze the findings in a meaningful way. For deviations from intended interventions, the risk remained low. Most studies implemented the digital tools as planned, and any changes along the way were generally reported and factored into the analysis. When it came to measurement bias, the risk was low. Most studies used appropriate and validated tools to measure outcomes, and many enhanced reliabilities through methods like triangulation.

To assess the overall risk of bias in the included studies, each bias domain was evaluated and scored based on the level of risk observed. A scoring system was applied as follows: domains rated as low risk were assigned a score of 1, those with moderate risk received a score of 2, and those with serious risk were scored as 3. The total scores across all bias domains were then summed and divided by the total number of domains (in this case, seven) to compute the average risk score.

In the current review, confounding was identified as having a serious risk and scored 3. Missing data and reporting bias were rated as moderate risks, each scoring 2. The remaining domains—selection bias, classification bias, deviations from intended interventions, and measurement bias—were assessed as low risk, each scoring 1.

The total score was calculated as:

3 (confounding) + 2 (missing data) + 2 (reporting bias) + 1 (selection bias) + 1 (classification bias) + 1 (deviations) + 1 (measurement bias) = 11. Dividing this sum by the number of domains (7) gives an average risk score of 1.57. Based on this scoring system, an average below 2 indicates a low overall risk of bias, supporting the reliability and validity of the findings in this systematic review.

The overall risk of bias in the included studies was assessed as low, with an average risk score of 1.57 across seven domains. While moderate risks were identified for missing data and reporting bias—particularly in studies from rural settings and donor-funded projects—these did not significantly undermine the findings. Confounding was a more serious concern in some studies due to variations in infrastructure and digital literacy, but many addressed this through stratified analyses, purposive sampling, and data triangulation. Other domains, including selection bias, classification bias, deviations from intended interventions, and measurement bias, were consistently rated as low risk. Overall, the review demonstrates strong methodological quality, supporting the reliability and validity of its conclusions.

Inclusion and Exclusion Criteria

To ensure that this systematic review comprehensively addressed its research objectives with methodological rigor and relevance, specific inclusion and exclusion criteria were applied. Included studies were those that examined the use of digital or technology-enabled interventions to support or enhance PC. Only studies conducted within Kenya or other LMICs with comparable healthcare systems were considered, to ensure contextual relevance to the Kenyan healthcare environment. The review focused on empirical studies—qualitative, quantitative, or mixed-methods—that provided data on implementation, outcomes, or stakeholder experiences related to palliative care technologies.

In order to maintain contemporary relevance and align with KNPCP and digital health strategies, the publication timeframe was limited to studies published between 2020 and 2025. Studies were further filtered to include only those published in English, and which had been sourced from peer-reviewed journals with a high

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

impact factor or from reputable grey literature sources such as government reports, NGO publications, or institutional program evaluations. To ensure academic significance, peer-reviewed studies were required to have at least 30 citations, reflecting their influence and recognition within the field. Exceptions were made for grey literature, which was included based on quality and relevance even if citation counts were lower.

Studies were excluded if they focused solely on high-income countries, as the infrastructure and health system dynamics in such contexts are not directly transferable to LMIC settings like Kenya. Additionally, articles that reported on digital health interventions not related to palliative care were excluded, as were papers that lacked empirical data, including opinion pieces, editorials, theoretical discussions, and non-systematic reviews. Publications falling outside the defined timeframe (i.e., prior to 2020 or beyond 2025) were not considered. Moreover, studies with fewer than 30 citations were excluded unless they were categorized as high-quality grey literature. Finally, studies published in low-impact or non-peer-reviewed sources without verifiable academic standards were also omitted to maintain the integrity and reliability of the review.

Power calculation

As this was a systematic review synthesizing existing studies, a formal power calculation was not applicable. Power calculations are typically conducted in primary research to determine appropriate sample sizes. However, several included studies reported small sample sizes and short follow-up periods, which may limit the strength and generalizability of their findings. Future primary studies should incorporate power calculations to ensure statistically robust results.

Presentation Of Data

Bias Domain	**Low Risk(1)**	**Moderate Risk(2)**	**Severe Risk(3)**
Confounding			X
Selection Bias	X		
Classification Bias	X		
Deviations from Intended Interventions	X		
Missing Data		X	
Measurement Bias	X		
Reporting Bias		X	

DISCUSSION

The final review included 32 studies that met the eligibility criteria. Of these, 14 studies (44%) were conducted specifically in Kenya, while the remaining 18 studies (56%) originated from other LMICs with comparable health system structures and challenges. In terms of methodology, the studies comprised 13 qualitative studies (41%), 11 quantitative studies (34%), and 8 mixed-methods studies (25%). Peer-reviewed journal articles accounted for 69% of the included studies, while the remaining 31% consisted of high-quality grey literature such as government policy reports, NGO program evaluations, and institutional research briefs.

Across the 32 studies, four main categories of digital interventions were identified. Telemedicine platforms were the most frequently evaluated, appearing in 15 studies (47%) and commonly cited for enhancing provider-patient communication, overcoming geographic barriers, and enabling continuous patient monitoring mHealth applications featured in 13 studies (41%), supporting functions such as symptom tracking, medication adherence, and remote health education. EHRs were assessed in 10 studies (31%), primarily linked to improved documentation, coordination of care, and workflow efficiency. Additionally, digital training tools, such as e-learning platforms and virtual modules, were evaluated in 9 studies (28%), aimed at strengthening the capacity of healthcare workers in delivering palliative care services.

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Despite the positive impact of these technologies, several recurring barriers were noted. Infrastructure limitations—including inconsistent internet access, unstable electricity, and inadequate digital equipment—were reported in 22 studies (69%), especially in rural or underserved regions. Gaps in digital literacy, affecting both providers and patients, were mentioned in 17 studies (53%). Cultural resistance to the use of technology in PC, particularly in end-of-life scenarios, was highlighted in 11 studies (34%), underscoring the need for culturally sensitive implementation strategies. Sustainability concerns, especially where digital health projects were donor-funded without long-term integration plans, were evident in 19 studies (59%).

Overall, the findings point to growing momentum in the use of digital health interventions to support PC across Kenya and other LMICs. The most effective programs were those that combined technological innovation with supportive infrastructure, user training, community engagement, and policy alignment. These integrated approaches demonstrated higher potential for scale-up, sustainability, and seamless integration into existing healthcare systems, particularly within Level 5 hospitals.

Frequency Table of Key Variables (n = 32 studies)

Variable	Frequency	Percentage (%)
Country Focus		
Studies in Kenya	14	44%
Studies in other LMICs	18	56%
Methodology		
Qualitative	13	41%
Quantitative	11	34%
Mixed Methods	8	25%
Publication Type		
Peer-reviewed articles	22	69%
Grey literature	10	31%
Digital Intervention Type		
Telemedicine	15	47%
mHealth	13	41%
Electronic Health Records (EHRs)	10	31%
Digital Training Tools	9	28%
Identified Barriers		
Infrastructure Limitations	22	69%
Digital Literacy Gaps	17	53%
Cultural Resistance	11	34%
Sustainability Issues	19	59%

Descriptive Statistics of Digital Intervention Frequencies

(For: Telemedicine, mHealth, EHRs, Training Tools)

Category	Frequency
Telemedicine	15
mHealth	13

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

EHRs	10
Training Tools	9

Calculations:

- Mean = (15 + 13 + 10 + 9) / 4 = 11.75
- Standard Deviation (SD) ≈ 2.63
- Variance ≈ 6.92
- Coefficient of Variation (CV) = (SD / Mean) × 100 ≈ 22.4%

Statement of Principle findings

This review found that telemedicine (47%) and mHealth tools (41%) were the most widely applied digital interventions supporting PC delivery across the 32 studies reviewed. These technologies were consistently associated with enhanced access to care, improved communication between providers and patients, and greater continuity of services. EHRs (31%) were linked to better documentation and coordination of care, while digital training modules (28%) addressed critical knowledge gaps among healthcare professionals. Despite these benefits, several challenges remain: infrastructure limitations were reported in 69% of the studies, digital literacy gaps in 53%, cultural resistance in 34%, and sustainability and funding issues in 59%. These findings highlight the importance of integrated strategies that address not only the deployment of digital tools but also the broader contextual barriers to effective PC implementation in LMIC settings.

Strengths and weakness of the study

One of the major strengths of this review is the comprehensive and systematic search strategy that included both peer-reviewed and grey literature sources, thereby maximizing the scope and relevance of the evidence reviewed. The adherence to PRISMA guidelines ensured methodological rigor and transparency. Additionally, the inclusion of diverse study designs—qualitative, quantitative, and mixed methods—allowed for a richer, multi-dimensional analysis of technological interventions in PC.

However, this review also had some limitations. The heterogeneity in study designs and outcomes limited the ability to conduct a meta-analysis or apply uniform outcome measures across studies. The review was restricted to English-language publications, which may have led to the exclusion of valuable data published in other languages. Furthermore, some included studies had moderate to high risk of bias, which may affect the reliability of certain findings. Finally, by limiting the timeframe to 2020–2024, the review may have missed earlier pioneering interventions or the most recent unpublished innovations.

Strengths and weakness of other studies

The 32 studies reviewed demonstrated several notable strengths that enhanced the overall quality of evidence. Many employed rigorous methodologies, with approximately 50% rated as having a low risk of bias due to clearly defined research objectives, robust data collection methods, and transparent reporting. Studies utilizing mixed-methods approaches offered deeper insights by triangulating qualitative and quantitative findings, while several others effectively contextualized their results within the specific sociocultural and infrastructural realities of LMICs, enhancing their relevance to the Kenyan healthcare setting.

However, common limitations were observed across the literature. Roughly 38% of the studies were classified as having a moderate risk of bias, often due to small sample sizes, ambiguous participant selection, or limited follow-up periods. An additional 12% of studies were deemed high risk, largely due to insufficient detail in data analysis or overreliance on donor funding without clear sustainability plans. Furthermore, the lack of standardized outcome measures made cross-study comparisons difficult. Several studies also lacked

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

disaggregated data, which hindered a nuanced understanding of technology's impact on specific subgroups such as children, rural populations, or caregivers.

Discussion of important differences in results

While most studies agreed on the benefits of telemedicine and mHealth in PC, differences in outcomes were evident based on setting and scale. For instance, urban-based studies tended to report more favorable outcomes due to better infrastructure, while rural settings highlighted more significant implementation challenges, such as unreliable internet and electricity. Some studies conducted in Kenya emphasized government support and integration with national strategies, which contributed to improved uptake, unlike studies from other LMICs where digital health tools remained in pilot phases. Additionally, variations existed in reported user satisfaction and provider engagement, likely influenced by training levels, cultural context, and literacy rates. These differences underscore the importance of local adaptation and stakeholder engagement when implementing digital solutions in PC.

CONCLUSION

This review highlights the transformative potential of digital health technologies in mainstreaming PC across LMICs, with Kenya serving as a focal example. Telemedicine, mHealth applications, and EHR have shown clear benefits in enhancing access, improving care coordination, and expanding the reach of palliative services. However, the review also underscores significant barriers—ranging from infrastructure deficits and digital illiteracy to regulatory uncertainty and limited funding—that must be addressed to achieve sustainable implementation.

To maximize the impact of digital tools, efforts should prioritize integration into existing health systems, contextual adaptation for rural and underserved populations, and alignment with national policies. Continued research, multi-sectoral partnerships, and investment in capacity building will be essential to scale and sustain digital PC interventions. Ultimately, a coordinated and inclusive approach is needed to ensure that technology serves as a bridge rather than a barrier to compassionate, equitable, and accessible end-of-life care. The following clarification are on the role of digital technologies in advancing access to and the scale of palliative care to clients:

- Digital technologies such as telemedicine, mHealth, and EHRs are recognized as essential in improving healthcare delivery, especially in LMICs [7]; [32].
- These tools are already widely used in high-income settings to enhance care access, continuity, and efficiency[31].
- In PC, they support remote monitoring, reduce hospital visits, and enable team-based care [31].
- Kenya has national policies acknowledging the role of PC, but implementation of digital solutions is inconsistent, particularly in rural areas[3].
- Gaps in infrastructure, training, and funding remain key barriers to full-scale adoption in LMICs[3].

This study recommends the following digitization role for palliative care from the most recent and comprehensive synthesis of digital health interventions in PC across LMICs, with a focused analysis on Kenya’s Level 5 hospitals by incorporating findings from studies published between 2020 and 2025, aligning with the latest national policy and digital health developments:

- It identifies the adoption rates and specific applications of key technologies telemedicine (47%), mHealth (41%), EHRs (31%), and digital training tools (28%), highlighting how these tools are used to enhance access, communication, documentation, and provider training.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI | Volume XII Issue XV June 2025 | Special Issue on Public Health

- The review analyzes contextual factors that influence digital health adoption, including infrastructural limitations (69%), digital literacy gaps (53%), cultural resistance (34%), and sustainability issues (59%). It underscores the need for context-sensitive, equitable, and policy-aligned implementation strategies.
- The study contributes detailed financial data, illustrating how digital interventions—particularly telemedicine and mHealth—can offer long-term savings through reduced travel, improved efficiency, and scalable implementation in both rural and urban settings.
- It offers evidence-based, practical recommendations for scaling digital palliative care, emphasizing phased rollouts, community engagement, capacity building, and integration into national and county health systems.
- The review outlines key regulatory developments in Kenya, including the now-overturned Digital Health Act of 2023, and compares them with global best practices (e.g., WHO and EU frameworks), highlighting the need for coherent and inclusive digital health governance.

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