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Research Article

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Impact of Modern Healthcare Technologies on Nursing Practice: A Cross-Sectional Study at the Diabetes Center in Al-Bayda City, Libya

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Abstract

Technological developments have become a crucial part of healthcare systems, greatly impacting nursing practice by enhancing professional efficiency, communication, and the quality of patient care. This study aimed to evaluate how contemporary technology affects nursing practice among nurses employed at the Aljabal Al Akhdhar Teaching Diabetes Center. A cross-sectional descriptive study approach was used. A sample of ninety-one nurses was included. A standardized questionnaire encompassing demographics, technology use, perceived advantages, difficulties, and future orientations was used to gather data. High levels of technology utilization were reported, particularly in the use of smart devices for vital signs monitoring (85.7%) and electronic medical records (76.9%). Most nurses indicated that technology improved the accuracy of documentation (89.0%), reduced medical errors (81.3%), and increased professional efficiency (86.8%). Several challenges were identified, including high costs (76.9%), concerns about data privacy and security (73.6%), and lack of adequate training (60.4%). No statistically significant associations were found between technology use scores and demographic characteristics ($p > 0.05$). Modern technology has a positive impact on nursing practice; however, addressing challenges related to training and technical support is essential to maximize its benefits. Strengthening institutional policies and providing continuous education are recommended to support effective technology integration in nursing practice.

Keywords: Diabetic Center; Electronic Health Records; Libya; Modern Technology; Nurses; Practice; Smart Devices

INTRODUCTION

The rapid advancement of digital technologies has fundamentally altered healthcare systems worldwide, changing the duties of healthcare workers and how patient care is provided. Electronic health records (EHRs), clinical decision support systems, telehealth services, and mobile health apps are examples of health information technologies that are becoming crucial components of the modern healthcare infrastructure (Strudwick et al., 2019). These technologies facilitate continuity and coordination of care across healthcare settings, improve clinical decision-making, and provide real-time access to patient data (Krick et al., 2019; Gates & Walker, 2020; WHO, 2020).

Advances in technology have become an essential component of healthcare systems, and their use has had significant effects on nursing practice, which is the cornerstone of healthcare delivery. Most

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healthcare staff members are nurses, and in clinical settings, they are the main users of health information systems (Serdar et al., 2023). The implementation of EHRs and other digital tools has been associated with improved documentation accuracy, enhanced patient safety, better communication among healthcare providers, and increased efficiency in workflow processes (Adeniyi et al., 2024). Furthermore, digital technologies facilitate evidence-based practice by providing nurses with timely access to clinical guidelines and patient data, ultimately improving the quality of care delivered (Nejad et al., 2023; Ismail et al., 2025).

Despite these advantages, the adoption of healthcare technology and its effective application in nursing practice remain complex and multifaceted. Research shows that the success of technological integration depends mainly on nurses' acceptance, competency, and engagement with these systems (Kieft et al., 2019; Strudwick et al., 2019). Factors such as system usability, training, organizational support, and workload significantly influence technology adoption (Zadvinskis et al., 2018; Al-Hashimi, 2022). In some cases, the implementation of electronic systems has been associated with increased documentation burden, workflow disruptions, and cognitive workload, which may negatively affect nursing performance and job satisfaction (Krick et al., 2019).

Digital health technologies are essential for bettering patient outcomes when it comes to managing chronic diseases, particularly diabetes mellitus. Electronic medical records, telehealth services, and remote monitoring devices are examples of technologies that facilitate ongoing patient monitoring, promote patient-provider communication, and increase treatment plan adherence. Nurses are crucial when it comes to utilizing these technologies to deliver patient-centered care and promote effective disease control (Booth et al., 2021; Nejad et al., 2023; McBride et al., 2017).

Significance of the study

The integration of healthcare technologies in developing countries remains uneven and faces several structural and organizational challenges. Limited infrastructure, inadequate financial resources, insufficient training, and concerns related to data privacy and security are major barriers to effective implementation (WHO, 2021; Park & Kim, 2021; Top & Yilmaz, 2022). Furthermore, empirical research examining how contemporary healthcare technologies affect nursing practice in many developing contexts, like Libya, is conspicuously lacking. This gap emphasizes the need for context-specific research to gain a deeper understanding of the application, advantages, and difficulties of technology use in nursing practice (Al-Badri & Al-Awami, 2021).

Aim of the study

The aim of the study was to evaluate how nurses at Aljabal Al Akhdhar Teaching Diabetes Center, Al-Bayda City, Libya, were affected by contemporary technologies.

Study question

How do nurses at Aljabal Al Akhdhar Teaching Diabetes Center, Al-Bayda City, use contemporary technology?

MATERIALS AND METHODS

Study Design

The current investigation used a descriptive cross-sectional study design.

Study Setting

The Diabetes Center in Aljabal Al Akhdhar Teaching Diabetes Center, Al-Bayda City, Libya, served as the study site. The center provides specialized healthcare services for diabetic patients from across the region and utilizes both conventional and modern technological systems for patient care, monitoring, and education.

Study Population and Sampling

All nurses employed at Aljabal Al Akhdhar Teaching Diabetes Center during the time of data collection were included in the study population. Participants were recruited using a census approach. The study included all nurses who matched the inclusion criteria and consented to participate (91 nurses).

Inclusion criteria:

- Nurses working at the Diabetes Center
- Nurses with at least 6 months of clinical experience

Exclusion criteria:

- Nurses who were on extended leave during the data collection period.
- Inadequate answers to the questionnaire.

Ninety-one nurses made up the final sample.

Study Tool:

A standardized self-administered questionnaire created by the researchers after a thorough analysis of pertinent literature was used to gather data.

There were five sections to the questionnaire:

1. Demographic attributes, including age, gender, and educational attainment
2. Technology Use in Nursing Practice (use of electronic medical records, smart devices, software applications, and communication tools)
3. Perceived Benefits of Technology (accuracy, efficiency, communication, reduction of errors)
4. Challenges in Technology Use (training, technical issues, cost, privacy concerns)
5. Future Directions and Professional Development (AI integration, virtual learning, policy development)

A dichotomous scale (Yes/No) was used to measure each item.

Validity

A team of five nursing and healthcare technology specialists determined the questionnaire's content validity by evaluating its comprehensiveness, relevance, and clarity. Small changes were made to improve the phrasing and appropriateness of the content based on their input.

Reliability

Cronbach's alpha coefficient was used to gauge the questionnaire's internal consistency and reliability. The tool's overall dependability was determined to be satisfactory ($\alpha = 0.82$).

Pilot Study:

Ten percent of the sample participated in a pilot study to evaluate the questionnaire's applicability, feasibility, and clarity. Accordingly, the necessary adjustments were made. The final analysis did not include the pilot sample.

Data Collection Procedure

Over the course of two months, data was gathered. After outlining the goal of the study, the researchers gave the questionnaires to participants during business hours. Participants filled out the anonymous questionnaires and sent them back right away.

Data Analysis

The Statistical Package for Social Sciences (SPSS) version 26 was used to code, input, and analyze the data. Descriptive statistics (frequencies, percentages, means, and standard deviations) and inferential statistics (the Chi-square test) were used to investigate the relationship between technology use scores and demographic traits. A p-value < 0.05 was considered statistically significant.

Ethical Considerations

The management of the Diabetes Center in Al-Bayda City gave permission to carry out the study. Prior to participation, informed verbal consent was obtained, and the study's goal was explained to the participants. Participants were given the assurance that their answers would only be utilized for research, and confidentiality and anonymity were scrupulously upheld. Participants were free to leave at any moment without facing any repercussions, and participation was completely optional.

RESULTS

Table (1). Demographic data-based distribution of the nurses under study (n = 91)

Variable	No.	%
Gender		
Male	23	25.3
Female	68	74.7
Age		
18–29	18	19.8
30–39	21	23.1
40–49	37	40.7
≥50	15	16.5
Education		
Intermediate Institute	48	52.7
Higher Institute	36	39.6
Diploma	7	7.7

According to Table (1), 74.7% of participants were female nurses. The most prevalent age group (40.7%) was 40–49 years old. In terms of educational background, 52.7% of the participants had an intermediate institute qualification.

Table (2). The distribution of the nurses under study based on features of technology use in nursing practice (n = 91)

Item	No. (Yes)	%
Use of electronic medical records	70	76.9
Use of smart devices for vital signs monitoring	78	85.7
Knowledge of healthcare software applications	65	71.4
Use of smart devices for communication	72	79.1
Receiving training	60	65.9

Table (2) indicates a high level of technology utilization among nurses. The most frequently used technology was smart devices for monitoring vital signs (85.7%), followed by electronic medical records (76.9%).

Table (3). The distribution of nurses under study based on their perceptions of the advantages of technology (n = 91)

Item	No. (Yes)	%
Improved response time to patient needs	77	84.6
Improved accuracy	81	89.0
Reduced medical errors	74	81.3
Improved communication	80	87.9
Increased efficiency	79	86.8

Table (3) demonstrates that nurses perceived strong positive effects of modern technology on nursing practice. The highest agreement was reported for improved accuracy of documentation (89.0%), followed by improved communication between healthcare professionals (87.9%).

Table (4). Distribution of nurses according to challenges faced when using technology (n = 91)

Item	No. (Yes)	%
Difficulty in using devices or software	40	44.0
Lack of training	55	60.4
Technical problems	58	63.7
Privacy concerns	67	73.6
High cost or lack of resources	70	76.9

Table (4) reveals that the most significant barrier to technology use was high cost and limited resources (76.9%), followed by concerns regarding patient data privacy and security (73.6%).

Table (5). Distribution of nurses according to their opinions about future directions and professional development (n = 91)

Item	No. (Yes)	%
Need to expand technology use in the center	85	93.4
Attend training programs	83	91.2
AI will be beneficial in the future	79	86.8
Virtual learning and simulation improve nursing skills	81	89.0
Need clear policies for technology use	87	95.6

Table (5) shows a highly positive attitude among nurses toward the future of healthcare technology. The majority of participants (95.6%) emphasized the need for clear institutional policies, while 93.4% supported expanding the use of technology.

Table (6). Relationship between the total technology use score in nursing and the personal characteristics of the nurses under study

Characteristics	Good	Fair	Poor	X2. value	df	p-value
Age				6.92	3	0.33
18-29(18)	11 (61.1%)	5 (27.8%)	2 (11.1%)			
29-39(21)	13 (61.1%)	6 (28.6%)	2 (9.5%)			
40-49(37)	22 (59.5%)	10 (27.0 %)	5 (13.5%)			
50+(15)	6 (40%)	9 (60%)	0 (0.0%)			
Gender				0.83	1	0.66
Male (23)	14 (60.9%)	6 (26.1%)	3 (13%)			
Female (68)	38 (55.9%)	24 (35.3%)	6 (8.8%)			
Educational level				5.02	2	0.29
Higher Institute (36)	22 (61.1%)	10 (27.8%)	4 (11.1%)			
Intermediate Institute (48)	26 (54.2%)	19 (39.6%)	3 (6.2%)			
Diploma (7)	4 (57.1%)	1 (14.3%)	2 (28.6%)			

According to Table (6), there were no statistically significant correlations ($p > 0.05$) between the demographic characteristics of nurses and their usage of contemporary technology.

DISCUSSION

The goal of the current study was to evaluate how contemporary technology has affected nursing practice at the Aljabal Al Akhdhar Teaching Diabetes Center, Al-Bayda City. The findings revealed that the majority of nurses were female, and the largest age group was between 40 and 49 years, indicating that most nurses were in their mid-career stage with considerable clinical experience. These findings are in line with earlier research (Almutairi et al., 2021; Khan et al., 2022) that found a concentration of women in the 30- to 50-year-old age range and more female engagement in the nursing sector.

According to the study, most participants employed contemporary technology on a daily basis. Specifically, most nurses used smart devices for monitoring vital signs, more than three-quarters used them for communication, and relied on electronic medical records. These findings align with the growing global trend toward digital health transformation, where electronic systems are increasingly integrated into clinical care to improve accuracy and patient safety (Al-Anzi, 2020; Hossain & Muhammad, 2021). The results confirm that technology has become an essential tool in nursing, facilitating efficient documentation, patient monitoring, and communication among healthcare providers. However, a lower percentage of nurses reported receiving adequate training when new systems were introduced, indicating a gap in continuous professional development.

Regarding the benefits of technology, most nurses reported that it improved response time (84.6%), enhanced accuracy (89%), reduced medical errors (81.3%), and improved communication between nurses and doctors (87.9%). These results are consistent with other research that showed how technology improves therapeutic effectiveness and patient safety (Eley et al., 2019; Alzahrani & Alshahrani, 2020). The boost in professional performance noted in this study emphasizes how technology can improve clinical efficiency and patient safety.

The current study's findings highlighted a number of issues related to the use of technology, including inadequate training, technical difficulties, and worries about the security and privacy of patient data. These issues highlight the need for improved infrastructure and ongoing education initiatives. Additionally, over 75% of participants cited high costs and inadequate resources.

These challenges are consistent with findings from earlier studies in other healthcare settings, which identified technical limitations, cost barriers, and insufficient user training as common obstacles to successful digital transformation in nursing (Alotaibi & Federico, 2017; Almutairi, 2021).

The majority of participants showed a great desire to attend more training courses and increase the use of technology in nursing practice. They also concurred that virtual learning and artificial intelligence will be crucial to healthcare in the future. This indicates that nurses are highly prepared for the digital transformation of healthcare practice.

Studies by Al-Shammari (2019), Khan et al. (2022), and Saleh et al. (2023) revealed similar findings, indicating that nurses are aware of the potential of contemporary technologies and are prepared to adapt if given adequate institutional and educational assistance.

The study's findings also demonstrated that there was no statistically significant correlation between nurses' overall technology use score and their demographic traits. This research suggests that organizational variables, training opportunities, and system availability have a greater impact on the adoption of contemporary technology in nursing practice than do individual traits. Research from Malaysia and Saudi Arabia revealed similar findings (Rahman et al., 2020; Alenezi et al., 2021).

The study's overall findings demonstrate that nurses at the Diabetes Center in Al-Bayda actively incorporate contemporary technology into their clinical practice and have a favorable opinion of it. The overall effect on patient care and professional performance is quite positive, notwithstanding current issues with privacy, cost, and training. To guarantee the sustainable and efficient use of technology in nursing practice, ongoing training, infrastructure investment, and well-defined institutional regulations are crucial.

CONCLUSION

Nurses demonstrated a high level of engagement with digital tools, including electronic medical records, smart devices, and healthcare applications, which contributed to improved accuracy, enhanced communication, reduced medical errors, and increased efficiency in patient care. However, several challenges were identified, such as insufficient training, technical difficulties, and concerns related to data privacy and security. Additionally, there was no statistically significant correlation between technology use and demographic traits, suggesting that when sufficient assistance is provided, all nurses gain equally from technology integration. Therefore, strengthening training programs, improving technical infrastructure, and establishing clear policies are essential to optimize technology use. Libyan nurses' performance and healthcare quality can be further improved by fostering a tech-friendly workplace and incorporating cutting-edge technologies like artificial intelligence and virtual learning.

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ETHICS

There are no ethical issues that may arise after the publication of the research.

Duality of interest: The authors declare that there is no conflict of interest regarding the publication of this paper. No financial, personal, or professional relationships that could be perceived as influencing the research findings or interpretations exist. The study was conducted independently, and the authors have no competing interests to disclose.

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