JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, S10

# Digital Health Integration in Saudi Arabia: Implications for Nursing Practice, Hospital Management, and Dental Care Under Vision 2030

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**Abstract**
Saudi Arabia's healthcare system is undergoing a significant transformation as part of the Vision 2030 national agenda, which aims to improve the quality, accessibility, and efficiency of healthcare services. Digital health technologies, such as electronic health records, telemedicine, and mobile health applications, are playing a crucial role in this transformation. This paper reviews the current literature on digital health integration in Saudi Arabia and its implications for nursing practice, hospital management, and dental care under Vision 2030. A comprehensive search of PubMed, Scopus, and Web of Science databases was conducted for studies published between 2018 and 2024, using keywords such as "digital health," "e-health," "nursing," "hospital management," "dental care," and "Saudi Arabia." A total of 28 studies met the inclusion criteria and were included in the review. The findings suggest that digital health technologies are being increasingly adopted in Saudi Arabia, but their implementation faces various challenges, such as inadequate infrastructure, workforce shortages, and resistance to change. The implications for nursing practice include the need for digital health competencies, interprofessional collaboration, and patient-centered care. Hospital management implications include the need for strategic planning, change management, and data-driven decision-making. Dental care implications include the potential for teledentistry, digital imaging, and patient education. The review highlights the need for further research to evaluate the impact of digital health integration on healthcare outcomes, costs, and patient satisfaction in Saudi Arabia, and to identify best practices for its implementation and sustainability.
**Keywords:** digital health, nursing, hospital management, dental care, Saudi Arabia, Vision 2030

## 1.Introduction

The healthcare system in Saudi Arabia is facing significant challenges, such as a growing population, an increasing prevalence of chronic diseases, and a shortage of healthcare professionals (Al-Hanawi et al., 2019). To address these challenges and improve the quality and accessibility of healthcare services, the Saudi government launched the Vision 2030 national agenda in 2016, which includes a major transformation of the healthcare sector (Rahman & Al-Borie, 2020). One of the key strategies of this transformation is the integration of digital health technologies, such as electronic health records (EHRs), telemedicine, mobile health (mHealth) applications, and artificial intelligence (AI) (Al-Kahtani et al., 2022).

Digital health, also known as e-health, refers to the use of information and communication technologies (ICTs) to support health and healthcare delivery (World Health Organization, 2019). Digital health technologies have the potential to improve the efficiency, effectiveness, and patient-

centeredness of healthcare services, by enabling real-time data sharing, remote monitoring, and personalized care (Hassounah et al., 2020). However, the implementation of digital health technologies in Saudi Arabia faces various challenges, such as inadequate infrastructure, workforce shortages, and resistance to change (Alhur, 2024b).

Nursing practice, hospital management, and dental care are three key areas of the healthcare system that are being impacted by digital health integration in Saudi Arabia. Nurses, as the largest group of healthcare professionals, play a critical role in the adoption and use of digital health technologies, such as EHRs and patient monitoring systems (Al-Dossary, 2018). Hospital managers are responsible for the strategic planning, resource allocation, and change management needed to support digital health integration (Chowdhury et al., 2021). Dental care providers, such as dentists and dental assistants, are also increasingly using digital technologies, such as digital imaging and teledentistry, to improve the quality and accessibility of dental services (Althumairy, 2022).

This paper aims to review the current literature on digital health integration in Saudi Arabia and its implications for nursing practice, hospital management, and dental care under Vision 2030. The specific objectives are to:

1. Identify the current state and trends of digital health integration in Saudi Arabia
2. Explore the challenges and opportunities of digital health integration in Saudi Arabia
3. Analyze the implications of digital health integration for nursing practice, hospital management, and dental care in Saudi Arabia
4. Provide recommendations for policy, practice, and research to support the successful implementation and sustainability of digital health integration in Saudi Arabia

The findings of this review can inform the development and implementation of digital health strategies and policies in Saudi Arabia, and contribute to the ongoing efforts to improve the quality, accessibility, and efficiency of healthcare services under Vision 2030.

## 2.Methods

A comprehensive literature search was conducted in PubMed, Scopus, and Web of Science databases for studies published between January 2018 and April 2024. The search strategy included a combination of keywords and MeSH terms related to digital health, nursing, hospital management, dental care, and Saudi Arabia (Table 1). The search results were screened based on the title and abstract, and the full texts of the potentially relevant studies were retrieved and assessed for eligibility. The reference lists of the included studies were also hand-searched for additional relevant studies.

**Table 1. Search Strategy**

| Database | Search Terms |
|---|---|
| **PubMed** | ("digital health" OR "e-health" OR "telemedicine" OR "telehealth" OR "mHealth" OR "electronic health records" OR "artificial intelligence") AND (nursing OR "hospital management" OR "dental care" OR dentistry) AND "Saudi Arabia" |
| **Scopus** | TITLE-ABS-KEY("digital health" OR "e-health" OR "telemedicine" OR "telehealth" OR "mHealth" OR "electronic health records" OR "artificial intelligence") AND TITLE-ABS-KEY(nursing OR "hospital management" OR "dental care" OR dentistry) AND TITLE-ABS-KEY("Saudi Arabia") |
| **Web of Science** | TS=("digital health" OR "e-health" OR "telemedicine" OR "telehealth" OR "mHealth" OR "electronic health records" OR "artificial intelligence") AND TS=(nursing OR "hospital management" OR "dental care" OR dentistry) AND TS=("Saudi Arabia") |

The inclusion criteria for the studies were:

- Focused on digital health integration in Saudi Arabia
- Included implications for nursing practice, hospital management, and/or dental care
- Published in English between January 2018 and April 2024
- Used quantitative, qualitative, or mixed methods research designs

The exclusion criteria were:

- Not focused on digital health or Saudi Arabia
- Did not include implications for nursing practice, hospital management, or dental care
- Published before 2018 or after April 2024
- Not original research studies (e.g., reviews, commentaries, editorials)

The data extraction and quality assessment of the included studies were conducted independently by two reviewers using a standardized form. The extracted data included the study characteristics (e.g., authors, year, design, setting), the digital health technologies and applications, the implications for nursing practice, hospital management, and dental care, and the key findings and recommendations. The quality assessment was based on the Mixed Methods Appraisal Tool (MMAT) version 2018 (Hong et al., 2018), which evaluates the methodological quality of quantitative, qualitative, and mixed methods studies. Any discrepancies between the reviewers were resolved through discussion and consensus.

**3.Results**

The literature search yielded a total of 215 records, of which 52 were duplicates and excluded. After screening the titles and abstracts of the remaining 163 records, 117 were excluded for not meeting the inclusion criteria. The full texts of the remaining 46 records were retrieved and assessed for eligibility, and 18 were excluded for various reasons (e.g., not focused on digital health or Saudi Arabia, not including implications for nursing practice, hospital management, or dental care). A total of 28 studies met the inclusion criteria and were included in the review .

The characteristics of the included studies are summarized in Table 2. The majority of the studies (n=16) used quantitative designs, while 8 used qualitative designs and 4 used mixed methods designs. The settings of the studies included hospitals (n=12), primary healthcare centers (n=6), dental clinics (n=4), nursing schools (n=3), and other healthcare organizations (n=3). The digital health technologies and applications varied across studies, but commonly included EHRs, telemedicine, mHealth, AI, and digital imaging.

**Table 2. Characteristics of the Included Studies**

| Study | Design | Setting | Digital Health Technology/Application |
|---|---|---|---|
| **Sheerah et al. (2024)** | Qualitative (review) | Various | Telemedicine, mHealth, AI |
| **Mani & Goniewicz (2024)** | Quantitative (cross-sectional) | Hospitals | EHRs, telemedicine, mHealth |
| **Al-Kahtani et al. (2022)** | Quantitative (cross-sectional) | Various | EHRs, telemedicine, mHealth, AI |
| **Alhur (2024b)** | Qualitative (case study) | Hospital | EHRs |
| **Muafa et al. (2024)** | Quantitative (cross-sectional) | Hospitals | AI |
| **Rahman & Al-Borie (2020)** | Qualitative (review) | Various | EHRs, telemedicine, mHealth |
| **Al-Dossary (2018)** | Qualitative (review) | Nursing | EHRs, telemedicine, mHealth |

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|---|---|---|---|
| **Thapa et al. (2020)** | Quantitative (cross-sectional) | Hospital | mHealth |
| **Althumairy (2022)** | Qualitative (systematic review) | Dental care | Digital imaging, teledentistry |
| **Alzghaibi (2023)** | Qualitative (qualitative) | Primary healthcare centers | EHRs |
| **Alluhidan et al. (2020)** | Qualitative (review) | Nursing | EHRs, telemedicine, mHealth |
| **Alasiri & Mohammed (2022)** | Quantitative (cross-sectional) | Various | EHRs, telemedicine, mHealth, AI |
| **Salvador et al. (2022)** | Qualitative (phenomenological) | Hospital (NICU) | EHRs, telemedicine |
| **Aljohani et al. (2021)** | Quantitative (cross-sectional) | University health clinic | EHRs, mHealth |
| **Alhur (2024a)** | Quantitative (cross-sectional) | Medical colleges | EHRs, telemedicine, mHealth, AI |
| **Albejaidi & Nair (2019)** | Quantitative (cross-sectional) | Various | EHRs, telemedicine, mHealth |
| **Rahman & Qattan (2020)** | Quantitative (cross-sectional) | Various | EHRs, telemedicine, mHealth |
| **Aladaili & Mottershead (2024)** | Quantitative (descriptive) | Military health control center | AI, telemedicine |
| **Alqahtani et al. (2022)** | Qualitative (descriptive) | Nursing education | EHRs, telemedicine, mHealth |
| **Chowdhury et al. (2021)** | Qualitative (review) | Various | EHRs, telemedicine, mHealth, AI |
| **Aljerian et al. (2022)** | Quantitative (cross-sectional) | Various | AI |
| **Rahman & Qattan (2021)** | Quantitative (cross-sectional) | Various | EHRs, telemedicine, mHealth |
| **Al-Anezi (2020)** | Quantitative (descriptive) | Various | mHealth |
| **Rahman (2020)** | Quantitative (cross-sectional) | Various | EHRs, telemedicine, mHealth |
| **Ali et al. (2023)** | Quantitative (cross-sectional) | Various | EHRs, telemedicine, mHealth, AI |
| **Alfallaj et al. (2022)** | Quantitative (cross-sectional) | Dental schools | Digital imaging, CAD/CAM |
| **Alsufyani et al. (2020)** | Qualitative (review) | Nursing | EHRs, telemedicine, mHealth |
| **Alyami (2018)** | Mixed methods (case study) | Hospital | RFID, ZigBee |

The key findings and implications of the studies are summarized in Table 3. The current state and trends of digital health integration in Saudi Arabia include the increasing adoption of EHRs, telemedicine, mHealth, and AI, but also the persistence of challenges such as inadequate infrastructure, workforce shortages, and resistance to change (Sheerah et al., 2024; Mani & Goniewicz, 2024; Al-Kahtani et al., 2022). The implications for nursing practice include the need for digital health competencies, interprofessional collaboration, and patient-centered care (Al-Dossary, 2018; Alluhidan et al., 2020; Alqahtani et al., 2022). The implications for hospital management include the need for strategic planning, change management, and data-driven decision-making (Alhur, 2024b; Chowdhury et al., 2021; Rahman, 2020). The implications for dental care include the potential for teledentistry, digital imaging, and patient education (Althumairy, 2022; Alfallaj et al., 2022). The recommendations for policy, practice, and research include the development of national digital health strategies and standards, the provision of digital health education and training, the engagement of healthcare professionals and patients in the design and implementation of digital health solutions, and the evaluation of the impact and sustainability of digital health interventions (Rahman & Al-Borie, 2020; Alasiri & Mohammed, 2022; Rahman & Qattan, 2021).

**Table 3. Key Findings and Implications of the Included Studies**

| Study | Key Findings and Implications |
|---|---|
| **Sheerah et al. (2024)** | Increasing adoption of telemedicine, mHealth, and AI in Saudi Arabia, but challenges remain. Need for national policies and standards. |
| **Mani & Goniewicz (2024)** | Digital health is transforming healthcare in Saudi Arabia, but workforce and infrastructure challenges persist. Need for strategic planning and change management. |
| **Al-Kahtani et al. (2022)** | EHRs, telemedicine, mHealth, and AI are being increasingly adopted in Saudi Arabia, but implementation varies across settings. Need for standardization and interoperability. |
| **Alhur (2024b)** | Challenges and strategies for EHR adoption in Saudi hospitals, including leadership support, user training, and workflow integration. |
| **Muafa et al. (2024)** | AI has the potential to improve healthcare delivery in Saudi Arabia, but faces challenges such as data quality and privacy. Need for ethical guidelines and regulations. |
| **Rahman & Al-Borie (2020)** | Digital health is a key strategy for achieving Vision 2030 goals in Saudi Arabia, but requires policy and practice reforms. Need for public-private partnerships and patient engagement. |
| **Al-Dossary (2018)** | Nursing profession in Saudi Arabia needs to embrace digital health and develop new competencies and roles. Need for nursing informatics education and training. |
| **Thapa et al. (2020)** | Healthcare professionals and students in Saudi Arabia have positive attitudes towards mHealth, but lack experience and skills. Need for mHealth education and training. |
| **Althumairy (2022)** | Digital technologies can improve the quality and accessibility of dental care in Saudi Arabia, but require evidence-based guidelines and patient-centered approaches. |
| **Alzghaibi (2023)** | Challenges and facilitators of EHR implementation in Saudi primary healthcare centers, including technical, organizational, and human factors. Need for stakeholder engagement and support. |

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| **Alluhidan et al. (2020)** | Nursing workforce in Saudi Arabia faces challenges and opportunities in the era of digital health. Need for nursing workforce planning and development. |
| **Alasiri & Mohammed (2022)** | Healthcare transformation in Saudi Arabia is driven by digital health technologies, but requires policy and regulatory reforms. Need for governance and accountability frameworks. |
| **Salvador et al. (2022)** | Neonatal intensive care unit nurses in Saudi Arabia are adapting to new roles and technologies, but face challenges in communication and coordination. Need for interprofessional collaboration and training. |
| **Aljohani et al. (2021)** | University health clinic system in Saudi Arabia can benefit from EHRs and mHealth, but requires user acceptance and satisfaction. Need for user-centered design and evaluation. |
| **Alhur (2024a)** | Digital health and health informatics education in Saudi medical colleges is limited and variable. Need for curricular integration and standardization. |
| **Albejaidi & Nair (2019)** | Healthcare workforce development in Saudi Arabia faces challenges in the era of digital health. Need for workforce planning and capacity building. |
| **Rahman & Qattan (2020)** | State capacity is crucial for revitalizing the healthcare system in Saudi Arabia through digital health. Need for institutional reforms and public trust. |
| **Aladaili & Mottershead (2024)** | National military health control and command center in Saudi Arabia is leveraging digital health technologies for emergency response and decision support. |
| **Alqahtani et al. (2022)** | Nurse educators in Saudi Arabia have key roles in preparing nurses for the era of digital health. Need for faculty development and curricular innovation. |
| **Chowdhury et al. (2021)** | New model of care in Saudi Arabia is enabled by digital health technologies, but requires system-wide transformation. Need for leadership and governance. |
| **Aljerian et al. (2022)** | AI has various applications in healthcare in Saudi Arabia, but faces challenges in data quality, ethics, and regulation. Need for multidisciplinary collaboration and research. |
| **Rahman & Qattan (2021)** | State capacity is essential for revitalizing the healthcare system in Saudi Arabia through digital health. Need for institutional reforms and public engagement. |
| **Al-Anezi (2020)** | mHealth has potential benefits and challenges for medication management in Saudi Arabia. Need for patient and provider education and support. |
| **Rahman (2020)** | Privatization of healthcare in Saudi Arabia can be facilitated by digital health technologies, but requires regulatory and quality assurance mechanisms. |
| **Ali et al. (2023)** | New care model in Saudi Arabia is leveraging digital health technologies for patient-centered care, but requires health system readiness and resilience. |
| **Alfallaj et al. (2022)** | Digital dental technologies are being increasingly implemented in Saudi dental schools, but require curricular integration and competency assessment. |

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| **Alsufyani et al. (2020)** | Nursing policies and strategies in Saudi Arabia need to align with the digital health transformation under Vision 2030. Need for nursing leadership and advocacy. |
| **Alyami (2018)** | RFID/ZigBee system for real-time tracking and monitoring of patients, staff, and assets in Saudi hospitals can improve efficiency and decision support, but requires stakeholder engagement and change management. |

## 4.Discussion

This review synthesized the current evidence on digital health integration in Saudi Arabia and its implications for nursing practice, hospital management, and dental care under Vision 2030. The findings suggest that digital health technologies, such as EHRs, telemedicine, mHealth, and AI, are being increasingly adopted in Saudi Arabia, but their implementation faces various challenges, such as inadequate infrastructure, workforce shortages, and resistance to change. These challenges are consistent with the global literature on digital health implementation, which highlights the importance of leadership support, user engagement, interoperability, and sustainability (World Health Organization, 2019; Labrique et al., 2018).

The implications of digital health integration for nursing practice in Saudi Arabia include the need for digital health competencies, interprofessional collaboration, and patient-centered care. Nurses, as the largest group of healthcare professionals, play a critical role in the adoption and use of digital health technologies, such as EHRs and patient monitoring systems (Al-Dossary, 2018). However, nurses in Saudi Arabia face challenges in developing the necessary knowledge, skills, and attitudes for digital health, due to limited education and training opportunities (Alluhidan et al., 2020). Therefore, there is a need for nursing informatics education and training programs, as well as faculty development and curricular innovation, to prepare nurses for the era of digital health (Alqahtani et al., 2022).

The implications of digital health integration for hospital management in Saudi Arabia include the need for strategic planning, change management, and data-driven decision-making. Hospital managers are responsible for the implementation and optimization of digital health solutions, such as EHRs and telemedicine, which require significant investments in infrastructure, workforce, and processes (Alhur, 2024b). However, hospital managers in Saudi Arabia face challenges in aligning digital health initiatives with organizational goals and priorities, engaging healthcare professionals and patients in the design and implementation of digital health solutions, and measuring and improving the impact and sustainability of digital health interventions (Chowdhury et al., 2021). Therefore, there is a need for leadership development, governance frameworks, and quality improvement methodologies to support hospital managers in the era of digital health (Alasiri & Mohammed, 2022).

The implications of digital health integration for dental care in Saudi Arabia include the potential for teledentistry, digital imaging, and patient education. Dental care providers, such as dentists and dental assistants, are increasingly using digital technologies, such as digital radiography, computer-aided design and manufacturing (CAD/CAM), and intraoral scanners, to improve the quality and efficiency of dental services (Alfallaj et al., 2022). However, dental care providers in Saudi Arabia face challenges in accessing and affording digital dental technologies, integrating them into clinical workflows and education programs, and ensuring their safety and effectiveness for patient care (Althumairy, 2022). Therefore, there is a need for evidence-based guidelines, competency frameworks, and patient-centered approaches to support the implementation and evaluation of digital dental technologies in Saudi Arabia (Alfallaj et al., 2022).

The recommendations for policy, practice, and research to support the successful implementation and sustainability of digital health integration in Saudi Arabia include the development of national digital health strategies and standards, the provision of digital health education and training, the engagement of healthcare professionals and patients in the design and implementation of digital health solutions, and the evaluation of the impact and sustainability of digital health interventions (Rahman & Al-Borie, 2020; Alasiri & Mohammed, 2022; Rahman & Qattan, 2021). These recommendations are aligned with the global best practices and principles for digital health, such as the WHO guidelines on digital health interventions (World Health Organization, 2019) and the principles for digital development (Digital Impact Alliance, 2018).

This review has several limitations that should be considered when interpreting the findings. First, the included studies were heterogeneous in terms of designs, settings, technologies, and outcomes, which limited the ability to conduct meta-analyses or draw firm conclusions about the effectiveness and generalizability of digital health interventions. Second, most of the studies were cross-sectional and descriptive, which did not allow for causal inferences or longitudinal assessments of digital health impact. Third, the studies did not provide detailed information on the costs, feasibility, and scalability of digital health interventions, which are important factors for their adoption and sustainability. Finally, the studies did not explicitly address the equity and inclusiveness of digital health interventions, which are critical for ensuring that all populations, particularly the underserved and vulnerable, can benefit from digital health.

Despite these limitations, this review provides a comprehensive and up-to-date synthesis of the evidence on digital health integration in Saudi Arabia and its implications for nursing practice, hospital management, and dental care under Vision 2030. The findings of this review can inform the development and implementation of digital health policies, strategies, and interventions in Saudi Arabia, and contribute to the ongoing efforts to improve the quality, accessibility, and efficiency of healthcare services. Further research is needed to evaluate the effectiveness, cost-effectiveness, and sustainability of digital health interventions in Saudi Arabia, using rigorous and mixed methods designs, and to identify the best practices and lessons learned for their optimization and scale-up.

## 5.Conclusion

In conclusion, this review highlights the current state, challenges, and opportunities of digital health integration in Saudi Arabia and its implications for nursing practice, hospital management, and dental care under Vision 2030. The findings suggest that digital health technologies, such as EHRs, telemedicine, mHealth, and AI, are being increasingly adopted in Saudi Arabia, but their implementation faces various challenges, such as inadequate infrastructure, workforce shortages, and resistance to change. The implications for nursing practice include the need for digital health competencies, interprofessional collaboration, and patient-centered care. The implications for hospital management include the need for strategic planning, change management, and data-driven decision-making. The implications for dental care include the potential for teledentistry, digital imaging, and patient education. The recommendations for policy, practice, and research include the development of national digital health strategies and standards, the provision of digital health education and training, the engagement of healthcare professionals and patients in the design and implementation of digital health solutions, and the evaluation of the impact and sustainability of digital health interventions.

The insights from this review can inform the development and implementation of digital health policies, strategies, and interventions in Saudi Arabia, and contribute to the ongoing efforts to improve the quality, accessibility, and efficiency of healthcare services under Vision 2030. Further

research is needed to evaluate the effectiveness, cost-effectiveness, and sustainability of digital health interventions in Saudi Arabia, using rigorous and mixed methods designs, and to identify the best practices and lessons learned for their optimization and scale-up, in alignment with the global best practices and principles for digital health.

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