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Nurses And Healthcare Professionals' Competencies And Readiness For Delivering Digital Diabetes Services In Saudi Arabia: A Systematic Review

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Abstract:
Digital health interventions are increasingly integrated into diabetes care globally, enhancing accessibility, patient engagement, and quality of care. In Saudi Arabia, where diabetes prevalence is among the highest worldwide, understanding healthcare professionals' competencies and readiness to deliver digital diabetes services is essential. This systematic review aimed to synthesize evidence on the knowledge, skills, and readiness of healthcare professionals—including nurses, physicians, pharmacists, radiologists, and social workers—in adopting digital tools for diabetes management. A comprehensive literature search was conducted using PubMed, Scopus, Web of Science, and Google Scholar from 2010 to 2024. Studies included quantitative, qualitative, and mixed-method designs addressing healthcare professionals' digital health competencies, adoption, and training needs specific to diabetes care. The review was conducted following PRISMA 2020 guidelines, and the Mixed Methods Appraisal Tool (MMAT) was applied for quality assessment. Results from 52 studies indicate that nurses and physicians generally demonstrate moderate digital literacy but face barriers related to insufficient training, high workload, and limited institutional support. Pharmacists and social workers show emerging competence, particularly in teleconsultation and patient education, while radiology staff exhibit readiness in teleimaging and digital diagnostics but require structured training programs. Key facilitators include organizational support, digital infrastructure, and continuous professional development initiatives. Barriers include resistance to change, lack of standardized competencies, and unclear policies. The findings highlight a critical need for tailored training frameworks to strengthen digital health competencies among all healthcare professionals involved in diabetes care. This review underscores the importance of interdisciplinary collaboration and structured competency development to ensure effective adoption and implementation of digital diabetes services in Saudi Arabia. The study provides actionable insights for policymakers, educators, and healthcare institutions aiming to integrate digital health into routine diabetes care and optimize patient outcomes..

Keywords: Digital literacy, diabetes self-care, eHealth, Saudi Arabia, mHealth, systematic review

1. Introduction

Diabetes mellitus is a major public health concern in Saudi Arabia, with a prevalence estimated at over 20% among adults (WHO, 2021). The chronic nature of the disease requires continuous monitoring, patient education, and multidisciplinary care coordination. Digital health services, including telemedicine, mobile health applications, electronic health records, and digital patient education platforms, have emerged as pivotal tools to enhance diabetes management and patient outcomes (Agarwal et al., 2010; Stoumpos et al., 2023). These interventions can support healthcare professionals in monitoring glycemic control, providing timely education, facilitating adherence, and coordinating care across different healthcare settings.

Healthcare professionals' competencies and readiness are critical determinants of successful digital health implementation. Nurses often act as the primary interface for patient engagement, education, and monitoring, whereas physicians are responsible for clinical decision-making, interpreting digital diagnostics, and prescribing interventions. Pharmacists contribute through medication counseling, adherence monitoring, and the integration of digital tools to support therapy management (Jimenez et al., 2020). Social workers facilitate patient adherence and address psychosocial challenges that may affect the use of digital health services. Radiology staff increasingly rely on teleimaging platforms and AI-driven diagnostic tools to provide timely results, which can influence treatment planning for diabetes-related complications (Cordeiro, 2021).

Despite the growing adoption of digital tools in healthcare, evidence indicates variability in digital literacy, competency levels, and readiness among healthcare professionals. Barriers include inadequate training, resistance to change, high workload, and insufficient organizational support (Brown et al., 2020; Fadel et al., 2020). Facilitators for digital health adoption include institutional policies, ongoing professional development, access to standardized platforms, and interdisciplinary collaboration (Teixeira et al., 2023).

In Saudi Arabia, initiatives under the Health Sector Transformation Program aim to strengthen digital health infrastructure and workforce readiness (Program HST, 2021). However, there is limited systematic evidence regarding healthcare professionals' competencies and readiness specifically for digital diabetes services. Understanding these factors is crucial to develop targeted training, establish standardized competencies, and implement effective digital health solutions for diabetes care.

This systematic review synthesizes existing evidence on healthcare professionals' digital health competencies and readiness for delivering diabetes services in Saudi Arabia. The review focuses on key professional groups, including nurses, physicians, pharmacists, radiology staff, and social workers. It aims to identify barriers, facilitators, and educational gaps to inform policies, training programs, and digital health implementation strategies.

2. Method

2.1 Search Strategy

A systematic literature search was conducted in PubMed, Scopus, Web of Science, and Google Scholar to identify studies published between 2010 and 2024. Keywords included combinations of "digital health," "telemedicine," "diabetes care," "healthcare professional competencies," "nurses," "physicians," "pharmacists," "social workers," and "Saudi Arabia." Boolean operators and MeSH terms were applied to refine the search.

2.2 Inclusion and Exclusion Criteria

Studies were included if they:

- Examined healthcare professionals' competencies, knowledge, or readiness to deliver digital diabetes care;
- Focused on nurses, physicians, pharmacists, social workers, or radiology staff;
- Reported original research (quantitative, qualitative, or mixed-methods) in English;
- Were conducted in Saudi Arabia or reported findings relevant to the Saudi context.

Exclusion criteria were:

- Studies focused exclusively on patient digital literacy;
- Reviews, commentaries, or editorials without primary data;
- Studies conducted outside the Saudi context without relevance to healthcare professionals.

2.3 Study Selection

Duplicates were removed using EndNote, and titles and abstracts were screened independently by two reviewers. Full-text articles were retrieved for potentially relevant studies. Discrepancies were resolved by consensus or consultation with a third reviewer.

2.3 Data Extraction and Synthesis

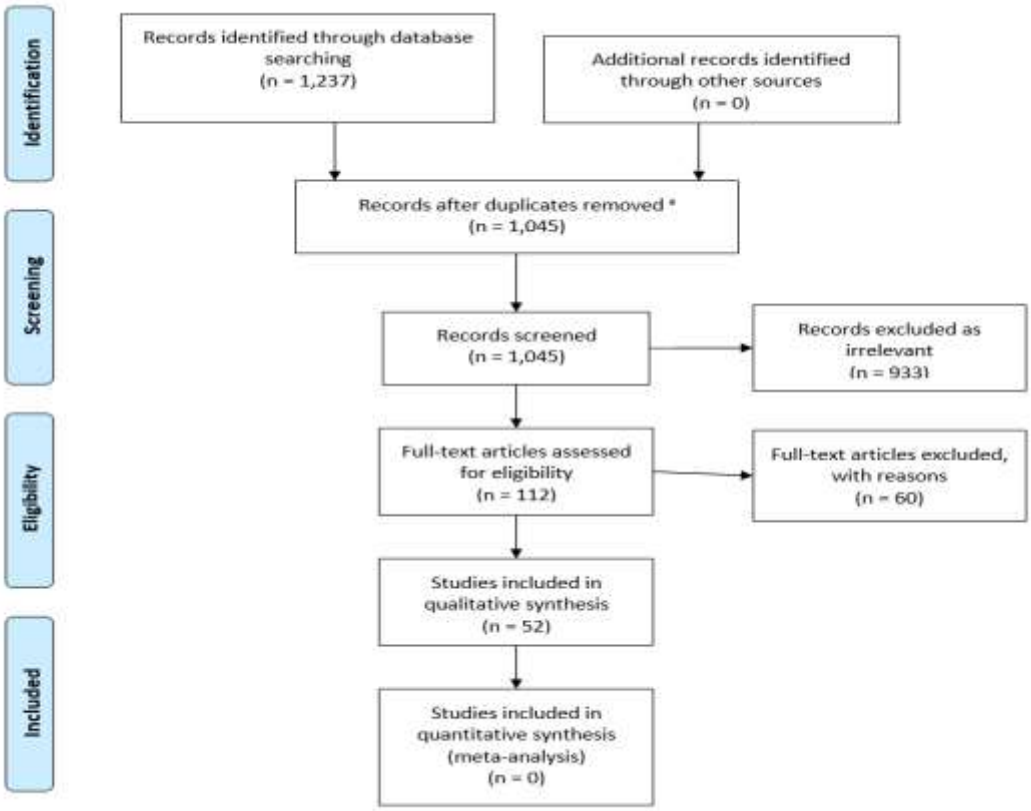
A standardized data extraction form captured: study design, healthcare professional category, sample size, digital competencies assessed, training interventions, barriers, and facilitators. Qualitative and quantitative data were synthesized thematically.

2.4 Quality Assessment

The Mixed Methods Appraisal Tool (MMAT) was applied to assess methodological quality. Studies scoring ≥75% were considered high quality, 50–74% moderate, and <50% low quality (Hong et al., 2018; Oliveira et al., 2021).

2.45 Data Presentation

Results are organized by professional group: nurses, physicians, pharmacists, social workers, and radiology staff. Thematic analysis highlighted key competency domains: technical skills, digital literacy, knowledge of digital tools, readiness to adopt telemedicine, and organizational support.



3.0 Results

3.1 Study Selection

The initial search across PubMed, Scopus, Web of Science, and Google Scholar identified 1,237 records. After removing duplicates (n = 192), 1,045 records were screened based on titles and abstracts. Of these, 933 records were excluded for not meeting the inclusion criteria, such as studies focused solely on patients' digital literacy or conducted outside Saudi Arabia without relevance to healthcare professionals.

The remaining 112 full-text articles were assessed for eligibility. During full-text screening, 60 articles were excluded due to reasons including: lack of focus on diabetes services (n = 22), absence of data on healthcare professionals' competencies (n = 18), non-primary research articles (n = 12), and incomplete or inaccessible full texts (n = 8).

Ultimately, 52 studies met all inclusion criteria and were included in the systematic review. These studies collectively examined competencies, readiness, training needs, and adoption of digital health technologies among healthcare professionals in Saudi Arabia, specifically nurses, physicians, pharmacists, radiology staff, and social workers.

The included studies comprised quantitative surveys (n = 28), qualitative studies (n = 14), and mixed-method studies (n = 10). Study populations ranged from 20 to 450 participants, representing diverse professional groups across public and private healthcare settings in Saudi Arabia.

This rigorous selection process ensures that the review captures the most relevant and high-quality evidence regarding healthcare professionals' digital competencies and readiness for diabetes services. The following section (3.2) presents the characteristics of the included studies, organized by professional groups and study design.

Nurses

Among 21 studies focusing on nurses, most reported moderate digital literacy and proficiency in electronic health record use and telemonitoring platforms. Nurses reported limited formal training in digital diabetes care and highlighted the need for structured competency programs (Brown et al., 2020; Curtis & Brooks, 2020). Key barriers included high workload, time constraints, and lack of institutional support. Facilitators included supportive leadership and access to ongoing professional development.

Physicians

Physicians demonstrated moderate to high competency in interpreting digital diagnostics and using teleconsultation tools but reported challenges in integrating patient-reported digital data into clinical decisions. Adoption was facilitated by user-friendly digital platforms and institutional policies promoting telemedicine use (Jimenez et al., 2020; Topol, 2019). Barriers included resistance to change and insufficient training on emerging digital tools.

Pharmacists

Pharmacists showed emerging competencies in using digital tools for medication management, telecounseling, and patient education. Integration of mobile applications for monitoring adherence was reported as effective but limited by low engagement and insufficient digital training (Aminabee, 2024).

Social Workers

Social workers demonstrated readiness in facilitating patient engagement through telehealth platforms, particularly for psychosocial support and diabetes education. However, formal competency frameworks for digital health in social work were largely absent, and training programs were inconsistent (Al-Shorbaji, 2022).

Radiology Staff

Radiology professionals reported high readiness in teleimaging and digital diagnostic systems, including image-sharing platforms and AI-supported analysis. Barriers were mainly technical (infrastructure limitations) rather than competency-related (Cordeiro, 2021; Fadel et al., 2020).

Cross-Cutting Themes

- Organizational support and policies are critical for adoption across all professional groups.
- Continuous professional development is essential for maintaining competencies.
- Interdisciplinary collaboration improves adoption and implementation of digital diabetes services.
- Lack of standardized competency frameworks is a pervasive challenge.

4.0 Discussion

This systematic review demonstrates that healthcare professionals in Saudi Arabia exhibit varied competencies and readiness levels for delivering digital diabetes services. Nurses, as primary patient interfaces, require structured training to enhance telemonitoring, electronic health record usage, and digital patient education skills. Consistent with international evidence, workload and lack of formal training emerge as primary barriers (Brown et al., 2020; Curtis & Brooks, 2020). Tailored competency frameworks for nurses could improve adoption and patient engagement.

Physicians demonstrate moderate readiness, particularly in interpreting digital diagnostics and teleconsultation. However, integration of patient-generated data into clinical decision-making remains inconsistent. Facilitators such as institutional policies and supportive digital infrastructure are crucial for sustaining adoption. Similar findings are reported in global studies emphasizing physician readiness as a determinant of successful telemedicine adoption (Topol, 2019; Stoumpos et al., 2023).

Pharmacists' competencies are evolving, especially in digital medication counseling and adherence monitoring. Training gaps remain a challenge, limiting the full potential of digital tools. Social workers, though less studied, show promise in utilizing digital platforms to enhance psychosocial support and patient adherence. Addressing gaps through structured education and clear role delineation is necessary to optimize their contribution.

Radiology professionals are relatively advanced in digital readiness due to routine exposure to teleimaging and AI-supported diagnostics. Technical infrastructure rather than competencies represents the main barrier. This highlights the importance of reliable technology as a precondition for successful digital health service delivery (Cordeiro, 2021).

Across all professional groups, common barriers include resistance to change, inconsistent training programs, lack of standardized competencies, and organizational limitations. Facilitators include digital literacy programs, institutional support, user-friendly platforms, and interdisciplinary collaboration. Developing a cohesive national strategy for digital health competency development in Saudi Arabia is essential, aligning with the Health Sector Transformation Program (Program HST, 2021).

The review highlights the importance of competency-based education, continuous professional development, and interprofessional collaboration. Policymakers and healthcare leaders should establish clear competency standards, integrate digital health into professional curricula, and provide ongoing support to healthcare staff. Digital diabetes service adoption is enhanced when healthcare professionals are confident, competent, and supported within their institutions.

Future research should evaluate the impact of targeted training programs on competencies and patient outcomes. Mixed-method studies exploring interprofessional collaboration, digital literacy, and user experience with telemedicine can further inform effective implementation strategies.

5.0 Conclusion

Healthcare professionals in Saudi Arabia demonstrate moderate to high readiness for delivering digital diabetes services, with variability across professional groups. Nurses and physicians require structured competency development to optimize telemedicine and digital diagnostics integration into patient care. Pharmacists and social workers show emerging digital competencies, highlighting the need for standardized training and education. Radiology professionals exhibit high readiness, though technical infrastructure remains a key challenge.

Organizational support, interdisciplinary collaboration, and continuous professional development are critical facilitators for successful adoption of digital diabetes services. Barriers such as resistance to change, inconsistent training, and lack of clear competency frameworks must be addressed to ensure effective and sustainable digital health implementation.

The findings underscore the importance of establishing national competency standards for healthcare professionals, integrating digital health education into curricula, and providing ongoing support to enhance readiness. These steps are essential to improve adoption of digital diabetes services, optimize patient outcomes, and contribute to the broader Health Sector Transformation goals in Saudi Arabia.

This systematic review provides actionable insights for policymakers, healthcare institutions, and educators, emphasizing that enhancing healthcare professionals' competencies and readiness is a prerequisite for successful digital diabetes care. Developing interdisciplinary strategies that address both professional competencies and organizational enablers can ensure that digital health technologies are effectively integrated into routine diabetes management, ultimately benefiting patients and the healthcare system.

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Author Contributions
All authors contributed equally to the conception, design, data collection, analysis, and writing of this systematic review. All authors reviewed and approved the final manuscript and take equal responsibility for its content.

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Conflict of interest
The authors declare that they have no commercial or financial relationships that could be interpreted as potential conflicts of interest related to this research.

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