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Original Article

The Role of Digital Healthcare Technology Within the Cancer Treatment Pathway – Results From a UK-Based Survey

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Abstract

Aim: Digital technologies in cancer care, including smartwatches, wearable sensors, and app-based platforms, enable continuous real-time health monitoring. However, many devices are designed for fitness or wellness markets and are not optimised for clinical monitoring of cancer patients. This survey explored the potential role of digital technologies across the cancer pathway and aimed to identify key barriers to adoption.

Materials and methods: A web-based questionnaire was developed through expert consensus, internally validated, and piloted with five individuals. It was distributed to UK-based healthcare professionals and academics via professional networks and social media. The survey examined: (1) the role of digital technology before, during, and after treatment; (2) technical barriers; and (3) human factors. Quantitative data were analysed descriptively and free-text responses thematically.

Results: Eighty-four responses were received (including 28% allied healthcare scientists, 26% nurses, 9% clinicians). 48% had used digital technologies in research and 27% in direct clinical care. Most respondents (95%) believed digital technologies could benefit cancer patients through direct communication with clinical teams (94%), mood monitoring (91%), and vital sign monitoring (87%). Perceived benefits varied across the cancer care pathway: before treatment, providing insight into patients' health (91%); during treatment, monitoring vital signs (96%) and side effects (91%); and after treatment, supporting rehabilitation (94%).

Technical barriers included poor integration into clinical systems (66%), limited interoperability (83%), data accuracy concerns (82%), and suboptimal user design (80%). Human factors included the need for long-term support (94%) and digital literacy (92%). Specialist teams were considered most appropriate leads for monitoring during prospective studies (77%) and primary care for long-term follow-up (53%), with patients playing a central role in both scenarios.

Conclusions: Digital technologies are viewed as valuable tools across the cancer pathway, but integration, interoperability, design, and human factors must now be addressed to enable effective and equitable clinical adoption.

Key words: Digital health technology; Oncology; Questionnaire; Wearable devices

Introduction

Digital-technologies in cancer care comprise interconnected devices and systems, such as smartwatches, other wearable sensors, and app-based health applications, which can continuously monitor and collect real-time

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health data. Such devices are of increasing interest in healthcare with the promise of improving patient care efficiencies through continual monitoring, enabling accessible and patient-centred care, faster identification of risk factors leading to treatment-related side effects and the potential to trigger timely interventions [1,2]. The Digital Medicine Society has published the 'playbook', which includes information for academics, clinical teams, industry and policy makers [3]. This information is designed to support the use and development of digital technology across healthcare.

There is a growing understanding that integrating digital technology within clinical research and within routine cancer care pathways can bring benefits to patients and for the NHS. This is epitomised by the UK's NHS 10-year plan, which includes expectations that digital technology will personalise and streamline health care. As cancer incidence rises globally, the use of such technology may help offset this increasing healthcare burden.

There is an extensive body of research exploring the use of digital technologies in healthcare. Hu *et al.* have presented a broad overview of the role of digital technology in prevention, diagnosis, treatment, prognosis and public health [4]. More focused reviews have examined digital technology in oncology [5], the use in oncology clinical trials [6] and regulatory requirements pertaining to use [7]. Digital technologies have been studied in multiple cancer populations including breast [8,9], colorectal [10], lung [11,12], head and neck [13], and in paediatric and young adults [14,15]. Research has explored patients' perceptions of digital technologies and identified key patient concerns which may be barriers to their successful use. Lazarou *et al.* identified that most patients valued user-friendly design and the need for devices to facilitate and enhance patient–clinician interactions [16].

Consumer-grade devices are predominantly designed for fitness and wellness markets and may not be optimised for clinical monitoring of cancer patients. To help focus development of digital technologies it is essential to understand where there is potential for such devices to improve the cancer treatment pathway. Therefore, we conducted a survey of professionals working in oncology, with the aim of understanding key technical barriers and human factors which influence device adoption and use. We sought to better understand the support that is needed for the successful use of digital technology within clinical pathways and to provide useful recommendations for guidelines concerning the optimal use of digital technology in oncology.

Methods

A web-based, cross-sectional, questionnaire was designed following ESTRO guidelines [17] through a consensus expert process. The consensus panel consisted of individuals from academic and clinical roles, who cared for patients with a range of different tumours at differing points in their treatment journey and who underwent different treatment modalities. The full questionnaire is available in Supplementary materials 1.

The following definition for digital healthcare technology was provided in the questionnaire:

> *Digital technology in cancer care refers to the use of interconnected devices and systems, such as smartwatches, wearable sensors, and app-based health applications, to continuously monitor and collect real-time health data from patients. For example, this technology enables remote tracking of vital signs, physical activity, symptom management, and treatment adherence, enhancing personalized care, early detection of complications, and improved overall patient outcomes and satisfaction.*

The questionnaire included 24 questions which fell into three domains: (1) the role of digital technology before, during and after cancer treatments – questions 1–6; (2) technical barriers to the use of digital technology within cancer pathways – questions 7–17; (3) human factors (patients and healthcare workers) relating to the use of digital technology in cancer pathways – questions 18–24. Finally, optional questions on the participants' demographic, academic or clinical role and experience of digital technologies were presented – questions 25–33.

The majority of survey questions used a 5-point Likert scale response. Quantitative responses were analysed descriptively and presented as bar charts for visualisation. The number of responders is included alongside each graph. All questions were mandatory to answer, except the final section on participant demographics. Free text fields were analysed thematically.

The questionnaire was first pre-tested at our institution to assess the understanding and accessibility of each question. This process aimed to identify any issues with the wording of questions or the answers, with feedback used to improve clarity. Pre-testers were also invited to give feedback on the focus of questions to ensure the relevance of each question to our research. Five pre-testers were identified who had experience of the digital technologies of interest and who together covered a range of professional roles.

Next, pilot testing was performed with a second independent group of five individuals to assess the survey as a complete process. These individuals provided feedback on the length and flow of the questions and the ease of access to the questionnaire platform. Pilot testers were invited to comment on the overall impression of the survey, ease of completion, and if they felt the content would be of interest to their professional group.

The questionnaire was hosted on Qualtrics at The University of Manchester and opened to all UK-based healthcare professionals and academics. The questionnaire was distributed (1) directly through relevant UK networks by email and word of mouth; and (2) via social media posting to target wider group participation. Posts also encouraged individuals to share the questionnaire with further professional networks where appropriate. The questionnaire excluded any professional who was not UK-based.

Results

Eighty-four individuals from NHS or UK higher education institutes responded to the survey, with 63 completing all questions. Within these responders, 52 provided demographic details, demonstrating a good split between professional job roles – 28% allied healthcare scientists, 26% nurses and 9% clinicians and across age groups. Most responders were female (77%). 48% of responders reported that they had used digital technology within research studies, with 27% having used digital technology for direct clinical care. Full participant demographics are provided in supplementary table S1.

Considering domain 1, the role of digital technology before, during and after cancer treatments. The majority (95%, strongly or somewhat agree) believed that digital technology has the potential to benefit cancer patients along their cancer treatment pathway (supplementary figure S1). The features considered most beneficial included direct communication with clinical teams (94%), monitoring mood (91%), and monitoring vital signs (87%) (Figure 1). Thematic analysis of free text responses identified reporting and management of treatment side effects as another potential area in which digital technologies could offer benefit.

Different features of digital technology were thought to be more beneficial at different points in existing treatment pathways (Figure 2). Before treatment (between initial diagnosis and starting cancer therapy), respondents ranked the ability of devices to provide insights into patients' own health (91% strongly/somewhat agree), baseline assessment of health (88%) and indications of fitness (87%) as most valuable.

During active treatment, digital technology was valued for the ability to monitor vital signs and glucose (96% and 93%, respectively). The continuous collection of toxicity metrics (91%), pain scores (94%) and fatigue scores (91%) were all ranked highly. Thematic analysis of the free text responses aligned with these findings and suggested a role for dietary monitoring. Respondents highlighted the importance of not over-burdening patients with digital measures during this time.

The highest ranked use of digital technology after cancer treatment was empowering rehabilitation (94%), with collection of toxicity/pain scores and fatigue scores ranked at 95% and 89%. In the free text responses, it was highlighted that digital technology should complement, not replace standard follow-up practices.

An additional question asked over what time scales digital technology might be useful after the end of active treatments. 75% saw value in short-term use (up to 3-months) whilst 73% saw value in follow-up to 1-year. Fewer respondents (61%) thought that digital technology would be valuable in monitoring patients throughout the entirety of routine cancer follow-up (supplementary figure S2).

Considering technical barriers to the use of digital technology, 51% (strongly/somewhat disagree) of responders felt digital technology was not well integrated into clinical care (supplementary Figure S3). Interoperability of devices (83%, strongly/somewhat agree), data accuracy (82%), and poor user design (80%) were identified as key barriers, Figure 3. The free text responses highlighted challenges relating to patient and staff education, accessibility of devices considering socio-economic aspects, finances, language and cultural barriers, and integration

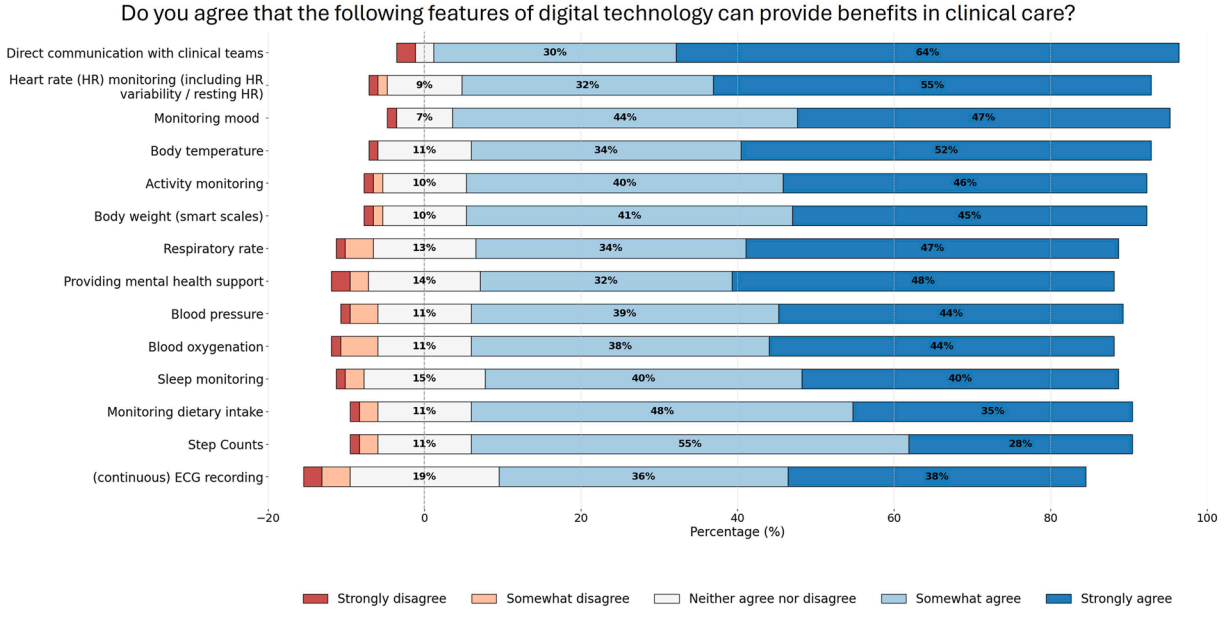
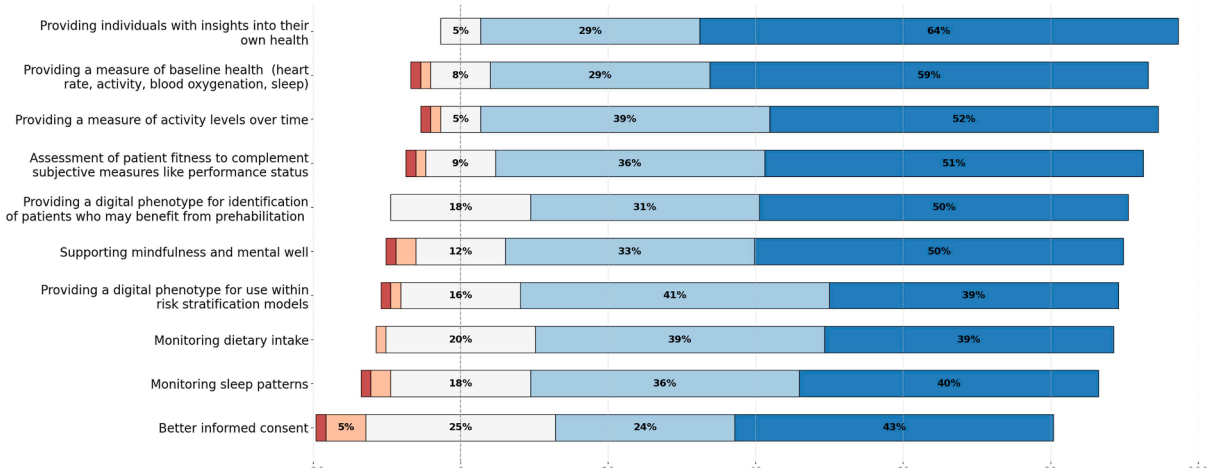
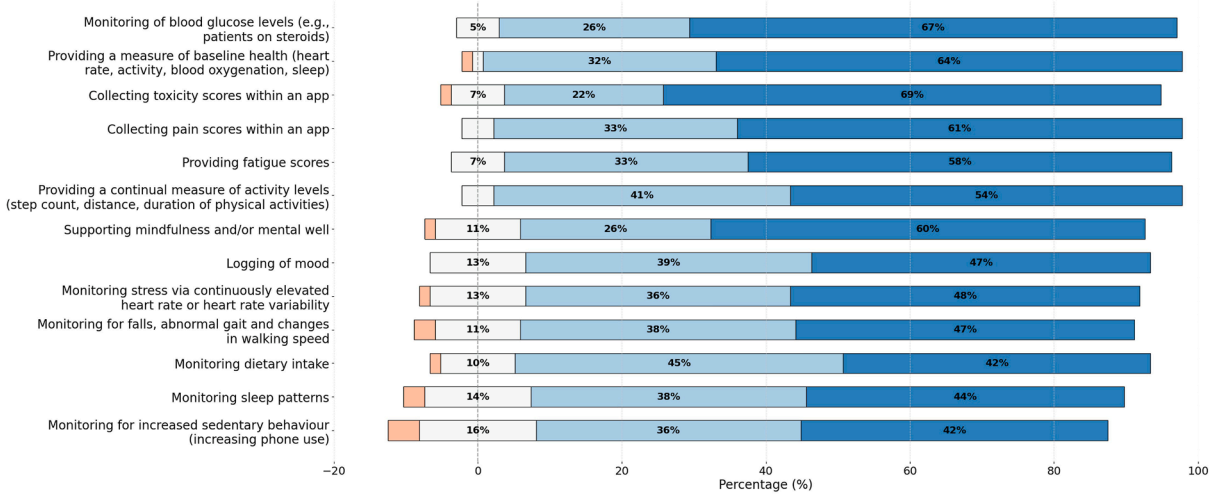


Fig 1. Ranking of responses to the question, 'Do you agree that the following features of digital-technology can provide benefit to cancer patients in clinical care?', n = 84. Participants ranked with strongly agree, somewhat agree, neither agree or disagree, somewhat disagree or strongly disagree for each feature listed.

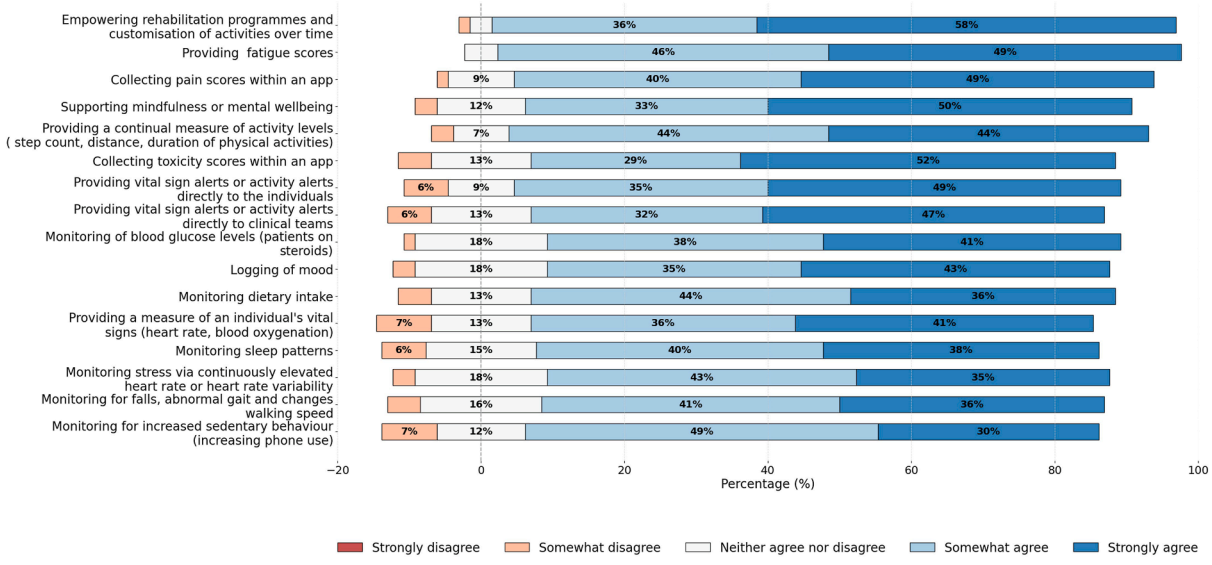
Thinking about before cancer treatment, where can digital technology complement existing care pathways to provide benefit to the patient and clinical care teams?



Thinking about during cancer treatment, where can digital technology complement existing care pathways to provide benefit to the patient and clinical care teams?



Thinking about after cancer treatment, where can digital technology complement existing care pathways to provide benefit to the patient and clinical care teams?



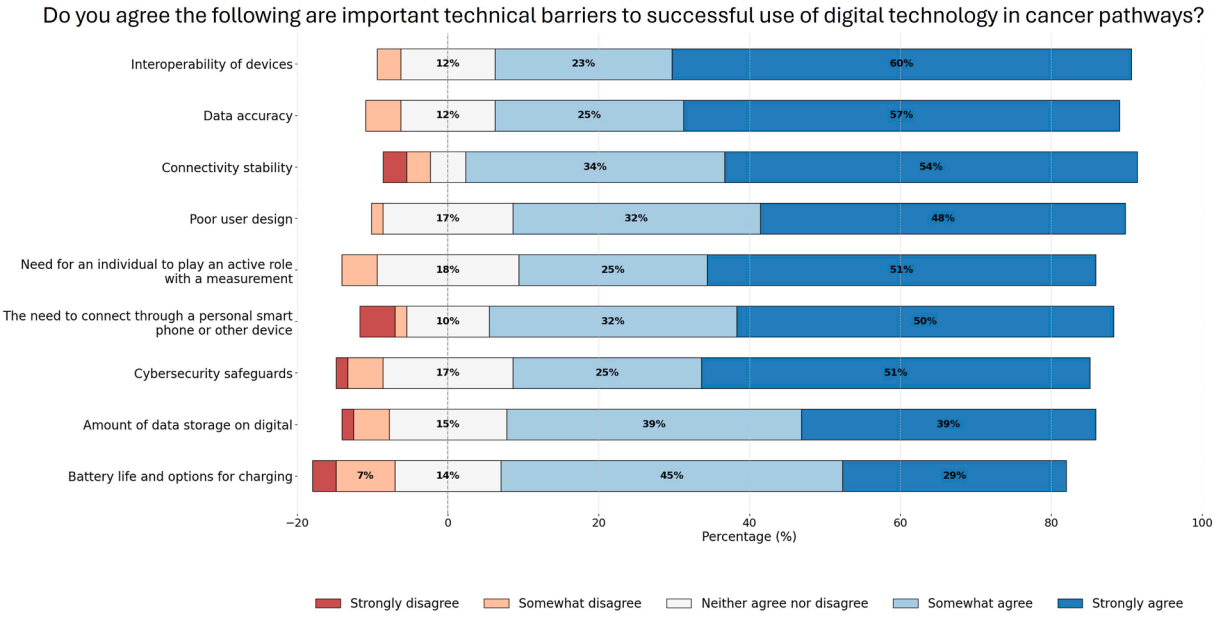


Fig 3. Ranking of responses to the question, 'Do you agree that the following are important technical barriers to successful use of digital-technology in clinical pathways?', n = 64. Participants ranked with strongly agree, somewhat agree, Neither agree or disagree, somewhat disagree or strongly disagree for each feature listed.

with existing technology for both the patient and the healthcare provider.

Only 6/64 (9.3%) of responders strongly agreed that hospital electronic patient records were ready for integration of digital technology (supplementary Figure S4). Regarding the preparation of data for inclusion in health records, there was uncertainty over who should take responsibility, with some respondents favouring a requirement for the device manufacturer to format and present data to a minimum agreed standard accessible for inclusion directly in electronic health records, whereas other responders favoured local processing of the data to select and format the data (Supplementary Figure S5). 41.2% of responders (26/63) agreed that a common data standard was needed for routinely used data elements needed in healthcare (supplementary Figure S5). In terms of local governance procedures for using digital technologies, most responders were not aware of any local policies for using a provided (72.6%) or a patient's own (71%) digital technology for monitoring (Supplementary Figure S6).

Figure 4 shows the ranking for who should take responsibility for monitoring outputs of digital technology within a clinical study and in the setting of routine clinical care. The specialist cancer team was seen to be most appropriate for monitoring within a study, with 77.4% of participants agreeing. For long-term monitoring in routine care, community healthcare providers were seen to be the most appropriate, with 53.2% agreeing. For both scenarios, most respondents agreed that the patient should also play a central role in monitoring their digital technology, with 46.8% within a study and 54.8% in long-term monitoring agreeing.

Considering domain 3, human factors (patients and healthcare workers) relating to the use of digital technology in cancer pathways. Figure 5 highlights the agreement with the statement 'Do you believe that digital technology will both (1) aid management of side effects of treatment and (2) improve patient empowerment – with 88.9% and 92.2% either strongly or somewhat in agreement, respectively.

Figure 6 (a) depicts how we can best support patients in using digital technology during a study period and (b) as part of routine care for longer-term monitoring. During a study period, the focus was on providing continual support (96%) and education for the clinical team to ensure high digital literacy (87%). For long-term monitoring, patient education was most important (96%) and the involvement of carers or family members (95%). In both scenarios, consideration for cultural considerations in how devices may be used or seen by a community was highly ranked, with this identified as an important theme in the free text response. Finally, for delivering information to an individual (supplementary figure S7), direct messaging with clear instructions was seen as most appropriate (83.9%). Finally, supplementary figure S8 ranks ethical considerations with responsibility for how to respond to abnormal readings (92%), inclusivity and equity in service (91%) and considerations for vulnerable adults and children (86% and 85%, respectively) ranked as the most important considerations.

Fig 2. Shows the responses to the question about how digital technology can best complement existing cancer care pathways for before, during and after treatment, n= 68. For each participants were asked to ranked each feature with strongly agree, somewhat agree, Neither agree or disagree, somewhat disagree or strongly disagree. Free text was also available to list additional options not included in the list.

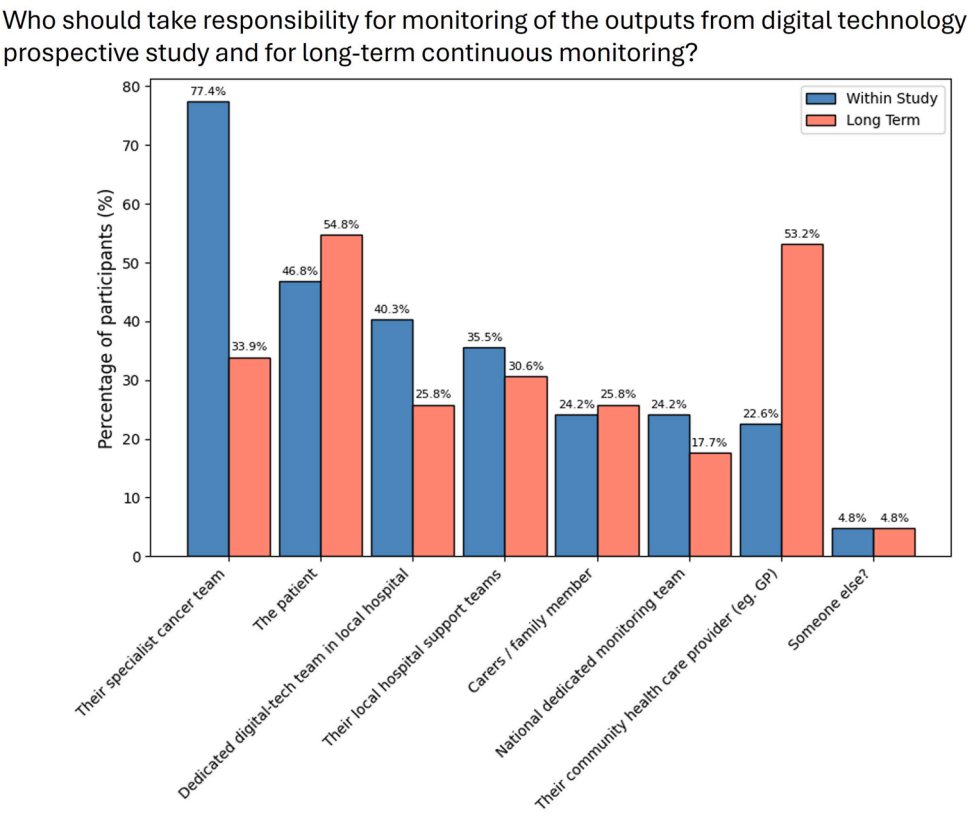


Fig 4. Percentages of participants who selected each answer for the question 'Who should take responsibility for monitoring of the outputs from digital technology)', for (**A**) within a prospective study and (**B**) for continuous long-term monitoring, n = 63. Participants could select all responses they believed appropriate.

Discussion

We report the results from a cross-sectional questionnaire targeting healthcare professionals involved at all stages of the cancer treatment pathway. Our multidisciplinary participants included a broad range of professionals and an even representation between those that had and had not used digital technology in studies involving patients with cancer. There was an almost universal agreement that digital technology had the potential to provide benefit across the cancer pathway, with 95% of participants strongly or somewhat agreeing with that statement. However, despite this potential, the primary limitation remains the lack of integration into routine care and electronic health records, with 51% highlighting this limitation. From a patient perspective, it was seen that appropriate and careful use of digital technology (avoiding over-burdening patients) could enhance empowerment.

A strength of our approach was to explore the features of digital technology which could complement current cancer care pathways before, during and after treatment. Although common features were identified, differences were seen that could be utilised. Before treatment, measures routinely captured by a device like heart rate, sleep, and activity could complement current performance and frailty metrics by providing longer-term trends that accurately reflect a patient's home setting and avoid recall and questionnaire bias. Such measures may assist in identifying patients where prehabilitation would be beneficial or in whom certain treatments may be too onerous or inappropriate. They could also streamline pre-treatment preparation for some patients by avoiding the need for time-consuming tests such as cardiopulmonary exercise testing. During treatment, symptom and toxicity monitoring was ranked highest. Similarly, after treatment, symptom monitoring remained highest ranked and was seen to enable better remote monitoring.

A mismatch between digital innovation and institutional informatics infrastructure was highlighted, with $<$10% strongly agreeing that their local systems were ready for digital technology. Part of this issue may be that no common approaches were identified for data processing where commercially available devices are to be used. There is a stated desire (41%) for a standardised data format for common data items, but an awareness that this would be difficult when discussing with manufacturers, primarily when the use of consumer-grade devices in healthcare is likely to represent a small share of device sales in a health and wellbeing market. Alongside the technical barriers, we identified uncertainty in the governance of using a provided device or a patient's own device as part of their treatment pathway, with $>$70% of respondents unaware of local procedures or policies.

Some of the largest disagreement between responses was found in the question asking if 'Digital technology is

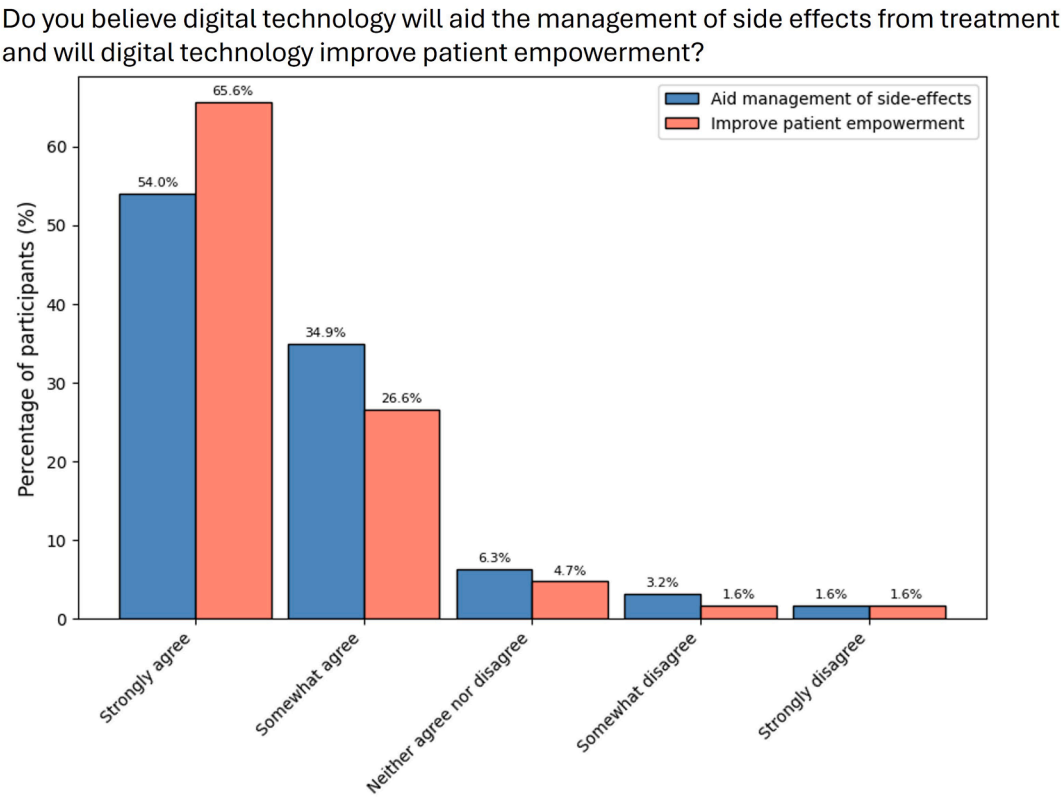


Fig 5. Ranking of responses to the questions, 'Do you believe digital-technology will aid the management of treatment side-effects?' and 'Do you believe digital technology will improve patient empowerment?' n = 63. Participants ranked with strongly agree, somewhat agree, Neither agree or disagree, somewhat disagree or strongly disagree for each question.

currently well integrated into clinical care?", with 33 saying somewhat or strongly disagree and 13 saying they agreed with the statement. When exploring this answer against participant demographics, there were no associations identified with any category. In particular, it is interesting to note there were no associations with those that had or had not used digital technology as part of a clinical study. Some of those who had used digital technology in clinical studies said they strongly disagreed with the statement and others said they somewhat agreed. This may reflect that each institution has its own procedures (or lack procedures) to support the use of digital technology.

In our final section exploring human factors, our results align with previous literature, for example Collinson *et al.* [18]. Digital literacy is the key consideration and needs to be bi-directional, with both the patient and clinical teams trained to acceptable standards. 88% of participants agreed that continuous support for the successful use of digital technology was needed, requiring considerations on staff roles and responsibilities as such studies are developed. Different responsibilities were highlighted for clinical studies versus long-term continual monitoring, with patient self-monitoring also endorsed in both scenarios, suggesting a need to develop shared-care models for digital technology. This last point also needs careful consideration of responsibilities for responding to abnormal readings (ranked highest in the ethical considerations question >90% agree), with clearly defined pathways to escalate readings whilst avoiding the potential for alert fatigue which is inherent in continuous monitoring.

Results have highlighted that digital technologies should be positioned as an adjuvant tool to complement, not replace, face-to-face clinical workflows. There is a lack of oncology-specific validation studies, with these needing to be focused on the domains and features highlighted as the most beneficial to clinical practice and patient needs. Validation studies could be focused in two ways: (1) validating the data provided from consumer-grade devices that the signal is clinically useful for a given study; or (2) validating that they can reliably predict outcomes of importance for patients, even if such data doesn't match what we might get compared to a medical device reference standard. For the latter, large-scale data collection studies are needed to build datasets which could be used to discover and validate such digital biomarkers; for example, the 'Manchester Data Contributor programme' aims to build such a dataset [19]. How best to integrate digital technology into clinical workflow should be co-designed with both the patient and their clinical teams. As it's heart, integration needs to consider ways to minimise additional burden from the use of digital technology. To this end, we suggest the following focus areas for the oncology community to work together to provide clear future directions for guidelines and policy to maximise the potential of digital technology in oncology:

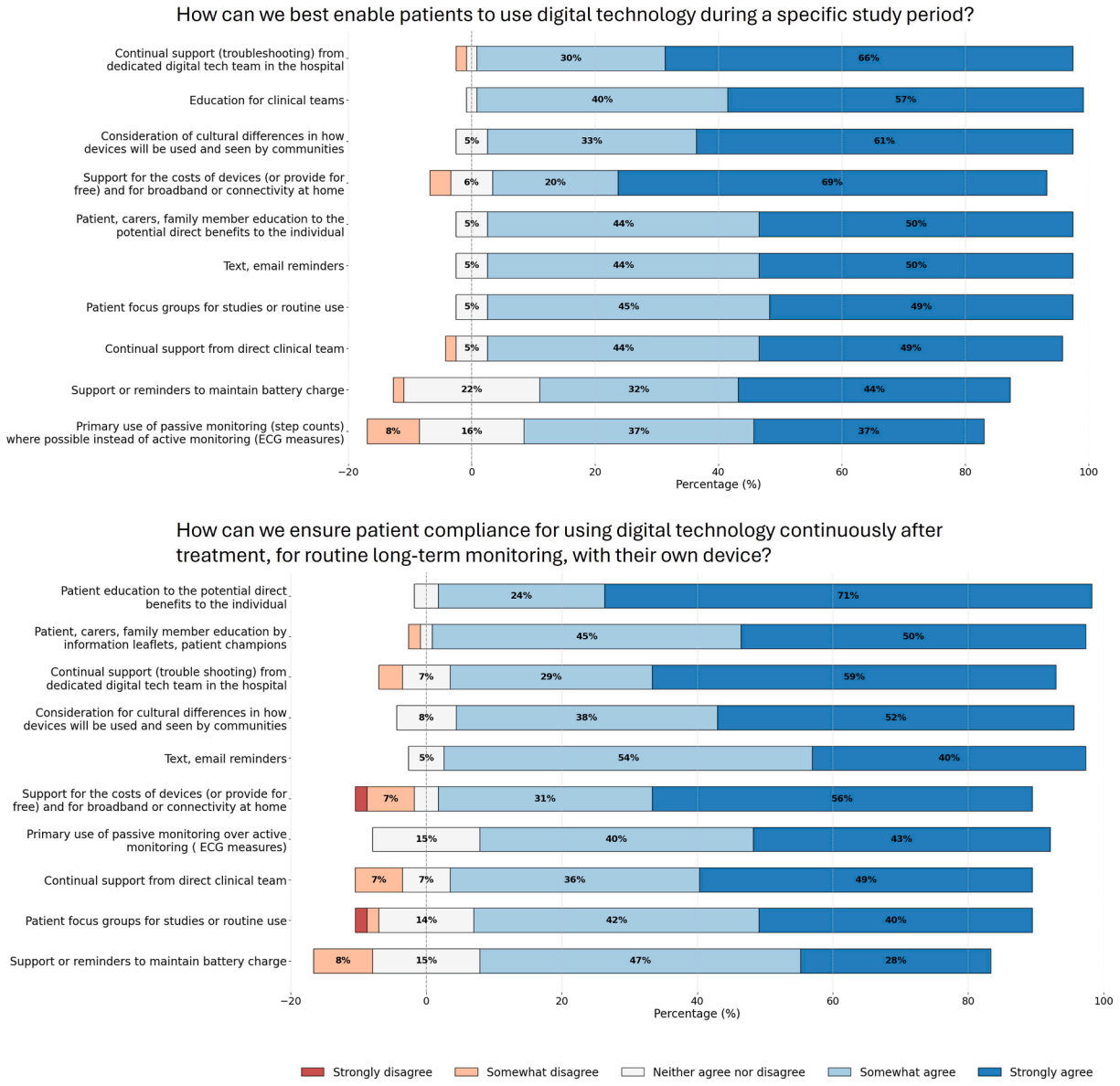


Fig 6. Ranking of responses to the questions, 'How can we best enable patients to use digital technology during a specific study period?' and 'How can we ensure patient compliance for using digital technology continuously after treatment, for routine long-term monitoring, with their own device?' n = 63. Participants ranked with strongly agree, somewhat agree, Neither agree or disagree, somewhat disagree or strongly disagree for each question.

1. Development of oncology-specific digital technology implementation guidelines, including a governance framework describing roles and responsibilities for the successful and safe use of digital technology within cancer care pathways.
2. Working with national professional bodies, develop a position statement for a standardised format for common data items and interoperability standards for integration with electronic health record systems, supported through ongoing open dialogue with manufacturers.
3. Embedded digital health education into oncology training and continual professional development activities to support best practice use of digital technology.

In conclusion, this survey of UK-based healthcare professionals and academics has demonstrated that digital technologies are viewed as potentially valuable tools across the cancer pathway. The participants agreed that digital technologies should complement and add value to current practice, with contact between patient and clinical teams maintained. Integration, interoperability, design, and human factors need to be addressed to enable effective and equitable clinical adoption. However, digital technology was seen

by the majority of participants to show the potential to benefit self-empowerment of patients throughout their cancer treatment.

CRediT Statement

Alan McWilliam: Conceptualization, Project administration, Methodology, Formal analysis, Writing – original draft, Writing – review and editing.

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Kathryn Banfill: Conceptualization.

Alison Birtle: Conceptualization.

Samuel Ingram: Conceptualization, Writing – review and editing.

Gareth Kitchen: Conceptualization.

Zoe Merchant: Conceptualization, Writing – review and editing.

Sally Taylor: Conceptualization, Writing – review and editing.

Harriet Unsworth: Conceptualization.

Anthony Wilson: Conceptualization, Writing – review and editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clon.2026.104297.

References

[1] Gupta A, Stewart T, Bhulani N, Dong Y, Rahimi Z, Crane K, *et al*. Feasibility of Wearable Physical Activity Monitors in Patients With Cancer. *JCO Clin Cancer Inform* 2018;2:1–10. https://doi.org/10.1200/CCI.17.00152.

[2] Cloß K, Verket M, Müller-Wieland D, Marx N, Schuett K, Jost E, *et al*. Application of wearables for remote monitoring of oncology patients: A scoping review. *Digit Health* 2024;10. https://doi.org/10.1177/20552076241233998.

[3] The Dime Society Playbook. https://playbook.dimesociety.org/playbooks/the-playbook/[Assessed 2nd March 2026].

[4] Hu S, Song D, Wan S, Zhang S, Luo C, Li N, *et al*. Digital health: current applications, challenges, and future directions for enhancing healthcare quality and safety. *Front Public Health* 2025;13:1646802. https://doi.org/10.3389/fpubh.2025.1646802.

[5] Beg MS, Gupta A, Stewart T, Rethorst CD. Promise of wearable physical activity monitors in oncology practice. *J Oncol Pract* 2017;13(2):82–89. https://doi.org/10.1200/jop.2016.016857.

[6] Beauchamp UL, Pappot H, Holländer-Mieritz C. The use of wearables in clinical trials during cancer treatment: systematic review. *JMIR Mhealth Uhealth* 2020;8(11):e22006-e206-e. https://doi.org/10.2196/22006.

[7] Ravizza A, De Maria C, Di Pietro L, Sternini F, Audenino AL, Bignardi C. Comprehensive review on current and future regulatory requirements on wearable sensors in preclinical and clinical testing. *Front Bioeng Biotechnol* 2019;7:313. https://doi.org/10.3389/fbioe.2019.00313.

[8] Awick EA, Phillips SM, Lloyd GR, McAuley E. Physical activity, self-efficacy and self-esteem in breast cancer survivors: a panel model. *Psychooncology* 2017;26(10):1625–1631. https://doi.org/10.1002/pon.4180.

[9] Ballinger TJ, Althouse SK, Olsen TP, Miller KD, Sledge JS. A personalized, dynamic physical activity intervention is feasible and improves energetic capacity, energy expenditure, and quality of life in breast cancer survivors. *Front Oncol* 2021;11:626180. https://doi.org/10.3389/fonc.2021.626180.

[10] Backman M, Wengstrom Y, Johansson B, Skoldengen I, Borjesson S, Tarnbro S, *et al*. A randomized pilot study with daily walking during adjuvant chemotherapy for patients with breast and colorectal cancer. *Acta Oncol* 2014;53(4):510–520. https://doi.org/10.3109/0284186X.2013.873820.

[11] Bade BC, Hyer JM, Bevill BT, Pastis A, Rojewski AM, Toll BA, *et al*. A patient-centered activity regimen improves participation in physical activity interventions in advanced-stage lung cancer. *Integr Cancer Ther* 2018;17(3):921–927. https://doi.org/10.1177/1534735418781739.

[12] Bade BC, Gan G, Li F, Lu L, Tanoue L, Silvestri GA, *et al*. Randomized trial of physical activity on quality of life and lung cancer biomarkers in patients with advanced stage lung cancer: a pilot study. *BMC Cancer* 2021;21(1). https://doi.org/10.1186/s12885-021-08084-0.

[13] Shammas-Toma M, Sampieri G, Xie M, Maxwell A, Esemezie A, Pham Q, *et al*. Wearable Technologies in Head and Neck Oncology: Scoping Review. *JMIR Mhealth Uhealth* 2025 Oct 10;13:e72372. https://doi.org/10.2196/72372.

[14] Bekkering WP, Vliet Vlieland TP, Koopman HM, Schaap GR, Beishuizen A, Anninga JK, *et al*. A prospective study on quality of life and functional outcome in children and adolescents after malignant bone tumor surgery. *Pediatr Blood Cancer* 2012;58(6):978–985. https://doi.org/10.1002/pbc.23328.

[15] Braam KI, van Dijk-Lokkart EM, Kaspers JL, Takken T, Huisman J, Bierings MB, *et al*. Cardiorespiratory fitness and physical activity in children with cancer. *Support Care Cancer* 2016;24(5):2259–2268. https://doi.org/10.1007/s00520-015-2993-1.

[16] Lazarou I, Krooupa A-M, Nikolopoulos S, Apostolidis L, Sarris N, Papadopoulos S, *et al*. Cancer Patients' Perspectives

and Requirements of Digital Health Technologies: A Scoping Literature Review. *Cancers* 2024;16(13):2293. https://doi.org/10.3390/cancers16132293.

[17] Webster A, Fog LS, Hall E, van Rossum PSN, Nevens D, Montay-Gruel P, *et al*. ESTRO guidelines for developing questionnaires in survey-based radiation oncology research. *Clin Transl Radiat Oncol* 2024;51:100895. https://doi.org/10.1016/j.ctro.2024.100895.

[18] Collinson S, Ingram-Walpole S, Jackson C, Soliman A, Chan AKC, Tholouli E, *et al*. Patient Experiences of Using Wearable Health Monitors During Cancer Treatment: A Qualitative Study. *Clin Oncol (R Coll Radiol)* 2025;37:103664. https://doi.org/10.1016/j.clon.2024.10.036.

[19] Open Science Framework, Manchester Data Contributor Programme. [Accessed March 23rd 2026]. https://doi.org/10.17605/OSF.IO/V9Q3H