



OPEN ACCESS

EDITED BY

Constantinos S. Pattichis,
University of Cyprus, Cyprus

*CORRESPONDENCE

Anna C. Singleton
✉ anna.singleton@sydney.edu.au

RECEIVED 21 July 2023

ACCEPTED 01 August 2023

PUBLISHED 11 August 2023

CITATION

Singleton AC, Estapé T, Ee C, Hyun KK and Partridge SR (2023) Editorial: Digital health quality, acceptability, and cost: steps to effective continuity of cancer care. *Front. Digit. Health* 5:1264638. doi: 10.3389/fdgth.2023.1264638

COPYRIGHT

© 2023 Singleton, Estapé, Ee, Hyun and Partridge. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Editorial: Digital health quality, acceptability, and cost: steps to effective continuity of cancer care

Anna C. Singleton^{1*}, Tanie Estapé², Carolyn Ee³, Karice K. Hyun¹ and Stephanie R. Partridge¹

¹Engagement and Co-Design Research Hub, Faculty of Medicine and Health, The University of Sydney, Sydney, NSW, Australia, ²Department of Psychosocial Oncology, FEFOC Foundation, Barcelona, Spain, ³The National Institute of Complementary Medicine, Health Research Institute, Western Sydney University, Sydney, NSW, Australia

KEYWORDS

cancer, digital health, electronic health, public health, implementation science, artificial intelligence, health equity

Editorial on the Research Topic

Digital health quality, acceptability, and cost: steps to effective continuity of cancer care

Over 19 million people were diagnosed with cancer globally in 2020 (1). Recently, digital health interventions, including electronic medical/health records, telemonitoring, online patient portals, artificial intelligence (e.g., machine learning) and web-, mobile-, and text message-based interventions have become commonplace across the cancer care continuum, from cancer screening to post-treatment follow-up (2, 3). Benefits of digital health interventions include improved access to and delivery of cancer screening, decision aids, health information, management and tracking tools (e.g., smart watches, apps, websites), including psychosocial and physical health, for people living with and beyond cancer and their caregivers (2–8). Moreover, digital health interventions are scalable, adaptable and can be co-designed with multidisciplinary teams, including end-users, researchers, and clinicians, to address unmet healthcare needs (9). However, many barriers to access and use of digital health interventions exist, especially in low-resource areas and low-income countries (10, 11). Limited access to digital health technologies and limited technological skills or abilities to seek and understand health information from digital health sources (i.e., low digital health literacy) can lead to inequities in care delivery (12, 13). Moreover, receiving too much information from digital health sources can result in negative experiences, including fear (14). Sustainability of digital health interventions can also be problematic due to lack of resources (e.g., funding, workforce capacity) (15). The contributions in this Research Topic highlight the importance of inclusive co-design and equitable delivery of digital health interventions in cancer care.

Co-designing health innovations with people with diverse expertise (e.g., lived-experience, clinical, research) has been found to improve the quality of the innovation and users' perceived acceptability and utility (16). In this Research Topic, Morton et al. highlight how the design of a surgery decision aid for people with genetic predisposition of cancer was improved by involving multidisciplinary expertise in co-design. The original decision aid included detailed descriptions of the decision options (e.g., have surgery now or decide later), pros and cons of each decision and a quiz to indicate the most suitable decision. Using an

iterative mixed-methods approach, participants made important alterations to the original decision aid, including a desire for concise descriptions of each decision option, including “do nothing”, and up-front implications of the decisions to set “realistic expectations”, with option to read additional information if desired. They also suggested a list of frequently asked questions, and a personally tailored summary of quiz results to facilitate clinician communications. Morton et al. emphasized the importance of including diverse co-designers from various jobs and ethnicities to facilitate development of future decision aids.

Once digital health interventions are designed, end-user testing is important for understanding acceptability, utility, and potential adaptations. Virtual patient platforms, including patient portals, are often used to support health self-management (2). In this Research Topic, Lamarche et al. describe how a fear of cancer recurrence program for patients was adapted into a program to support caregivers using a mixed methods, multidisciplinary approach, which was successfully user-tested by caregivers and therapists (17). Further, results from O'Connor et al. mixed methods evaluation (service use data, survey, interviews) of a patient portal to support follow-up care for 627 men with prostate cancer with low risk of recurrence revealed that within the portal, participants were most likely to access their test results and the communication systems (e.g., secured messaging, email) to contact their clinical team. Most participants felt the portal was quick, easy, convenient and time-saving compared to traveling to the hospital and reduced stress and facilitated communication with clinicians. However, people who declined to participate reported that digital equity was an issue, due to a lack of computer, internet, or technical skills. Participants suggested provision of technical support and technology could reduce barriers.

In low-income countries and low-resource areas, digital health inequities are exacerbated. For example, although there is some evidence of patients' acceptability and utility of virtual patient platforms (e.g., electronic personal health records; ePHRs), successful implementation is limited (17, 18). Wubante et al. conducted a cross sectional questionnaire of 402 health professionals in Ethiopia to evaluate their knowledge and attitudes regarding electronic personal health records. Most (93.5%) had never used ePHRs before but 64.4% perceived them to be useful for managing health and 55.5% had favorable attitudes, especially those with to the required technology, high digital health literacy and skills and access to computer training. Wubante et al. suggest providing training about technical aspects of ePHRs and their usefulness for health professionals could improve knowledge, attitudes, and use.

Digital health literacy plays a critical role in people's ability to use digital health innovations effectively. Nguyen et al. suggest that a validated measure of digital health literacy is key to understanding if a person is proficient enough to adopt a novel digital health intervention or require additional education or training. Nguyen et al. conducted an exploratory and confirmatory factor analysis to validate a novel digital health literacy tool for Vietnamese adolescents in Vietnam ($N=236$). Results revealed that the tool was valid across gender, education, marital status, age, location, and household economy, which may facilitate collection of future high-quality digital health literacy data.

Throughout the cancer care continuum, routinely collected clinical data can also be evaluated using artificial intelligence, such as machine learning, to predict patient health outcomes. In a population-based retrospective cohort study ($N=52,199$), Zhang et al. used machine learning to predict lymph node metastases in patients with renal cell carcinoma, based on their age, sex, tumour laterality, T and M stages, tumour size, histology, and grade. Their model showed high internal and external validity (AUC of 0.930 and 0.958, respectively) and good clinical applicability. As a result, Zhang et al. released a freely available online risk calculator.

This Research Topic *Digital Health Quality, Acceptability, and Cost: Steps to Effective Continuity of Cancer Care* provides readers with emerging evidence that furthers understanding of how digital health interventions can be harnessed to support patients, caregivers and healthcare professionals throughout the cancer care continuum and improve health outcomes. Equity, digital health literacy and sustainability are central considerations for successful digital health integration and usage in cancer care, which can be achieved through multidisciplinary codesign and testing.

Author contributions

AS: Conceptualization, Writing—original draft, Writing—review & editing. TE: Writing—review & editing. CE: Writing—review & editing. KH: Writing—review & editing. SP: Writing—review & editing.

Funding

AS's salary was funded by a National Health and Medical Research Council of Australia (NHMRC) Investigator Grant Emerging Leadership 1 Fellowship (GNT2017575). CE's salary was funded by an endowment from the Jacka Foundation of Natural Therapies. SP's salary was funded by National Heart Foundation of Australia Future Leader Fellowship (#106646). KH's salary was funded by NHMRC Investigator Grant Emerging Leadership 1 Fellowship (GNT1196724). TE's salary was funded by FEFOC Foundation, Barcelona, Spain.

Acknowledgments

We would like to thank the authors who contributed their work to this editorial and reviewers for their critical appraisal of the authors' research.

Conflict of interest

TE was employed by FEFOC Foundation.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated

organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* (2021) 71(3):209–49. doi: 10.3322/caac.21660
2. Garg S, Williams NL, Ip A, Dicker AP. Clinical integration of digital solutions in health care: an overview of the current landscape of digital technologies in cancer care. *JCO Clin Cancer Inform.* (2018) 2:1–9. doi: 10.1200/CCI.17.00159
3. Morris BB, Rossi B, Fuemmeler B. The role of digital health technology in rural cancer care delivery: a systematic review. *J Rural Health.* (2022) 38(3):493–511. doi: 10.1111/jrh.12619
4. Escrivá Boulley G, Leroy T, Bernetière C, Paquenseguy F, Desfriches-Doria O, Préau M. Digital health interventions to help living with cancer: a systematic review of participants' engagement and psychosocial effects. *Psychooncology.* (2018) 27(12):2677–86. doi: 10.1002/pon.4867
5. Roberts AL, Fisher A, Smith L, Heinrich M, Potts HWW. Digital health behaviour change interventions targeting physical activity and diet in cancer survivors: a systematic review and meta-analysis. *J Cancer Surviv.* (2017) 11(6):704–19. doi: 10.1007/s11764-017-0632-1
6. Cheng L, Duan M, Mao X, Ge Y, Wang Y, Huang H. The effect of digital health technologies on managing symptoms across pediatric cancer continuum: a systematic review. *Int J Nurs Sci.* (2020) 8(1):22–9. doi: 10.1016/j.ijnss.2020.10.002
7. Zhai S, Chu F, Tan M, Chi NC, Ward T, Yuwen W. Digital health interventions to support family caregivers: an updated systematic review. *Digit Health.* (2023) 9:20552076231171967. doi: 10.1177/20552076231171967
8. Hong YA, Hossain MM, Chou WS. Digital interventions to facilitate patient-provider communication in cancer care: a systematic review. *Psychooncology.* (2020) 29(4):591–603. doi: 10.1002/pon.5310
9. Sanz MF, Acha BV, García MF. Co-Design for people-centred care digital solutions: a literature review. *Int J Integr Care.* (2021) 21(2):16. doi: 10.5334/ijic.5573
10. Holeman I, Evans J, Kane D, Grant L, Pagliari C, Weller D. Mobile health for cancer in low to middle income countries: priorities for research and development. *Eur J Cancer Care (Engl).* (2014) 23(6):750–6. doi: 10.1111/ecc.12250
11. Bhatt S, Evans J, Gupta S. Barriers to scale of digital health systems for cancer care and control in last-mile settings. *J Glob Oncol.* (2018) 4:1–3. doi: 10.1200/JGO.2016.007179
12. Bamgboje-Ayodele A, Smith A, Short CE, Fardell JE, Shaw J, Beatty L, et al. tools for adults living with cancer and their caregivers: a systematic literature review and author survey study. *Patient Educ Couns.* (2021) 104(10):2480–9. doi: 10.1016/j.pec.2021.03.012
13. Richardson S, Lawrence K, Schoenthaler AM, Mann D. A framework for digital health equity. *NPJ Digit Med.* (2022) 5(1):119. doi: 10.1038/s41746-022-00663-0
14. Arora NK, Hesse BW, Rimer BK, Viswanath K, Clayman ML, Croyle RT. Frustrated and confused: the American public rates its cancer-related information-seeking experiences. *J Gen Intern Med.* (2008) 23(3):223–8. doi: 10.1007/s11606-007-0406-y
15. Shaffer KM, Turner KL, Siwik C, Gonzalez BD, Upasani R, Glazer JV, et al. Digital health and telehealth in cancer care: a scoping review of reviews. *Lancet Digit Health.* (2023) 5(5):e316–27. doi: 10.1016/S2589-7500(23)00049-3
16. Steen M, Manschot M, De Koning N. Benefits of co-design in service design projects. *Int J Des.* (2011) 5(2):53–60.
17. Joseph L, Lavis A, Greenfield S, Boban D, Humphries C, Jose P, et al. Systematic review on the use of patient-held health records in low-income and middle-income countries. *BMJ Open.* (2021) 11(9):e046965. doi: 10.1136/bmjopen-2020-046965
18. Kumar M, Mostafa J. Electronic health records for better health in the lower-and middle-income countries: a landscape study. *Library Hi Tech.* (2020) 38(4):751–67. doi: 10.1108/LHT-09-2019-0179