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Digital health readiness – insights from healthcare leaders in operational management: a cross-sectional survey

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Abstract

Background Developing countries' public health systems struggle with digital health implementation, and reports of low digital health readiness exist within the workforce. This study investigates the perceived digital health readiness of healthcare leaders in operational management to implement digital health tools.

Methods A cross-sectional survey using the E-Ready 2.0 scale was used to measure digital health readiness ($n=329$) in 11 hospitals in the Western Cape, South Africa (September 2023 – March 2024). Descriptive statistics summarised respondent characteristics and the E-Ready 2.0 subscales: conditions for change at the workplace and among individuals, support and engagement from management, colleagues' readiness, consequences for the status quo and workplace attitudes. Statements scoring 60% or more were considered to have higher readiness. Chi-square and Mann–Whitney U tests were used to examine associations between demographic variables and subscale statements.

Results A total of 143 healthcare leaders responded (56.1% response rate) ($n=114$ nurses [79.7%], $n=29$ medical doctors [20.3%]). The average age was 46.4 ± 10.0 years. Overall, higher levels of readiness (above 70%) were observed with statements related to workplace attitudes, whereas conditions for change at the workplace and among individuals showed lower readiness (below 50%).

Conclusion Despite significant investment in digital health tools, there remains limited digital health readiness among those responsible for leading these implementations.

Keywords Digital health readiness, Operational management, Health information systems, Implementation changes, Leadership

Background

The World Health Organization (WHO) defines digital health as the field of knowledge and practice associated with the development and use of digital health tools to improve health [1]. Digital health tools are software applications used by healthcare professionals to support healthcare services [2, 3], for example, supporting clinical decision making and streamlining administrative and research procedures within health systems [2, 4].

Approximately 30% of the world's data volume is generated in healthcare [5] including South Africa. Data are often fragmented across various health settings, leading to incomplete utilisation of these data [6]. Digital health tools, such as electronic medical records, support the integration and streamlining of healthcare data to improve service delivery, decrease the cost of healthcare, and improve the quality of care delivery [7–9].

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In South Africa, the use of digital health tools is widespread, implementation and progress varies across hospitals. These tools include hospital information systems [10], electronic health records [11], telemedicine platforms [12] and mobile health applications [13]. Additionally, virtual health services such as teleconsultation and e-prescription [14] are also widely used. An example of a digital health dashboard is the COVID-19 dashboard, launched in 2020 in the Western Cape, which provided users with up-to-date and accurate information about COVID-19 [15]. Numerous healthcare settings can benefit greatly from the adoption of digital health tools. However, adoption requires digital health readiness [16–20].

The digital health readiness of healthcare leaders in operational management refers to the ability to lead and manage effectively within the digital health environment, particularly during periods of system transformation and rapid technological innovation [21–23]. Part of digital health readiness includes adequate competence to manage the complexities of digital health and drive innovation to optimise the benefits of digital technologies in healthcare delivery [22, 24, 25]. Digital health readiness varies both globally [9, 23, 24, 26] and nationally [25, 27–31], and the significant variation in levels of digital health readiness in the workplace remains a challenge [23, 32, 33]. Factors such as resistance to change, inadequate training in technical skills, poor digital infrastructure, lack of organisational and individual readiness and support, financial constraints, and inadequate resource allocation within healthcare systems influence digital health readiness [16, 28, 32, 34–36].

Healthcare leaders in operational management are typically experienced nurses and medical doctors responsible for the oversight and management of day-to-day functions in healthcare facilities [37–39]. These healthcare leaders are responsible for the implementation of new innovations, such as digital health tools, but often have limited knowledge of implementation science and poor digital health readiness [21, 23, 37, 38, 40]. To ensure the successful integration of digital health tools, healthcare leaders must have high levels of readiness, understand technology changes, and embrace new technologies [21, 37, 41]. Understanding the level of digital health readiness in organisations can assist with in the development of support strategies for future digital health tool implementation [23, 40].

This study investigates digital health readiness among healthcare leaders in operational management across hospitals at various stages of digital health tool implementation. It focuses on themes related to planning workplace change: capacity to change, motivation to change, leadership promoting change, culture to change, and characteristics of the implementation object [9, 36, 40]. First, the capacity to change considers the individual (competence, experience, support and training) and organisational factors contributing to the capacity to use digital health tools [25, 33, 36, 42]. Second, motivation to change considers personal and individual motivation. This includes experience, willingness, trust and positive attitudes toward working with digital health solutions [20, 36]. Third, leadership promoting change is concerned with the need for change and guidance in the implementation of digital health tools which is central to readiness [18, 21]. Fourth, changing culture affects how colleagues perceive and value change [40, 43]. Finally, the characteristics of the implementation object refer to the practical aspects of the integration of digital health tools into existing workplace routines [34].

Therefore, this study aims to investigate the digital health readiness of healthcare leaders in operational management, a group that has been previously under researched in the literature, by focusing on their capacity for change, motivation to change, leadership's role in promoting change, organisational culture's support for change, and characteristics of the implementation object, to gain valuable insight into their current capabilities and potential barriers to digital health tool implementation within healthcare systems.

Methods

Research design

A cross-sectional survey was used to investigate the perceived digital health readiness of healthcare leaders in operational management to implement digital health tools.

Setting

To ensure diverse representation, various categories of public hospitals in the Western Cape, South Africa, were included in this study. The hospitals in this study have varying levels of digital health tool implementation, with both current and planned initiatives across all hospitals. The South African Department of Health categorises public hospitals into district, regional, tertiary, central and specialised hospitals [44]. District Hospitals: Serve a defined local population, offering basic inpatient, outpatient, and emergency services with limited specialist care. They typically have 50–600 beds and are supported by regional hospitals. Regional Hospitals: Provide more specialised services (with 200–800 beds) within provincial boundaries, offering 24-h care and referring patients to tertiary hospitals for advanced treatment. Tertiary Hospitals: These hospitals offer subspeciality services, with 400–800 beds, and receive referrals from regional hospitals across provinces. Central Hospitals: Provide advanced tertiary care for multiple provinces with up to

1200 beds. They are affiliated with universities and are required to conduct training and research. Specialised Hospitals: Focus on specific services such as psychiatry, tuberculosis, infectious diseases, or rehabilitation, with up to 600 beds.

Sample

The study population included healthcare leaders in operational management in selected health services (nurses and medical doctors in general and specialist health services $N=329$). Purposive sampling was used to identify three out of the six districts (Cape Town Metropolitan, Cape Winelands, and Overberg) and to recruit healthcare leaders in operational management. Healthcare leaders were included based on their active role in day-to-day management within their respective hospital departments, namely, decision-makers regarding patient care-related issues, staffing and material resources.

The districts chosen for the study represented diverse healthcare settings, from urban to rural areas. The inclusion of healthcare leaders from different categories of hospitals ensured representation across various levels of care. A sample size of 178 was calculated using the Raosoft online calculator [45] on the basis of a desired confidence level of 95%, margin of error of 5% and proportion of 50%.

Questionnaire

A self-administered questionnaire based on the E-Ready 2.0 scale was administered to measure individual and organisational readiness to facilitate eHealth implementation in healthcare [40]. The scale includes a hands-on guidebook providing suggestions and activities to promote implementation in low scoring themes of capacity to change, motivation to change, leadership promoting change, culture to change, and characteristics of the implementation object; however, it does not provide scoring instructions. The scale allows researchers to choose a specific eHealth initiative, for example, "Sufficient allocated time to implement… *digital health tools such as a digital health dashboard*" and "Feel comfortable working with… *digital health tools such as a digital health dashboard*".

The scale consists of six subscales and 32 statements that investigate 1) perceived conditions for change in the workplace for example, competency and resources for practice change; 2) perceived individual conditions for change, for example, prior experience of changing practice; 3) perceived support and engagement among management, for example, how urgency for change is communicated by management; 4) perceived readiness among colleagues, for example, how change is collectively valued by colleagues; 5) perceived consequences for the status quo, for example, worries regarding how practice change can influence current workflows; and 6) perceived workplace attitudes toward change, for example, self-reported attitudes toward the proposed change. In addition, three single items were investigated: compatibility with current work routines, commitment to change and perceived need for change (Table 1).

Likert-type scales were used to measure the agreement of statements in each subscale including the three additional items, in terms of readiness. The scales had different response options (Table 1). The pilot version demonstrated a questionnaire completion time of 10 min.

Data collection

Data were collected from September 2023 to March 2024 using a self-administered questionnaire in 11 hospitals. Both paper and online formats were used, on the basis of the individual preference. Study data were collected and managed using REDCap (Research Electronic Data Capture) [46, 47].

The department heads were contacted and informed about the study through email or telephone calls. Additionally, they were asked to identify potential participants who met the inclusion criteria of the study, introduce the study to individuals, and ascertain who would be willing to participate.

The link to the online questionnaire was sent to email addresses provided by department heads; an open link/QR code was also sent to department heads to distribute to individuals. The paper questionnaire was given to individuals at arranged meetings. To provide participants with the flexibility to respond at their convenience, both paper and electronic questionnaires were made available for completion over an extended period. With the electronic questionnaire, participants had the benefit of being able to leave the page and return to where they left off using a unique link that was sent to their individual email address once leaving the page. The researcher was notified when the completed paper questionnaires were ready for collection at each facility, with an average completion time of two weeks.

Statistical analysis

The data were analysed using IBM SPSS Statistics (Version 29.0) [48]. Descriptive statistics were used to analyse the demographic variables of the respondents, and frequencies were calculated for each statement in the scale. The Likert-type scales were recoded, and two categories were created: lower readiness (scores 0 and 1 were recoded as "1") and higher readiness (scores 2 and 3 were recoded as "2"). The subscale on *perceived consequences for the status quo* was recoded as follows; lower readiness

Table 1 Layout of the E-Ready 2.0 scale

Subscales/additional items	Rating scale	Statement/s	Original study α	This study α	Theme
Perceived conditions for change at the workplace	0 = Does not exist at all, 1 = Exists to a small extent, 2 = Exists to a fairly large extent, 3 = Exists to a large extent	8	.69	.97	Capacity
Perceived individual conditions for change	0 = Does not exist at all, 1 = Exists to a small extent, 2 = Exists to a fairly large extent, 3 = Exists to a large extent	3	.56	.98	Motivation
Perceived support and engagement among management	0 = Not at all, 1 = To some extent, 2 = Fairly large extent, 3 = Large extent	5	.84	.97	Leadership
Perceived readiness among colleagues	0 = Not at all, 1 = To some extent, 2 = Fairly large extent, 3 = Large extent	5	.72	.97	Culture
Perceived consequences on status quo	0 = Considerably worse, 1 = Somewhat worse, 2 = Unchanged, 3 = Slightly better, 4 = Much better	5	.87	.96	Implementation object characteristics
Perceived workplace attitudes toward change	0 = Very negative, 1 = Rather negative, 2 = Rather positive, 3 = Highly positive	3	.77	.86	Motivation
Compatibility	0 = Not at all, 1 = Quite bad, 2 = Quite good, 3 = Very good	1	n/a	n/a	Implementation object characteristics
Commitment	0 = Passive, 1 = Rather passive, 2 = Rather active, 3 = Active	1	n/a	n/a	Motivation
Need for change	0 = Pointless, 1 = Some value, 2 = Fairly great value, 3 = Great value	1	n/a	n/a	Implementation object characteristics

Source: Author creation using the E-Ready 2.0 scale domains, subdomains and statements. Dannapfel, P., Thomas, K., Chakhunashvili, A., Melin, J., & Trolle Lagerros, Y. (2022). A Self-help Tool to Facilitate Implementation of eHealth Initiatives in Health Care (E-Ready): Formative Evaluation. JMIR Formative Research, 6(1), e17568. https://doi.org/10.2196/17568

(scores 0 and 1 were recoded as "1"), higher readiness (scores 3 and 4 were recoded as "3") and unchanged (score 2 remained "2") (Table 1).

In the analysis, the threshold for readiness was set at 60%. This decision was based on recommendations from the developer of the E-Ready 2.0 scale [40]. As a result, scores of 60% and above indicated higher readiness, whereas scores of less than 60% indicated lower readiness. For example, statements in the subscales needed to be rated 2 or 3 (3 or 4 for *perceived consequences for the status quo)* to be classified as higher readiness, which corresponds to a score of 60% and above.

Group comparisons based on age in years, years worked at their current workplace, and overall experience in years in the healthcare industry were performed via Chi-square tests and Mann–Whitney U tests. The threshold for statistical significance was $p < 0.05$.

Results

There were 255 surveys distributed, and 143 completed surveys were returned (response rate 56.1%). The respondents were mostly female (81.1%, $n = 116$). The mean age was 46.4 (± 10.0) years, ranging from 25 to 63 years. Most were nurses (79.7%, $n = 114$), and the remaining were medical doctors (20.3%, $n = 29$). On average, the respondents had 22.4 (± 11.3) years of experience in healthcare and reported an average of 12.7 (± 10.5) years of service at their current workplace (Table 2).

Nurses were older on average than medical doctors were (48.7 ± 8.6 vs. 37.4 ± 10.2 years respectively, U = −4.9 $p = < 0.001$). Nurses reported having more years of experience in healthcare than medical doctors (24.9 ± 10.1 vs 12.7 ± 10.5 years respectively, U = −5.0 $p = < 0.001$). Nurses also reported more service years in their current workplace than medical doctors (14.7 ± 10.6 vs 4.9 ± 5.6 years respectively, U = −4.8 $p = < 0.001$) (Table 2).

The respondents were from district (28.0%, $n = 40$), regional (13.3%, $n = 19$), tertiary/central (24.5%, $n = 35$) and specialist hospitals (34.3%, $n = 49$), working in various settings such as emergency (9.2%, $n = 13$), mental health (33.1%, $n = 47$), general (36.6%, $n = 52$) and other specialist areas (21.1%, $n = 30$) (Table 2).

Table 2 Demographic characteristics ($n = 143$)

Variables/Professional role	Nursing $n = 114$ (79.7%)	Medical Doctor $n = 29$ (20.3%)	All $n = 143$	Test	P
Gender				X^2=0.66	.418
Male	20 (18.5%)	7 (24.1%)	27 (18.9%)		
Female	94 (82.5%)	22 (75.9%)	116 (81.1%)		
Age in years (Mean ± SD)	48.7 (± 8.6)	37.4 (± 10.2)	46.4 (± 10.0)	$U = -4.9$	< .001
25–35	9 (8.1%)	14 (48.3%)	23 (16.1%)	X^2=29.8	< .001
36–49	43 (38.7%)	10 (34.5%)	53 (37.1%)		
≥ 50	59 (53.2%)	5 (17.2%)	64 (44.8%)		
***Area of work**				X^2=34.2	< .001
Emergency	8 (7.1%)	5 (17.2%)	13 (9.2%)		
Mental health	26 (23.0%)	21 (72.4%)	47 (33.1%)		
General	49 (43.4%)	3 (10.3%)	52 (36.6%)		
Other specialist area	30 (26.5%)	5 (17.2%)	30 (21.1%)		
Years of experience in healthcare (Mean ± SD)	24.9 (± 10.1)	12.7 (± 10.5)	22.4 (± 11.3)	$U = -5.0$	< .001
≤ 10	8 (7.1%)	13 (44.8%)	21 (14.7%)	X^2=25.8	< .001
≥ 10	104 (92.9%)	16 (55.2%)	120 (85.1%)		
Hospital type				X^2=13.0	.005
District	25 (21.9%)	15 (51.7%)	40 (28.0%)		
Regional	17 (14.9%)	2 (6.9%)	19 (13.3%)		
Tertiary/Central	27 (23.7%)	8 (27.6%)	35 (24.5%)		
Specialist	45 (39.5%)	4 (13.8%)	49 (34.3%)		
Years of service at current workplace (Mean ± SD)	14.7 (± 10.6)	4.9 (± 5.6)	12.7 (± 10.5)	$U = -4.8$	< .001
≤ 5 years	25 (22.1%)	21 (72.4%)	46 (32.2%)	X^2=27.5	< .001
6–9 years	16 (14.2%)	3 (10.3%)	19 (13.3%)		
≤ 10 years	72 (63.7%)	5 (17.2%)	77 (53.8%)		

Source: The authors

X^2= Pearson chi-square test; U = Mann–Whitney U Test

* Area of work: General (e.g., medical, surgical, orthopaedic, paediatric, outpatient), other specialist areas (critical care units, midwifery/obstetrics, oncology, operating theatre), mental health (adult and child/adolescent)

Digital health readiness

The subscales and statements concerning motivation to change, and implementation object characteristics were associated with higher digital health readiness (more than 60%). However, while the motivation to change theme overall showed higher readiness, there were also some subscales and statements within this theme that showed lower readiness (less than 60%). In addition, themes associated with leadership promoting change, culture to change and capacity to change were also associated with lower readiness (less than 60%) (Table 3).

The motivation to change theme focused on prior experience with changing practices, self-reported attitudes towards the proposed change, and willingness to commit to change. This theme included two subscales: *perceived workplace attitudes toward change* (three statements), and *perceived individual conditions for change* (three statements), along with an additional statement on *commitment to change*. The highest readiness scores were related to *perceived workplace attitudes towards change* with high agreeability among respondents, well above the 60% threshold. Most respondents (89%, $n = 127$) viewed their manager's attitude towards digital tool implementation positively, whereas 86% ($n = 123$) had positive attitudes themselves. However, only 71% ($n = 100$) believed their colleagues had positive attitudes towards digital tool implementation. Additionally, 60% ($n = 99$) indicated that they would take an active role in implementing digital tools. In contrast, the section on *perceived individual conditions for change* had the lowest readiness scores. Less than half of the respondents had experience with digital solutions (45%, $n = 65$), and there was low readiness for competency (44%, $n = 63$) and comfort (45%, $n = 64$) in working with digital tools (Table 3).

The implementation object characteristics theme focused on practice changes affecting current workflows, compatibility with existing routines, and the recognised need for change. The theme included one subscale on:

Table 3 The E-Ready 2.0 scale organised into subscales/additional items and statements from higher to lower readiness and corresponding themes

Subscales/additional items	Statement/s	Higher readiness % (n)	Lower readiness % (n)	Theme
Perceived workplace attitudes towards change	Your manager's attitude	89% (127)	11% (16)	Motivation
	Your attitude	86% (123)	14% (20)	Motivation
	Among colleagues	71% (101)	29% (42)	Motivation
Perceived consequences on status quo	Your ability to exercise your professional role	77% (110)	10% (14)	Implementation object characteristics
	Your ability to offer high quality care	76% (108)	10% (15)	Implementation object characteristics
	Your ability to manage all your work	76% (108)	14% (20)	Implementation object characteristics
	Your current routines at your workplace	76% (108)	11% (16)	Implementation object characteristics
	Your ability to work in accordance with your values	73% (105)	13% (18)	Implementation object characteristics
Need for change	How do you perceive the value of implementing digital tools at your workplace	72% (103	28% (40)	Implementation object characteristics
Commitment	What role would you like to have when a digital tool is being implemented at your workplace	69% (99)	31% (44)	Motivation
Compatibility	How well does digital tools fit with current work routines?	64% (92)	36% (51)	Implementation object characteristics
Perceived support and engagement among management	Encourages staff to engage in activities to implement digital tools	58% (83)	42% (60)	Leadership
	Communicates the need for implementing digital tools	57% (81)	43% (62)	Leadership
	Have insights in how digital tools will influence status quo	52% (74)	48% (69)	Leadership
	Takes an active role in implementing digital tools	50% (71)	50% (72)	Leadership
	Clearly communicates with staff how digital tools will be implemented	48% (69)	52% (74)	Leadership
Perceived readiness among colleagues	Take a collective responsibility for the implementation	53% (76)	47% (67)	Culture
	Work together to adapt current work routines to digital tools	52% (75)	48% (68)	Culture
	Discuss how work routines need to change when implementing digital tools	48% (69)	52% (74)	Culture
	Discuss new duties that needs to be done when implementing digital tools	46% (66)	54% (77)	Culture
	Discuss duties that need to be omitted when implementing digital tools	45% (65)	55% (78)	Culture
Perceived conditions for change at the workplace	Sufficient allocated time to implement digital tools	46% (66)	54% (77)	Capacity
	Experience among colleagues to implement new work routines	46% (66)	54% (77)	Capacity
	Adequate competency to implement digital tools	45% (65)	55% (78)	Capacity
	Sufficient support and guidance to adapt digital tools to our workplace	45% (64)	55% (79)	Capacity
	Experience among colleagues to work with digital solutions	43% (62)	57% (81)	Capacity
	Clear goals how to implement digital tools	41% (58)	59% (85)	Capacity
	Sufficient staff resources to implement digital tools	39% (56)	61% (87)	Capacity
	Sufficient training to be able to use and work according to digital tools	39% (56)	61% (87)	Capacity
Perceived individual conditions for change	Experience to work with digital solutions	45% (65)	55% (78)	Motivation
	Feel comfortable to work with a digital dashboard	45% (64)	55% (79)	Motivation
	Competency to work with a digital dashboard	44% (63)	56% (80)	Motivation

Source: Author creation using the E-Ready 2.0 scale domains, subdomains and statements. Dannapfel, P., Thomas, K., Chakhunashvili, A., Melin, J., & Trolle Lagerros, Y. (2022). A Self-help Tool to Facilitate Implementation of eHealth Initiatives in Health Care (E-Ready): Formative Evaluation. JMIR Formative Research, 6(1), e17568. https://doi.org/10.2196/17568

perceived consequences for the status quo (five statements) and two additional statements on *need for change* and *compatibility.* The responses revealed higher readiness in the subscales and statements scoring above the 60% threshold. Most respondents (77%, $n=110$) felt that digital tools could improve their efficiency in performing their professional duties, whereas fewer (73%, $n=105$) thought that the digital tools matched their values. A majority (64%, $n=92$) believed the digital tools would fit well into their work routines, and 72% ($n=103$) thought that digital tools would add value to the workplace (Table 3).

The leadership promoting change theme addressed how management communicates the need for change

with one subscale on *perceived support and engagement among management* (five statements). The respondents showed lower readiness in this theme with scores below the 60% threshold for readiness. Most of the respondents felt that their managers encouraged the use of digital tools (58%, $n=83$), but fewer (48%, $n=69$) agreed that managers would discuss how these digital tools would be implemented practically (Table 3).

The culture to change theme addressed how colleagues collectively value change with one subscale on *perceived readiness among colleagues* (five statements). This theme had low readiness scores, with none of the statements meeting the 60% threshold. Most respondents (53%, $n=76$) agreed that colleagues take collective responsibility for implementing digital tools. However, fewer respondents (52%, $n=76$) felt that colleagues adapt work routines to digital tools, and even fewer (45%, $n=65$) discussed which duties to omit (Table 3).

The capacity to change theme, covering competency and resources for practice change, included a subscale on *perceived conditions for workplace change*) (eight statements). This subscale had some of the lowest readiness scores. Fewer than 50% of the respondents felt they had enough time to implement digital tools (46%, $n=66$) or that their colleagues had sufficient experience with new work routines (46%, $n=66$). The lowest level of agreement was related to having adequate staff resources (39%, $n=56$) and training for digital tools (39%, $n=56$) (Table 3).

Factors associated with digital health readiness

Respondents with 10 or more years of overall experience in healthcare had a stronger interest in taking an active role in implementing digital tools (higher readiness 73.3%, $n=88$) vs. (lower readiness 26.7%, $n=32$) than did those with fewer than 10 years of experience (higher readiness 57.1%, $n=12$) vs. (42.9%, $n=9$) ($X^2 = 7.7$, $p=0.009$).

An association was found between readiness and age; respondents in the 50 years and older age group tended toward lower readiness for perceived competency working with digital health tools (higher readiness 32.8%, $n=21$) than did those in other age groups (lower readiness 67.2%, $n=43$) ($X^2= 6.5$, $p=0.040$). Pairwise comparisons revealed a difference between groups with higher readiness among the younger age group, 25–30 years (higher readiness 60.9%, $n=14$) vs. (lower readiness 39.1%, $n=9$). The middle group, 36–49 years, displayed roughly equal distributions in readiness scores (higher readiness 49.1%, $n=26$) vs. (lower readiness 50.9%, $n=27$).

There was an association between respondents who had 10 or more years of service at their current workplace and their perception of sufficient allocated time to implement digital tools. The majority of the respondents reported lower readiness (higher readiness 35.1%, $n=27$) vs. (lower readiness 64.9%, $n=50$) ($X^2 = 8.8$, $p=0.012$) in contrast to those working for 6–9 years in their current workplace (higher readiness 68.4%, $n=13$) vs. (lower readiness 31.6%, $n=6$) and less than 5 years (higher readiness 54.3%, $n=25$) vs. (lower readiness 45.7%, $n=21$) who indicated higher readiness. Similarly, respondents' experience with digital solutions was associated with the number of service years at their current workplace, with lower readiness observed in those with 10 or more service years at the same workplace (higher readiness 35.1%, $n=27$) vs. (lower readiness 64.9%, $n=50$) ($X^2 = 7.7$, $p=0.020$). The respondents with 6–9 years of service in their current workplace showed higher readiness (higher readiness 57.9%, $n=11$) compared to those with lower readiness (42.1%, $n=8$). Similarly, those with five or less years of service in their current workplace also had higher readiness (higher readiness ready 58.7%, $n=27$) vs. (lower readiness, 41.3%, $n=19$).

Discussion

This study on digital health readiness among healthcare leaders in operational management revealed higher readiness in terms of motivation to change and implementation object characteristics themes. However, gaps in readiness were identified, particularly in the themes of leadership promoting change, culture to change, and capacity for change. Issues related to the motivation theme were also identified in the subscale concerned with prior experience. The difference in readiness shows that while there is a willingness and understanding to adopt digital health tools, there are significant barriers to gaining support from leadership, shaping organisational culture and efficiently implementing these digital health tools. It is important to address areas of lower readiness to ensure that healthcare leaders are provided with the skills and knowledge to facilitate the implementation of digital health tools.

In this study healthcare leaders believed that digital health tools can significantly improve their work, align with their values, enhance care quality, manage workloads, and support decision making through better coordination and information sharing. Similarly, numerous studies have shown that digital health tools can improve the quality of healthcare services and support healthcare professionals [20, 24, 40, 49–51]. Digital health tools can support healthcare leaders in reducing medical errors, addressing missing patient information, preventing duplication of information and reducing costs and timewasting [16, 20, 49, 52].

The healthcare leaders in operational management in this study had positive attitudes towards digital health tools which was also shared by their colleagues

and managers. This aligns with other studies that show that healthcare workers generally support digital technology if they believe it will improve their work [53, 54]. Studies have shown that positive workplace attitudes are essential for successfully implementing digital health technologies [36, 43, 55]. Positive attitudes can lead to higher acceptance and support of digital change [22, 25, 56]. Therefore, it is important that the need for training is acknowledged at a strategic level. Training can help healthcare leaders understand digital health tools, drive participation in technology conferences, and assist with keeping up to date on government regulations and policies [57, 58], while assisting them in adapting to the implementation of these tools, adopting the necessary roles, and maintaining a positive attitude to support the successful implementation of digital health tools [57, 58]. This study indicates that healthcare leaders who have many years of service at the same workplace setting often exhibit lower readiness for digital health tools. This reluctance is partly due to their perception of increased burdens and time constraints associated with learning and implementing these technologies [27, 51, 59]. Research shows that inadequate staffing and insufficient training hinder the effective implementation of digital health tools [16, 36, 50, 60]. A learning culture that supports continuous education and training is essential for fostering a positive attitude and successful implementation of digital health tools [61].

Research indicates that 60% of the barriers to digital health readiness are attributed to people-related factors, with 30% related to resources [59], with similar findings to those of other studies [16, 20, 32, 62]. Barriers to the successful adoption and sustentation of digital health tools are common in healthcare [9]. Challenges in capacity, leadership and culture are frequently reported [20, 28, 60, 63–65]. This study revealed lower readiness in areas such as time, resources, and support, with less than 50% of healthcare leaders agreeing that these areas were available and sufficient. Issues such as frequent power outages and reliance on paper records further reinforce the belief that paper-based systems are more reliable and convenient [16, 27, 29, 62]. Healthcare leaders with many years of service in the same workplace setting may be more set in their ways and less open to adopting digital health tools, with the apprehension of being overwhelmed by additional responsibilities and needing more support [34, 56, 66].

Leadership readiness challenges include poor communication, lack of active involvement, unclear implementation strategies, and impacts on current work routines. Studies show that managers with a strong interest in technology are more successful in implementing digital changes [43, 67]. Effective managers that prioritise listening to employee feedback and that encourage innovation tend to be more effective in leading digital transformation initiatives [66]. This study revealed that there is a need for more support and engagement from management. Many managers themselves might be unfamiliar with digital health tools lacking the relevant formal and informal training or may not have been mentioned in their management job descriptions [43]. Managers play an important role in digital health transformation and must align their readiness with that of their staff [68].

The evidence suggests that individuals with more years of experience in healthcare are generally more optimistic about digital technologies [27, 69]. In this study, experienced healthcare leaders were eager to be actively involved in the implementation of digital health tools, likely because they understood existing challenges and inefficiencies [27, 33]. However, older healthcare leaders (above the age of 50) show lower readiness, and age is often a predictor of digital health readiness [9, 55, 70]. Older healthcare leaders may need more time to adapt to digital health tools due to limited exposure early in their careers or education, affecting their competency and familiarity with such tools [24, 43, 53, 56, 71]. Studies also suggest that younger individuals are generally more confident in digital health technologies than older people are [24].

South Africa faces major challenges in terms of digital health readiness, including an overburdened healthcare system, staff shortages, financial constraints, and limited time resources [35, 38, 43, 72]. In contrast, European countries with more advanced healthcare systems often have better digital health readiness due to stronger healthcare infrastructures, more financial resources, and comprehensive training and education programs for healthcare professionals [73–76].

The study contributes new insights specifically for healthcare leaders in operational management. The findings underscore the importance of focusing on this group to facilitate the successful implementation of digital health tools. Addressing the unique challenges faced in South Africa, such as resource constraints and staff shortages, requires a holistic approach. Strategies should focus on support mechanisms, continuous learning, and adaptability to the changing digital health environment. Development of digital health leadership skills and improvement of staff digital literacy are vital steps in closing the digital health gap [22, 77–79]. By aligning these strategies with the specific needs of healthcare leaders, South Africa can advance towards better digital health readiness.

Limitations

The varying stages of digital health tool implementation in the studied healthcare facilities may have influenced participant responses, with those individuals from healthcare facilities in early stages of implementation possibly reporting lower readiness. The tool may not have fully captured all the key factors such as technological infrastructure, financial resources and, regulatory policies. Additionally, focusing on healthcare leaders in operational management may not reflect the perspectives other healthcare professionals. Future research should include a broader range of healthcare professionals for a more comprehensive view digital health readiness. Lastly, the study did not target specific digital health tools or align tool administration with their implementation stages. The approach allowed for investigating general readiness themes and future research could develop tailored tools for specific digital health tools and stages.

Conclusion

Research on digital health readiness among healthcare leaders in operational management has revealed higher motivation to change and implementation object characteristics. However, gaps in readiness were identified, particularly in the themes of leadership promoting change, culture to change, and capacity for change. Issues were also identified in some motivation-related subscales, especially those related to prior experience with digital health tools. The study contributes new insights specifically for healthcare leaders in operational management. Despite the considerable investment made in developing and implementing digital health tools to improve healthcare delivery, the digital health readiness of those responsible for guiding these implementations are limited, which presents a significant challenge. The results indicate that although healthcare leaders believe that digital health tools can be beneficial in the workplace, they need support strategies to facilitate implementation. Therefore, addressing this gap should be a primary focus, with investment in digital health tools accompanied by ongoing upskilling and formal training initiatives. This approach can ensure that healthcare leaders are not only equipped with the latest digital health tools but also have the necessary skills and confidence to use them effectively.

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Authors' contributions

IS, JC, and LMP contributed to the design and planning. IS managed the data collection and data analyses. JC and LMP supervised the data analyses and interpretation of the data. IS wrote the manuscript draft, and JC and LMP reviewed and revised the text. All authors contributed to, reviewed, and approved the final manuscript.

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Data availability

All datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Ethical approval to conduct the study was obtained from the Institutional Review Board at a university in the Western Cape (reference number: BM23/6/13) and The National Health Research Database (reference number: WC_202308_032). All the respondents provided signed informed consent to participate in the study. When completing the online version, informed consent was obtained by checking the 'informed consent' box, digitally signing with a name, and dating the document (the completed consent form was made available for download). All methods were performed in accordance with the relevant guidelines and regulations or Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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