

Digital health technologies for patients with cancer during end-of-life care: A systematic review of available tools and their use, barriers, and opportunities

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Introduction

End-of-life care is crucial for individuals with life-limiting conditions, focusing on their physical, emotional, and spiritual needs. The COVID-19 pandemic has highlighted the need for accessible and effective healthcare. When effective home-based EOL care is provided, evidence shows it reduces hospital visits, symptom burden, and caregiver burden. Utilising effective technologies to provide virtual home-based EOL care and support may allow for better service coordination, real-time communication and bridge perceived gaps in the provision of effective, patient-centred palliative care while optimising resource use. Therefore, this systematic review aimed to synthesize international research on digital health solutions for cancer patients during end-of-life stages.

Methods

Systematic review with narrative synthesis of findings. Three electronic databases (Scopus, Web of Science, PsychINFO) were searched using key/MeSH search terms/headings relevant to end-of-life, digital health, and palliative/hospice care, from January 2010 to June 2021. Eligible published, peer-reviewed studies selected included participants with cancer receiving home- or community-based palliative care. The article selection process is shown via the PRISMA flow diagram in Figure 1. Mixed Methods Appraisal Tool was used to assess bias.

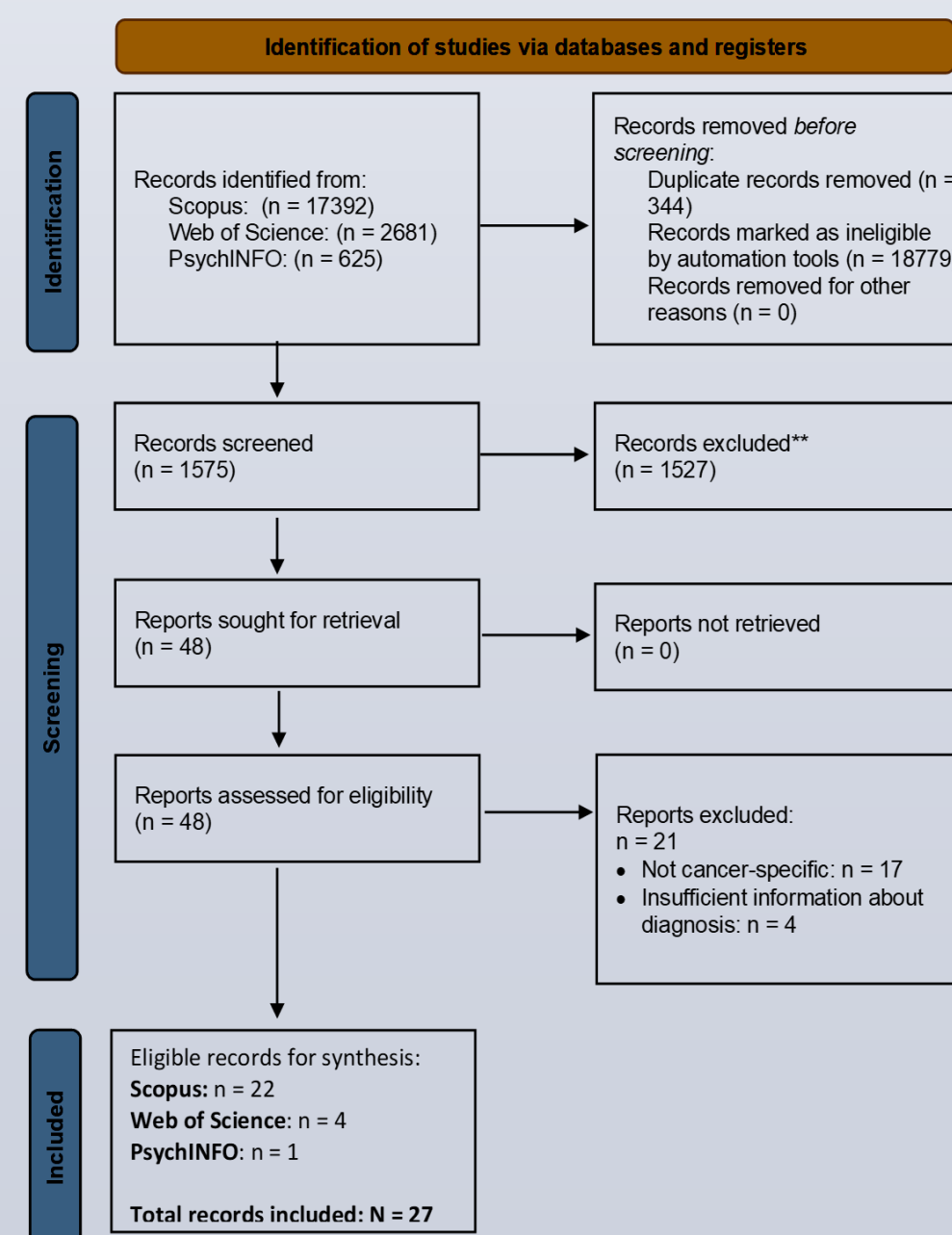


Figure 1. PRISMA flow chart showing study screening and selection process

Results

Characteristics	Number of studies (n=27)
Year of publication	
2010-2013	5
2014-2017	11
2018-2021	11
Location	
High Income Countries (HIC)	26
Low-Middle Income Countries (LMIC)	1
Study Design	
Randomized Controlled Clinical Trials (RCTs)	8
Quantitative descriptive studies	8
Qualitative studies	6
Mixed methods	3
Quantitative non-RCTs	2
Intervention Delivery Mechanisms	
Telehealth/ predominately telephone calling	15
Mobile Health (using apps)	5
e-Health (using websites)	7
Intervention Content	
Education (both caregivers and patients)	7
Communication with the clinicians -- both caregivers and patients	19
Pain, symptom & activity monitoring (patients)	9
Medication management	1
Advance care planning	1
Follow up	1

Table 1 Study characteristics (n=27)

The search yielded 27 eligible articles published between 2012 and 2021 (See Table 1 to see the summary of the results).

Most studies were conducted in high-income countries (see figure 2), with various study designs, including randomized controlled trials, qualitative studies, and quantitative descriptive studies.

The interventions utilized telehealth, mobile health (apps), and e-health (websites) for education, communication with clinicians, symptom monitoring, and medication management.

Except for one study, all included studies reported positive outcomes for caregivers and patients when using digital health interventions in the context of end-of-life (EOL) palliative care. Telehealth interventions were found to reduce stress, depression, and improve caregivers' quality of life. They also enhanced patient-centred care and reduced the need for travel to palliative care centres.

Discussion

Two main barriers were identified: limited internet access and low computer literacy among patients and caregivers. Addressing these barriers is essential for ensuring equitable access to digital technologies in palliative care.

Challenges included the traditional emphasis on a physical presence and lack of awareness of intervention programs. Potential solutions included providing educational materials and adopting a co-design approach involving end-users and balancing technology use with a human-centred physical presence. The importance of including a medical informatics engineer in the development team was also emphasized.

The reviewed studies primarily focused on using digital communication tools between clinicians and patients/caregivers, supporting remote palliative care. However, the review highlighted a limited application of advanced digital tools, with a reliance on telehealth and videoconferencing. Exploiting recent advancements in Information and Communication Technologies (ICTs), such as Artificial Intelligence (AI) and Augmented Reality (AR), could lead to more personalized palliative care interventions. Remote monitoring using digital tools would enable timely responses and benefit patients in remote areas.

Utilizing technology in palliative care can enhance face-to-face interactions and improve overall care, even for those unfamiliar with such tools. This review emphasizes the potential of digital health in palliative care, urging the resolution of barriers, exploration of advanced technologies, and enhancement of communication to provide accessible and personalized care for end-of-life cancer patients.

Geographical distribution of studies

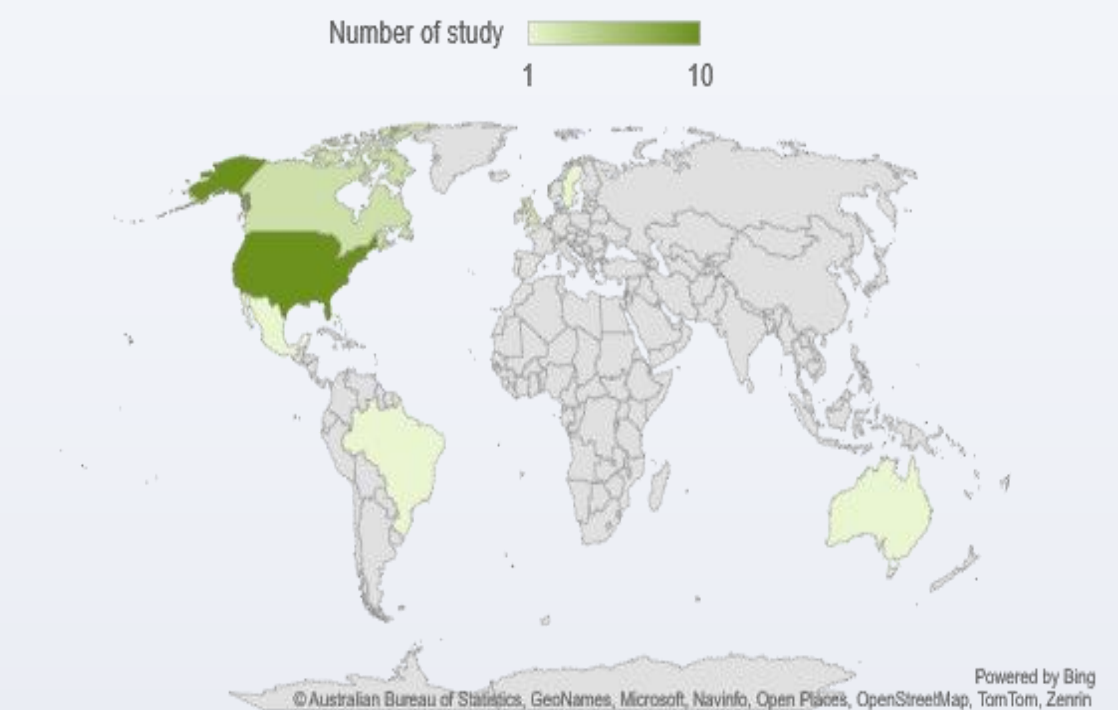


Figure 2. Geographical distribution of studies

Conclusion

This review concludes that though valuable in remote monitoring, the evidence for using digital tools in the end of life is still limited and mainly used in developed nations. The findings of this review highlight the potential of digital health tools to enhance home and community-based palliative care for cancer patients at the end of life. Addressing the identified barriers and leveraging advanced technologies can pave the way for more effective, accessible, and patient-centred interventions, ultimately improving the quality of care and support provided in these challenging circumstances. Our findings offer empirical foundations for further study on the use of cutting-edge digital technologies for palliative end-of-life care.



 **DIGITAL HEALTH STUDY GROUP**