Journal of Advanced Nursing

WILEY

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Targeted Digital Health Intervention in End-of-Life and Hospice Care: A Scoping Review

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Received: 14 August 2024 | **Revised:** 12 December 2024 | **Accepted:** 18 December 2024

Funding: This study was supported by the Mo-Im Kim Nursing Research Institute, College of Nursing, Yonsei University, Seoul, South Korea (Grant number: 6-2022-0153) and partially supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (Grant number: RS-2024-00352980) and this research was supported by the Brain Korea 21 FOUR Project, funded by the National Research Foundation (NRF) of Korea, Yonsei University College of Nursing.

Keywords: digital health | end-of-life care | hospice care | scoping review | terminal care

ABSTRACT

Aim: Digital health interventions, including health analytics, telehealth, mHealth and digitised healthcare systems, are rapidly advancing and demonstrate effectiveness in palliative care. Although end-of-life (EOL) and hospice care are within palliative care, they differ in outcomes, target populations and delivery systems. This review examines research trends to guide digital health strategies for EOL and hospice care.

Design: Scoping review.

Data Sources: Systematic searches in CINAHL, MEDLINE, SCOPUS, EMBASE, Cochrane and Web of Science identified studies from 2019 to 2023 using keywords 'end of life', 'hospice' and 'digital health'.

Methods: Following the Joanna Briggs Institute framework, two reviewers independently screened studies, extracted data and categorised health challenges and digital health types per World Health Organization and Deloitte classifications.

Results: Among 4342 studies, 38 met the inclusion criteria. Most were retrospective (36.8%) without control groups (68.3%). Key targets included healthcare systems (44.2%) and patients (25.6%), focusing on health analytics (44.7%) and mHealth (23.7%) for EOL transitions and symptom management. Main challenges included utilisation (34.9%), efficiency (32.6%) and quality (30.2%).

Conclusion: Digital health interventions hold potential for enhancing EOL and hospice care but face challenges such as study design limitations, appropriate modality selection, rapport-building and risks of exacerbating health inequalities. Future interventions should emphasise human-centred digital capabilities for healthcare providers and user-centred designs.

Impact: This review highlights opportunities for digital health to improve quality of life for EOL and hospice patients and caregivers. The insights provide guidance for applying digital health interventions in different settings and highlight the importance of equipping healthcare providers with human-centred digital competencies.

Reporting Method: The reporting was guided by the PRISMA extension for scoping reviews (PRISMA-ScR).

Patient or Public Contribution: No patient or public contribution.

Summary

- What does this paper contribute to the wider global clinical community?
  - Digital health interventions tailored to individual needs improve patient outcomes and quality of life in end-of-life and hospice care.
  - Digital health interventions must consider digital determinants and diverse user characteristics to ensure inclusivity, accessibility and equitable healthcare access for all patients, aligning with global health priorities.
  - Study identifies digital health competencies for healthcare providers in end-of-life and hospice care, informing education and training to develop a skilled workforce capable of maximising digital health benefits for patient care and caregiver support.

1 | Introduction

Recently, digital technologies have been developed and implemented to improve health outcomes and achieve affordable and universal coverage (World Health Organization 2021). Digital health refers to the integration of digital technologies into healthcare and includes mobile health (mHealth), health information technology, wearable devices, telemedicine, telehealth and personalised medicine (US Food and Drug Administration 2020). It is actively used for diagnosis and predictive analytics, optimisation of healthcare systems and treatment outcomes, as well as for direct use by patients with cancer or other chronic diseases. The result is often an improvement in quality and a reduction in the costs of healthcare (National Academies of Sciences, Engineering, and Medicine et al. 2021). Digital health can be divided into telehealth, mHealth, health analytics and digitised health systems categories (Monitor Deloitte 2015). Digital health intervention usage has accelerated since the COVID-19 pandemic (Peek, Sujan, and Scott 2020), suggesting that understanding the interventions is essential. More recently, to ensure the safe and systematic use of an exponentially growing number of digital health technologies, the World Health Organization (WHO) has outlined health system challenges, appropriate digital health interventions and useful strategies (World Health Organization 2023).

End-of-life (EOL) refers to the final period of a patient's life. Hospice care for individuals at EOL and their family is focused on managing medical, psychological, social, cultural and spiritual issues (National Cancer Institute 2021). EOL and hospice care are part of the continuum of palliative care which starts at the diagnosis of serious and chronic illness. Hospice provides special care for people who are nearing EOL and have stopped treatment to cure or control their illness (National Cancer Institute 2024). Common considerations for hospice for patients at EOL are functional independence, pain and symptom management and a focus on spending quality time with friends and family (Currow, Agar, and Phillips 2020). It is these specific characteristics that distinguish EOL and hospice from palliative care which focuses on optimal functioning, pain and symptom management, attention to psychological, social, spiritual and cultural aspects of the illness and treatment beginning at diagnosis.

2 | The Review

Previous studies (Escriva Boulley et al. 2018; Marthick et al. 2021) have demonstrated that digital health interventions are effective in treating anxiety, depression, pain and cognitive function. Studies have been conducted on the effectiveness of digital health interventions and the strategies for their implementation in patients receiving palliative care (Ingle et al. 2021; Lally et al. 2021; Stockdill et al. 2021; Webb et al. 2021). In addition, digital health interventions have proven useful in delivering care to patients, irrespective of where they lived (Crawford and Serhal 2020). Research on artificial intelligence and digital health interventions demonstrates their potential to improve primary healthcare delivery and access, especially in resource-poor settings (Saif-Ur-Rahman et al. 2023). Choi and Lin (2023) explore the potential of digital health technologies in addressing health equity gaps in palliative care, emphasising their ability to improve accessibility and personalise care. As EOL and hospice care transitions from hospitals to homes—where approximately 25% of deaths now occur (Teno et al. 2018)—digital health might be valuable in supporting patients and caregivers at home. Current EOL and hospice care actively incorporates digital health interventions, including videoconferencing and telephone communication between healthcare providers (HCPs) and caregivers (Middleton-Green et al. 2019) and self-guided virtual reality interventions for pain management (Guenther et al. 2022). 'Self-guided' refers to interventions used independently by patients, without the direct supervision or support of healthcare professionals (Torok et al. 2020). However, identifying interventions that are specifically useful for and used by patients receiving EOL and hospice care, which have different care goals than palliative care, is difficult because of the lack of focused review studies.

3 | Aim

This study aimed to identify recent research trends in the use of digital health interventions in patients receiving EOL and hospice care. The findings will help build strategies to ensure that patients receiving EOL and hospice care have appropriate support for their physical, psychological, social, cultural and spiritual needs, which will ultimately improve the quality of EOL and hospice care.

To elucidate the characteristics of digital health interventions in EOL and hospice care, we posed the following research questions: (1) What were the trends in digital health interventions in EOL and hospice care over the past 5 years? (2) What were the targets of the digital health interventions, and what were the overarching objectives of the studies? (3) What types of digital health interventions, along with their barriers, facilitators, intervention methodologies and outcome measures, were employed in relevant research? (4) To what extent does the current research cover the domains of the WHO's health system challenges?

4 | Methods

4.1 | Design

This scoping review was conducted according to the Joanna Briggs Institute (JBI) scoping review framework (Aromataris and Munn 2020) and adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews guidelines (PRISMA-ScR) (Tricco et al. 2018).

4.2 | Search Methods

The systematic search strategy was designed in collaboration with a medical librarian (DJ). In February 2023, we conducted a preliminary literature search for the scoping review of digital health interventions in EOL and hospice care. We developed a comprehensive search strategy using the population, concept and context (PCC) criteria, focusing on EOL and hospice (populations) and digital health intervention (concept). In the formal search on 14 June 2023, we used keywords such as "end of life", "hospice" and "digital health" coupled with Boolean operators, proximity locators and MeSH terms, in the CINAHL, MEDLINE, SCOPUS, EMBASE, Cochrane and Web of Science databases. The terms were modified for each instance, considering the variations in subject headings across the databases. We refined our inclusion criteria and searched for articles published in English within the last 5 years (1 January 2019 to 13 June 2023).

4.3 | Eligibility Criteria

To identify relevant studies, inclusion and exclusion criteria were developed by consensus among the authors during the identification of research questions. The inclusion criteria were as follows: (1) research conducted with people in EOL or hospice care; (2) intervention studies utilising digital health, including e-health, digital health, and web-based, Internet, and mobile applications; (3) intervention study designs such as randomised controlled trials (RCTs), and quasi-experimental, pilot, prospective, retrospective and qualitative studies; and (4) studies conducted in palliative care presenting outcomes separately for EOL care. Exclusion criteria were as follows: (1) involved people exclusively in palliative care and not in EOL or hospice care; (2) focused on paediatric patients; (3) employed digital health as a research tool rather than an intervention; (4) exclusively tested the effectiveness of telehealth, tele-prescribing, etc. (5) non-intervention study designs, such as reviews, editorials, commentaries and systematic reviews; and (6) data analytics predictions not targeted at EOL and hospice care. All articles included in this review were intervention studies that used digital health in individuals in EOL and hospice care. We included studies that reported the use of digital health in this population, even if they were not designated as RCTs or quasi-experimental studies. This scoping review focused on primary studies to provide a comprehensive overview of original findings and data. Systematic reviews, editorials, commentaries and reviews were excluded to avoid duplication of data and to focus on individual study characteristics and methodologies.

4.4 | Search Outcome

The research team, comprising three researchers (MJ, HJ and SK) with advanced degrees and expertise in EOL and hospice care, utilised a screening guide to train the reviewers on the eligibility criteria. In the first screening round, articles with titles or abstracts featuring keywords related to EOL, hospice and digital health were considered. In the second round, two researchers independently reviewed the full texts based on the pre-established criteria. Reviewer disagreements on study selection were resolved by a consensus process within the team facilitated by a third researcher.

Figure 1 shows our search process. The search retrieved 4342 studies, which was reduced to 3421 after removing duplicates. After primary and secondary screening, 38 studies were selected for analysis (Beeksma et al. 2019; Courtright et al. 2019; Davies et al. 2019; Li, Lin, and Hwang 2019; Middleton-Green et al. 2019; Niki et al. 2019; Parikh et al. 2019; Raubenheimer et al. 2019; Shinall et al. 2019; Sullivan et al. 2019; Turley et al. 2019; Wegier et al. 2019; Bentley et al. 2020; Lee et al. 2020; Major and Aphinyanaphongs 2020; Manz, Chen, et al. 2020; Moore et al. 2020; Wilkie et al. 2020; Millares Martin 2021; Ohta and Ryu 2021; Pandya 2021, 2022; Perna et al. 2021; Taseen and Ethier 2021; Yang and Shin 2021; Yang et al. 2021; Austin, Siddall, and Lovell 2022; Gajra et al. 2022; Guenther et al. 2022; Huang et al. 2022; Luethi et al. 2022; Masukawa et al. 2022; Owusuaa et al. 2022; Pachchigar et al. 2022; Sandham et al. 2022; Cornetta et al. 2023; Mooney et al. 2023; Oliver et al. 2023).

4.5 | Quality Appraisal

Regarding quality appraisal and considering current evidence suggesting its non-necessity in scoping reviews (Pollock et al. 2021), we decided not to conduct a quality appraisal. While this approach cannot minimise bias or assess evidence levels as a systematic review can, provides a broad overview of the study topic and helps identify gaps in the field. To maintain rigour, we followed the stringent methodology of a scoping review.

4.6 | Data Extraction and Analysis

The general information and data related to the four research questions in the selected studies were compiled and analysed using Microsoft Excel 2020. The following categories were used to organise the data:

1. General information and study design: title, year, authors' names, study design, population, sample size, participants' average age and medical history.
2. Information related to the research questions: Targeted digital health intervention, purpose of the intervention, types of digital health intervention, involvement of HCPs, health system challenges, barriers and facilitators during the intervention, key findings, specific methods in health analytics, data source, data split, validation and model development.

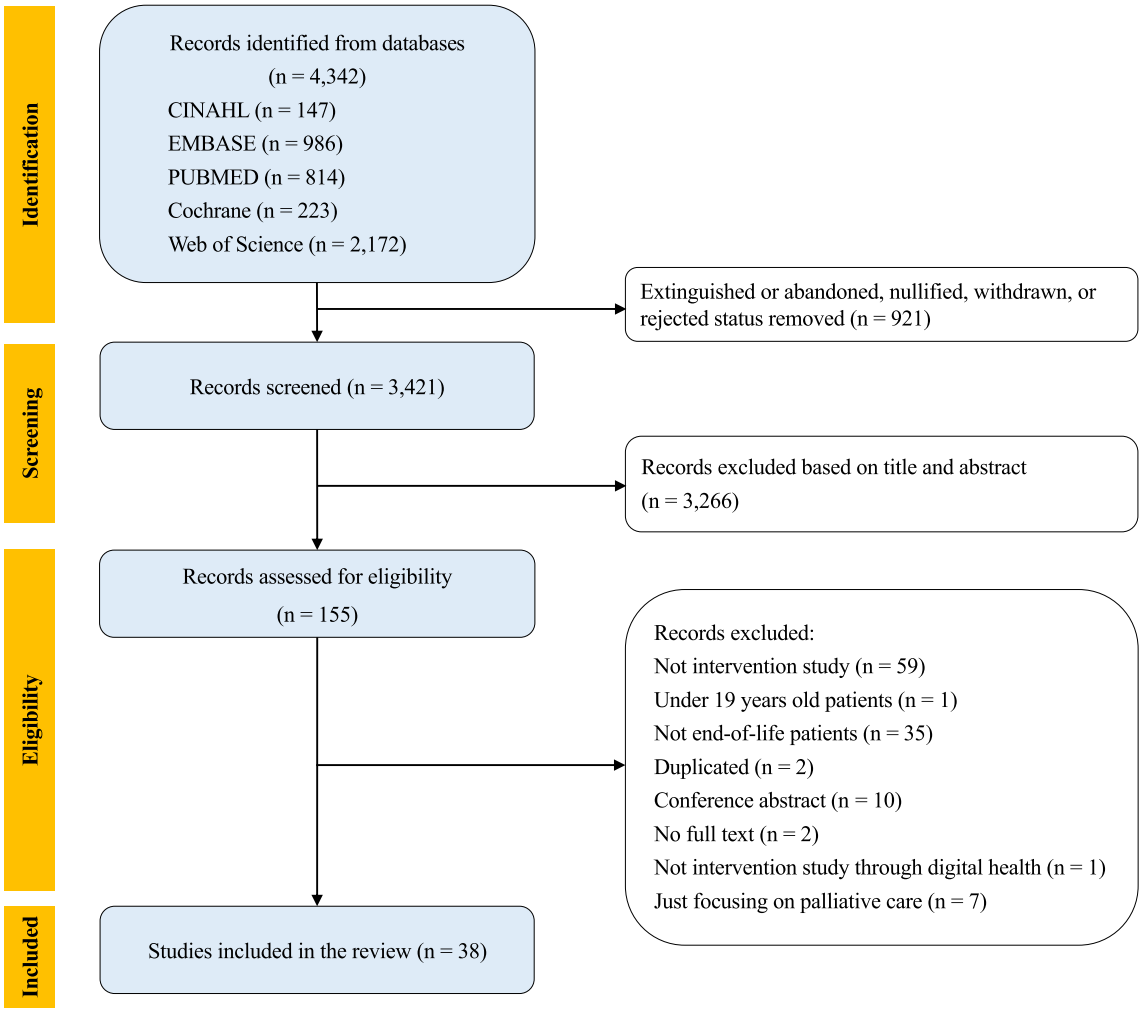

FIGURE 1 | PRISMA flowchart in this review.

If a study possessed multiple attribute, it was counted as a double. Instances of double-counting are clearly indicated in both the table and the text.

Health system challenges were classified according to the WHO's digital health intervention categories (World Health Organization 2023). The classification of digital health types followed the Deloitte report (Monitor Deloitte 2015). The stratification and functional classification of the purpose of digital health technologies into evidence tiers were based on the intervention criteria of evidence tier C as defined by the National Institute for Health and Care Excellence in the 2019 diagnosis (National Institute for Health and Care Excellence 2019). The data were encoded and analysed using descriptive statistics, such as frequency and percentage, in Microsoft Excel 2020.

5 | Results

5.1 | Characteristics of the Selected Studies

Table 1 outlines the characteristics of the studies focusing on digital health interventions in EOL and hospice care that were reviewed in this study.

As of 30 January 2020, when the WHO declared the COVID-19 pandemic, the number of intervention studies had decreased compared with that in 2019. However, it remained stable from 2020. Based on region, North America had the highest number of studies ($n = 15$, 39.5%), Europe ($n = 8$, 21.1%) and Oceania ($n = 4$, 10.5%). Africa had the lowest number of studies ($n = 2$, 5.3%). By country, the United States had the most studies with 34.2% ($n = 13$), followed by the United Kingdom ($n = 4$, 10.5%), Australia, Japan and Taiwan with 7.9% ($n = 3$) each. The individual countries where interventions were conducted are listed by digital health interventions category in the supplement. In terms of study design, retrospective studies constituted 36.8% ($n = 14$). RCTs accounted for 13.2% ($n = 5$), and randomised crossover studies, 2.6% ($n = 1$). Of the 38 experimental studies, 24 (68.3%) did not include a control group. Of the 14 (36.8%) that had a control group, 6 (15.8%) provided usual care, 5 (13.2%) used non-digitised health interventions and 3 (7.9%) used other interventions. Regarding targets, 19 (44.2%) studies involved healthcare systems, followed by patients ($n = 11$, 25.6%), caregivers ($n = 7$, 16.3%) and HCPs ($n = 6$, 14.0%). Studies with multiple targets were counted redundantly to reflect each attribute. Digital health interventions primarily targeted patients in EOL and hospice care without a specific diagnosis ($n = 24$, 63.2%), and those with chronic diseases other than cancer ($n = 2$, 5.3%). Of the six

TABLE 1 | Descriptions of the 38 studies included in this review.

Characteristics	*n* (%)
Region (country[a]) (*N* = 38)	
North America (USA, Canada)	15 (39.5)
Asia (Taiwan, Japan, India, South Korea)	9 (23.7)
Europe (UK, Netherlands, Germany, Switzerland)	8 (21.1)
Oceania (Australia, New Zealand)	4 (10.5)
Africa (South Africa)	2 (5.3)
Year of publication (*N* = 38)	
2019	12 (31.6)
2020	6 (15.8)
2021	7 (18.4)
2022	10 (26.3)
2023	3 (7.9)
Study design (*N* = 38)	
Retrospective, prognostic cohort study	14 (36.8)
Observational, interview, user test	8 (21.1)
Pre-post test	6 (15.8)
RCT	5 (13.2)
Quasi experimental study	4 (10.5)
Randomised cross-over	1 (2.6)
Control group or comparator (*N* = 38)	
None	24 (68.3)
Yes	14 (36.8)
Usual care	6 (15.8)
Non-digitised health intervention	5 (13.2)
Other types of intervention	3 (7.9)
Target(*N* = 43[b])	
Healthcare system	19 (44.2)
Patients	11 (25.6)
Caregivers	7 (16.3)
Healthcare providers	6 (14.0)
Population history (*N* = 38)	
Not limited to specific diseases	24 (63.2)
Cancer	12 (31.6)
Chronic diseases, except cancer	2 (5.3)
Digital health categories (*N* = 38)	
Health analytics	17 (44.7)
mHealth	9 (23.7)
Telehealth	7 (18.4)
Digitised health systems	5 (13.2)
Involvement of healthcare providers (*N* = 38)	
Involved	13 (34.2)
Fully automated or self-guided[c]	4 (10.5)
NA or NP	21 (55.3)
Purpose of digital health interventions (*N* = 38)	
Calculate	15 (39.5)
Treat	15 (39.5)
Self-manage	4 (10.5)
Active monitoring	2 (5.3)
Preventive behaviour change	2 (5.3)
Diagnose	0 (0)

Abbreviations: NA, not applicable; NP, not present.
[a]In order of countries with high frequency.
[b]Studies with multiple targets were counted redundantly to reflect each attribute.
[c]Self-guided: used independently by user.

interventions aimed at HCPs, four were profession-specific. Two of these involved nurses, whereas the other two, chaplains. The most frequently used digital health intervention tool was health analytics (*n* = 17, 44.7%), followed by mHealth (*n* = 9, 23.7%), telehealth (*n* = 7, 18.4%) and digitised health systems (*n* = 5, 13.2%). HCPs were involved in 13 interventions (34.2%), while self-guidance was followed in 4 (10.5%). The primary purpose of the digital health interventions was treatment (*n* = 15, 39.5%) and calculation (*n* = 15, 39.5%), followed by self-management (*n* = 4, 10.5%). Treatment includes managing physical, psychological or spiritual symptoms, including pain, anxiety and depression, through applications or telephone consultations. Calculation includes timely transition to EOL and hospice care, using machine learning for mortality predictive models.

5.2 | Characteristics of Different Types of Digital Health Interventions

5.2.1 | Health Analytics

Seventeen studies (44.7%) applied health, of which 11 (64.7%) confirmed the transition to palliative or hospice care by predicting mortality and 5 (29.4%) predicted changes in symptoms and physical condition; 1 study (5.9%) focused on predicting mortality and aimed to help set supportive treatment goals based on patient preferences. There were eight interventions (47.1%) that focused on patients with cancer, followed by five (29.4%) on those with unspecified diagnoses and four on those with chronic diseases. Data for model development were extracted from seven institutional sources (sample size range: 134–128,941), six prospectively collected datasets (sample size range: 60–24,582) and four public datasets (sample size range: 400–635,590). Fourteen studies measured mortality as the primary outcome. The remaining three studies monitored symptoms and physical status. Of the 17 studies, 4 (23.5%) observed the clinical utility of the models, all of which were integrated into the institutional

electronic medical record system. Comprehensive information on studies using health analytics can be found in Table S1.

5.2.2 | mHealth

Nine studies applied mHealth, of which, eight were self-guided or fully-automated and one required the involvement of HCPs. Of the nine studies, three targeted HCPs and two, caregivers. The average age of participants, including patients and caregivers, was between 43.0 and 71.1 years. Six studies focused on monitoring and managing physical symptoms, two on psychological well-being and one on enhancing knowledge and self-efficacy. Of the studies that addressed physical symptoms, five targeted overall physical symptoms and three focused specifically on pain. Notably, two of the three studies related to pain management used virtual reality and one used a platform. Barriers to the utilisation of mobile health (mHealth) included sudden deterioration of the patient's health condition, discomfort with the utilisation of mHealth and low participation in intervention. The identified facilitators included personalised content, face-to-face counselling prior to enrolment, regular user engagement and encouragement of use. Studies with multiple targets, outcome variables, barriers and facilitators were counted redundantly for each attribute. Table S2 contains a more detailed overview of the studies using mHealth.

5.2.3 | Telehealth

Telehealth was used in seven studies, including two RCTs, one quasi-experimental study with a control group and four efficacy studies without a control group. The countries that reported telehealth research were the United States ($n=3$), the United Kingdom ($n=2$), Australia ($n=1$) and Africa ($n=1$). Of these studies, four used videoconferencing; two, telephone; and one, both videoconferencing and telephone as communication modalities. Barriers to telehealth use were technical challenges ($n=3$), need for structured protocols for various situations ($n=3$), privacy concerns ($n=2$) and cost ($n=1$). Facilitators for HCPs, caregivers and peer groups included personal support and relationships with staff. Studies with multiple barriers and facilitators were counted redundantly for each attribute. Table S3 provides a more detailed overview of studies using telehealth.

5.2.4 | Digitised Health System

Five studies used digitised health systems. Four of these aimed to provide information to HCPs, while one addressed regional gaps between institutions. Of these, three aimed to align patient preferences with the care they received, while two focused on providing accurate protocols to HCPs. Four of these programmes were based on the institutional electronic health record system and one was designed to use an information communication and technology (ICT) system. The key factors identified as barriers and facilitators were accurate recording and active use by HCPs. The provision of information and establishment of protocols based on reliable guidelines were also highlighted. Table S4 provides a comprehensive overview of studies using digitised health systems.

5.3 | Gaps in Digital Health Interventions and Healthcare Systems for EOL and Hospice

Figure 2 shows the health system challenges and the types of digital health interventions. Studies with multiple characteristics were counted redundantly to reflect each attribute. Regarding the WHO's health system challenges, 15 studies (34.9%) focused on improving utilisation; 14 (32.6%), efficiency; 13 (30.2%), quality; and 1 (2.3%), availability. Improvements in utilisation were primarily targeted at patients (14.0%), caregivers (11.6%), healthcare systems (7.0%) and HCPs (2.3%). Notably, telehealth (18.6%) was a major intervention area targeting patients, caregivers and HCPs. Health analytics (27.9%) in health systems focused on predictive models. Efficiency efforts used health analytics (2.3%) and digitised health systems (2.3%). Quality improvement was identified in 9.3% for both patients and health systems, with the predominant technologies being mHealth (16.3%) and health analytics (9.3%). No study measured acceptability, accountability, information, cost or equity as primary outcomes.

6 | Discussion

This scoping review identified 38 studies that focused on digital health interventions in EOL and hospice care and analysed them according to the four research questions: research trends, characteristics of participants, types of interventions with their barriers/facilitators and comparisons with the WHO domains. The findings showed a decline in publications with a retrospective design and without control groups after the WHO declared the COVID-19 pandemic. The studies primarily focused on health systems and patients, and health analytics was the most utilised digital health tool. The four most popular digital interventions were health analytics, mHealth, telehealth and digitised health systems. Among the WHO's health system challenges, utilisation, efficiency, and quality were identified, mainly utilising telehealth and health analytics. However, no studies were identified in the acceptability, accountability, information, cost or equity domains.

6.1 | Challenges for Research Design

Studies have shown that despite the challenges posed by the COVID-19 pandemic, many countries continued to implement digital health interventions that used digitalisation for prevention and promotion during the pandemic. However, only a small number of RCTs (13.2%) provided evidence of effective digital health interventions, which is consistent with integrated reviews of health strategies (Sleeman et al. 2018) and highlights the need for robust research in EOL and hospice care. These findings align with research on digital health interventions in palliative (Finucane et al. 2021) and supportive care (Marthick et al. 2021). RCTs play an important role in reducing clinical uncertainty and providing evidence-based care (Barry et al. 2023), and it is essential to build objective evidence for digital health interventions for EOL and hospice care. Barriers, such as low participant adherence, technical issues and difficulties with enrolment, can be addressed by considering 'substantial equivalence' (Murray et al. 2016) as an alternative trial approach.

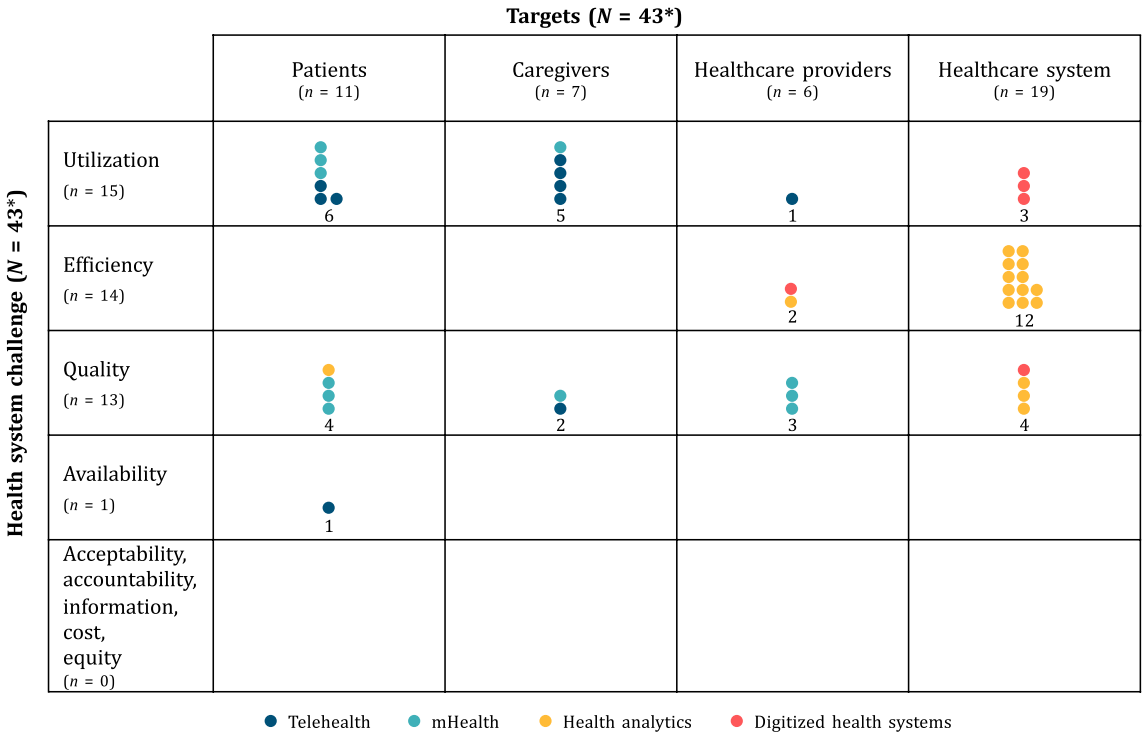

FIGURE 2 | Health system challenges and digital health types used by the interventions. *Studies with multiple characteristics were counted redundantly to reflect each attribute.

The WHO's classification of digital health interventions (World Health Organization 2023) can be useful for establishing substantial equivalence as a criterion for research on digital health interventions and these approaches can ultimately improve the delivery of evidence-based EOL and hospice care.

6.2 | Expansion of Target Population

This study found that digital health interventions in EOL and hospice care transcend specific diagnoses and target diverse populations. These findings confirm the potential of digital health interventions to alleviate existing inequalities in hospice care among under-represented populations (Tobin et al. 2022). Digital health interventions have a significant impact on both physical and psychological symptoms in patients with cancer (Escriva Boulley et al. 2018; Marthick et al. 2021). In addition, interventions using digital modalities have positive effects on patients with other chronic diseases (Shan, Sarkar, and Martin 2019; Haridy et al. 2021; Wongvibulsin et al. 2021). Although the modalities of digital health interventions applied to specific conditions are as diverse as the conditions (Escriva Boulley et al. 2018; Shan, Sarkar, and Martin 2019; Haridy et al. 2021; Marthick et al. 2021; Wongvibulsin et al. 2021), a significant advantage of digital health technologies is their capacity to facilitate personalised care (National Academies of Sciences, Engineering, and Medicine et al. 2021). Effective use of these approaches can enhance personalised disease management and extend EOL and hospice care to previously underserved populations. Future research should explore the feasibility and effectiveness of disease- or population-specific personalised care in EOL and hospice care.

Caregivers play essential roles as stakeholders in ensuring the quality of EOL and hospice care. This review found that 16.3% of the interventions targeted caregivers, which pales in comparison to the 44.2% targeted by healthcare systems. Caregivers play a critical role in assessing and managing patient's symptoms while also managing their own health, which is significantly associated to patient outcomes (Reblin et al. 2023). Digital health interventions, including mobile health interventions, have been reported as effective (Escriva Boulley et al. 2018; Ingle et al. 2021; Marthick et al. 2021; Walton et al. 2023) in addressing caregivers' knowledge deficits and psychological distress (Sellars et al. 2019). This study used mHealth-enabled interventions specifically targeting caregivers, and the high mean age of the participants supported the applicability of these interventions to older adults. Future research should include mHealth-based interventions that focus on caregivers' psychological well-being, effective communication or bereavement, which are essential components of EOL and hospice care (National Consensus Project for Quality Palliative Care 2018). Caregivers play a pivotal role in EOL and hospice patient care (Currow, Agar, and Phillips 2020). Focusing on digital health interventions designed for caregivers can enhance their ability to excel in their roles, ultimately improving the delivery of quality EOL and hospice care.

6.3 | Enhancing HCP Engagement

This study identified HCPs' active engagement as both a key barrier and facilitator to the use of digital health interventions across telehealth, mHealth, health analytics and digitised health systems. In particular, HCPs' digital capabilities are critical to the success of

the interventions, which is consistent with existing studies on barriers and facilitators to the adoption of digital health technologies by HCPs (Borges do Nascimento et al. 2023). To address this issue, training and education programmes aimed at enhancing HCPs' digital health competencies and incorporating core elements from the Digital Competency Framework for Health Professionals can strengthen their skills (Brice and Almond 2020). Strategies such as designing digital health interventions with easy-to-use interfaces, intuitive navigation and implementing adherence promotion campaigns can reduce the burden on HCPs (Borges do Nascimento et al. 2023). Barriers to digital health interventions include personal and psychological issues, HCPs' digital competencies, infrastructure and technology barriers and concerns about increased workload (Borges do Nascimento et al. 2023). Additional obstacles such as privacy concerns, costs, unreliable information, lack of structured protocols and technical issues also hinder the adoption of telehealth and digitised health systems. Behaviour is influenced not only by individual abilities but also by interactions with the physical and social environment (Chen et al. 2023). HCPs are moderately confident in using digital technologies and believe in their potential to improve outcomes (Mills et al. 2021). Translating this willingness of HCPs into effective digital health interventions require a multi-level strategy. Structural support from organisations and policies is essential to address challenges related to costs, guidelines, technological infrastructure, etc.

6.4 | Opportunities to Extend the Application

Health analytics, the most common type of digital intervention, has been particularly studied for deep learning-based mortality prediction models and is actively used in patients with terminal cancer. However, only 23.5% of these models are used in clinical settings. In addition to mortality, issues such as communication, shared decision-making, fluid intake and symptom management can be addressed by predictive models in EOL and hospice care (National Institute for Health and Care Excellence 2015). Using other outcome variables can objectively evaluate the effectiveness of EOL and hospice care (Sharafi, Ziaee, and Dahmardeh 2023), and future research needs to go beyond mortality prediction and synthesise evidence on optimal hospice care functions on the basis of substantial equivalence. The next most prevalent types, mHealth and telehealth, focus on engaging with stakeholders. From a patient-centred perspective, involving HCPs, patients and caregivers, who are central to care, is important. These interventions offer the advantages of personalised care. However, achieving this requires implementing the necessary changes and strategies to facilitate stakeholder engagement by considering digital literacy and user environment. The digitised health system, the least identified type in this review, aims to deliver care aligned with patient preferences (Sleeman et al. 2018). Integrating this system, which encompasses the care process and outcomes, with health analytics could serve as a clinical guidance to facilitate optimal care aligned with patient preferences and best interests.

6.5 | Advancing Health Equity

Our study demonstrates the extent to which research on digital health in EOL and hospice care currently covers the WHO's domain of digital interventions aimed at achieving health equity (World Health Organization 2023). However, it identified interventions that address only four of the nine domains of the WHO's health system challenges: availability, quality, utilisation and efficiency. When challenges were analysed by target group, research on health system efficiency predominated, while efforts to address utilisation were most common for patients and caregivers. Despite these efforts, research addressing health equity in EOL and hospice care remains limited. Digital health can close the health equity gap through personalised technology and improved accessibility to healthcare (Choi and Lin 2023). It has improved healthcare delivery and access in resource-poor settings (Saif-Ur-Rahman et al. 2023). Recognising its potential in advancing global health equity, the WHO has promoted digital health as global health priority (World Health Organization 2021). However, these digital technologies can also unintentionally widen health gaps and inequalities for under-resourced populations (Choi and Lin 2023; Saif-Ur-Rahman et al. 2023). Groups with inequalities in hospice care access—older adults, ethnic minorities and those living in rural or deprived areas (Tobin et al. 2022)—also report vulnerability to digital health interventions (Nouri et al. 2020; Zhang et al. 2023). The systemic process by which certain groups are deprived of equal access to digital technologies such as the internet leads to inequalities in access to healthcare and health information (McCall et al. 2022). These social determinants of health are critical in predicting health outcomes and are associated with health disparities (World Health Organization 2024). Digital health disparities exist within marginalised populations, where barriers such as digital literacy, language skills and physical vulnerabilities related to technology infrastructure exacerbate access issues (Choi and Lin 2023). When applying digital health intervention to EOL and hospice care, it is essential to consider the digital determinants of health (Sieck et al. 2021) alongside traditional factors influencing EOL and hospice care. Digital determinants are complex and operate across individual, interpersonal, community and societal levels, influencing outcomes and equity (Richardson et al. 2022). In this study, at the individual level, barriers to digital health interventions identified included sudden deterioration in patient condition, low engagement with interventions, technical difficulties and cost. At the interpersonal level, relationships with staff, personal support, encouragement to use, regular user engagement and face-to-face counselling before enrolment were reported as facilitators of digital health interventions. At the community level, the need for structured protocols was reported as a barrier, and at the societal level, privacy concerns and discomfort with mHealth use were reported as barriers. Digital determinants shape the accessibility, usability, and effectiveness of digital interventions in EOL and hospice care (Sieck et al. 2021). Therefore, to avoid exacerbating existing health inequities, it is important to ensure equitable access to digital health interventions at each level in EOL and hospice care. Identifying unique characteristics of vulnerable populations and exploring available resources is essential.

6.6 | Strengthening Building Rapport Efforts

This study's findings demonstrate the broad application and acceptance of telephone-based telehealth across various settings. They are consistent with previous studies that have highlighted the benefits to accessibility, ease of use, record keeping, service

delivery and patient satisfaction (Saif-Ur-Rahman et al. 2023). Consistent with these findings, telephone-based mHealth interventions were reported to be effective and well-adopted, supporting improved patient experience and operational efficiency. Building rapport between users and HCPs significantly enhances engagement with telephone-based telehealth, aligning with evidence of its importance in digital health settings (McClelland et al. 2024). Patients engaged in telehealth found that the modality of consultation itself had minimal impact on rapport-building (Singhal, Riley, and Cowie 2023). Rather, it was the quality of care that mattered, and person-centred or relationship-based care was the basis for rapport-building, regardless of the modality used (Koppel et al. 2022). This study identified that a lack of strategies for various situations hindered rapport-building (English, Gott, and Robinson 2022). Implementing participatory human-centred design that reflects user-specific needs has been effective in enhancing trust and safety among participants (Porche et al. 2022). Addressing user needs through these designs supports culturally relevant interventions (Brewer et al. 2020). This highlights the potential of participatory human-centred design in developing structured protocols that support building rapport within diverse digital settings. On the other hand, HCPs continue to have concerns about digital health, specifically that digital technologies may reduce face-to-face consultation time with patients, which could limit building rapport with new patients (Hancock et al. 2019; Singhal, Riley, and Cowie 2023). Thus, it is essential to identify and address factors that affect HCPs' rapport-building with patients and caregivers.

6.7 | Limitations of This Study

This study had some limitations. It focused on articles published up to June 2023 and considered the previous 5 years; thus, more recent trends in digital health may have been missed. As a scoping review, the findings lack specificity for particular diagnoses, providing a generalised view of digital health interventions in EOL and hospice care. The study design characteristics limit the ability to validate and recommend the objective effectiveness of interventions. Future systematic reviews and meta-analyses are needed to determine the effectiveness of digital health interventions for specific diagnoses. Table 1 highlights a geographical bias, with 39.5% of studies originating from North America, limiting generalisability. No details on health equity such as race or ethnicity were extracted. However, studies from three countries outside North America (Europe, Oceania and Africa) explored telehealth. Studies conducted in low- and middle-income countries or rural settings were also included.

6.8 | Implication for Practice and Future Research

This review highlights the importance of integrating digital health interventions into EOL and hospice care to improve symptom management and quality of life for patients and caregivers. Efforts must ensure that vulnerable populations, such as the older adults, ethnic minorities and those in rural or underserved areas are not excluded or disadvantaged. This includes providing personalised support, offering technology training to caregivers and patients and ensuring accessibility to digital health resources. HCPs should prioritise implementing human-centred digital solutions that foster relationships, improve patient engagement and prioritise personalised care. Specifically, HCPs should proactively identify barriers to digital tool utilisation, such as patient discomfort with technology or low participation rates and work collaboratively with healthcare teams to provide solutions, including face-to-face counselling and regular engagement reminders. In addition, maximising the effectiveness of digital health interventions in EOL and hospice care requires the empowerment of human-centred digital capabilities among HCPs. Building rapport with patients in EOL and hospice care and caregivers in various digital environments will be a new challenge in the era of digital transformation. HCPs will be able to prioritise rapport-building by using digital tools to facilitate empathetic communication and by maintaining a patient-centred approach in all interactions. Balancing personal and environmental aspects of HCPs facilitates digital health engagement. Future research must address study design gaps by incorporating control groups and prospective methodologies to better evaluate digital health interventions in EOL care. Digital health interventions reduce healthcare costs (National Academies of Sciences, Engineering, and Medicine et al. 2021), with systematic reviews reporting generally positive cost-effectiveness (Gentili et al. 2022). Multisectoral incentives drive HCPs' use of digital health technologies (Borges do Nascimento et al. 2023). Our findings lack confirmation in EOL and hospice care; further research should explore financial outcomes related to costs or incentives from users or HCPs perspective. Finally, future research should build on digital health determinants to support effective inclusion and equitable access. The National Institute on Minority Health and Health Disparities Research (NIMHD) framework develops strategies for equitable digital health access by addressing structural and social disparities (Richardson et al. 2022). Holistically addressing digital health factors via the NIMHD framework ensures equitable solutions for EOL and hospice care, respecting patients and caregivers' needs.

7 | Conclusion

The healthcare industry is poised for transformation through the Fourth Industrial Revolution, with digital health technology at its core (Sripathi and Leelavati 2024). The findings of this study confirm that despite the challenges of the pandemic, digital health interventions have continued. Digital health interventions in EOL and hospice care have been applied to a variety of patient populations, including symptom management for patients and caregivers and proactive interventions through model development, and have demonstrated the potential for personalised care across a range of diseases. Digital health interventions in EOL and hospice care address some of the health system challenges defined by the WHO, but more research is needed to ensure health equity by considering digital determinants and diverse user characteristics to ensure that marginalised populations are not excluded. The review highlighted the potential of digital health to support caregivers and HCPs in EOL and hospice care. To maximise its effectiveness and adoption, systemic support at organisational and policy levels is essential. This includes enhancing HCPs' digital health capacities and fostering stronger relationships with patients and caregivers. Financial considerations, including incentives and costs, also warrant further research. Expanding digital health interventions in terms

of purposes, modalities and targets, alongside improving HCPs capabilities, could help reduce health inequities and improve quality of life for EOL and hospice patients and caregivers.

Author Contributions

All authors contributed to this manuscript. Study conception and design, data interpretation and writing and revision: Misun Jeon, Heejung Jeon and Sanghee Kim; data acquisition and data analysis: Misun Jeon. All authors have carefully reviewed and approved the final version of the manuscript.

Acknowledgements

Misun Jeon and Heejung Jeon received a scholarship from the Brain Korea 21 FOUR Project funded by the National Research Foundation (NRF) of Korea, Yonsei University College of Nursing.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The datasets generated and/or analysed in this study are available to the public. Upon reasonable request, the dataset can be obtained from the corresponding author.

Peer Review

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1111/jan.16734.

Statistics

The author(s) affirm that the methods used in the data analyses are suitably applied to their data within their study design and context, and the statistical findings have been implemented and interpreted correctly. The author(s) agrees to take responsibility for ensuring that the choice of statistical approach is appropriate and is conducted and interpreted correctly as a condition to submit to the Journal.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.