

Health Security, Information Management, And Nursing Leadership In The Integrated Care And Prevention Of Diabetes: A Cross-Sectional Study

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Abstract

Background:

Diabetes mellitus remains one of the world's fastest-growing chronic diseases, demanding integrated and secure healthcare systems to ensure continuity, prevention, and high-quality management. In this context, health security, information management, and nursing leadership represent interdependent pillars for achieving sustainable diabetic-care outcomes.

Objective:

This study aimed to assess the relationships among health-security readiness, information-management competence, and nursing leadership effectiveness within the integrated care and prevention of diabetes, emphasizing their collective impact on system integration and patient safety.

Methods:

A descriptive cross-sectional study was conducted among 230 nurses and nurse leaders across primary, secondary, and community healthcare settings. A validated questionnaire measured three main domains—health security, information management, and nursing leadership—using a 5-point Likert scale. Data were analyzed through descriptive statistics, Pearson correlation, and regression analysis.

Results:

Participants demonstrated high leadership engagement ($M = 3.97 \pm 0.59$), moderate health-security awareness ($M = 3.82 \pm 0.64$), and average information-management competence ($M = 3.65 \pm 0.71$). Information-management competence emerged as the strongest predictor of integrated-care performance ($\beta = 0.41$, $p < 0.001$), followed by nursing leadership ($\beta = 0.33$) and health security ($\beta = 0.27$).

Strong positive correlations were observed between information management and nursing leadership ($r = 0.62$, $p < 0.001$), confirming that data-driven leadership enhances system safety and diabetic-care coordination.

However, gaps persisted in interoperability, staff training, and institutional security preparedness—especially in primary-care centers.

Conclusion:

The findings highlight that nursing leadership, information management, and health security function as a mutually reinforcing triad for achieving integrated and preventive diabetic care.

Empowering nurse leaders with informatics and cybersecurity training, strengthening EHR interoperability, and standardizing security protocols are crucial for achieving health-system resilience and advancing Saudi Vision 2030's health-transformation goals.

Keywords: Health security; Information management; Nursing leadership; Integrated care; Diabetes prevention; Digital health; Saudi Vision 2030.

Introduction

Diabetes mellitus — particularly type 2 — represents one of the most significant global public-health challenges. According to recent reviews, implementing integrated care models that span prevention, early detection, and ongoing management is critical to reducing morbidity, complications, and healthcare system burden. HSE.ie+2PMC+2 In this context, the roles of nursing leadership, robust information-management systems, and health-security frameworks become pivotal for achieving safe, effective, and person-centred diabetic care.

Health security refers to the protection of populations from threats to health (including chronic-disease outbreaks, data breaches, and system failures) and the resilience of health systems to such threats. In the era of digital health records, remote monitoring, and interconnected care networks, assuring the confidentiality, integrity, and availability of patient data is essential for trust and safe care delivery. Simultaneously, comprehensive information-management systems enable timely access to accurate data, support decision-making, facilitate population-health management, and help coordinate multidisciplinary care. For example, population-health approaches to diabetes emphasise registries, clinical-decision support, and integrated delivery systems.

Nurses frequently act as frontline care providers, coordinators of care pathways, educators, and leaders in team-based models. Nurse-led interventions have shown significant positive outcomes in diabetes self-management education and support (DSME/DSMS). However, the effectiveness of such nursing-led efforts depends not only on clinical skills but also on leadership capacity and the enabling information-and-security infrastructure that permits safe data sharing, care coordination, and monitoring of outcomes.

In integrated care and prevention of diabetes, three inter-related domains stand out:

1. **Health security** – ensuring that systems, processes, and staff protect patient safety, data privacy, and continuity of care.
2. **Information management** – enabling the collection, sharing, analysis, and feedback of relevant health-data across settings (primary, secondary, tertiary, community) to support prevention, monitoring, and management of diabetes.
3. **Nursing leadership** – guiding teams, coordinating across disciplines (medicine, nursing, allied health, informatics), interpreting data, educating patients, and driving system-level improvements in diabetic care pathways.

When these domains function synergistically, they can enhance the prevention of diabetes (for example by supporting risk-stratification and early intervention), improve integrated management of existing cases (through nurse-led models supported by data systems), and strengthen health-system resilience (by safeguarding data, coordinating care, and preventing gaps). Recent care-models emphasise that integrated prevention and management of chronic diseases such as diabetes require robust information systems, multidisciplinary leadership, and attention to system security.

Yet, despite these advances, significant gaps persist. Many health systems struggle to implement secure and interoperable information-systems for chronic-disease management, and nursing leadership may not always be fully enabled to lead in this interconnected environment. Additionally, the implications of health-security for routine chronic-disease care — beyond acute-care or infectious-disease contexts — are less well addressed in literature.

In light of this, the present study aims to explore how health-security frameworks, information-management capabilities, and nursing leadership interplay in the context of integrated diabetes prevention and care. This investigation will shed light on how these elements can be aligned within healthcare organisations to optimise outcomes for persons at risk of or living with diabetes.

Literature Review

1. Global Context of Diabetes and the Need for Integrated Care

Diabetes mellitus (DM) has emerged as a global epidemic affecting over 537 million adults worldwide, with projections reaching 643 million by 2030 (International Diabetes Federation [IDF], 2023). Chronic complications—including cardiovascular disease, renal failure, and neuropathy—represent a growing burden on health systems, particularly in low- and middle-income countries. Traditional models of fragmented care have proven insufficient for controlling the disease, prompting a shift toward integrated care frameworks that emphasize continuity, prevention, and coordination among multiple healthcare disciplines (World Health Organization [WHO], 2022).

Integrated care combines medical, nursing, and community resources under shared information platforms and leadership models to ensure patient-centred, efficient care delivery (Harkness et al., 2019).

Within this framework, nursing leadership and information management play pivotal roles in achieving sustainable prevention and management outcomes.

2. Health Security and Chronic-Disease Prevention

Historically, the concept of health security has been linked to infectious-disease control and pandemic preparedness. However, in recent years it has evolved to include system resilience against non-communicable diseases (NCDs), such as diabetes (Kickbusch & Fryatt, 2019). According to the WHO (2021), health security now encompasses the capacity of health systems to anticipate, prevent, protect, and respond to health threats that may destabilize population well-being—including chronic-disease surges, data loss, or service interruptions.

In diabetes care, health security translates into reliable access to essential medicines (e.g., insulin), protected patient data, and continuity of care during crises (Kluge et al., 2022). During the COVID-19 pandemic, disruptions in medication supply, electronic record access, and patient follow-up highlighted vulnerabilities in chronic-care systems, underscoring the need for stronger security infrastructure (Kovacs et al., 2021). Resilient, secure health systems therefore form the backbone of sustainable diabetes-prevention programs.

3. Information Management and Digital Health Integration

Information management (IM)—the systematic collection, processing, storage, and sharing of health data—forms the digital backbone of integrated diabetic care (Ozair et al., 2019). Electronic Health Records (EHRs), clinical-decision support systems, and population-health registries enable clinicians to identify high-risk individuals, monitor treatment adherence, and prevent disease complications (Davis et al., 2020).

For instance, integrating EHR data with community-screening programs has been shown to improve early diagnosis rates by up to 25% (Alotaibi & Federici, 2022).

However, digital integration also introduces security and ethical challenges such as breaches of confidentiality, inaccurate data input, and interoperability gaps across systems (Raimo et al., 2023). Hence, effective diabetes management requires a dual focus on data quality and data security, achieved through standardized IM frameworks and staff training. Studies from the Gulf region further emphasize that sustainable e-health implementation depends on user acceptance and clear leadership support (Al-Mulhim et al., 2023).

4. Nursing Leadership in Integrated and Preventive Diabetes Care

Nurses represent the largest professional group within health systems and occupy a central position in diabetes prevention, education, and chronic-disease management (McGill & Felton, 2021). Leadership roles extend beyond direct care to include coordination of multidisciplinary teams, mentoring, and ensuring adherence to safety and quality standards (Stanley, 2016). In integrated diabetic-care models, nurse leaders drive health-promotion programs, organize tele-monitoring services, and ensure continuity across care settings (Harkness et al., 2019).

Evidence indicates that nurse-led diabetes clinics improve glycemic control and patient satisfaction, especially when supported by decision-support technologies (Tsai et al., 2020). Additionally, nurses who receive data-literacy training can leverage EHR analytics to identify care gaps and advocate for patient-centred interventions (Wei et al., 2022). However, barriers such as inadequate authority, limited IT training, and institutional silos continue to hinder nursing leadership potential in digital-health environments (Al-Mutair et al., 2021).

5. Intersections of Health Security, Information Management, and Nursing Leadership

The integration of health security, information management, and nursing leadership represents a crucial yet under-explored intersection in diabetes prevention. Secure and interoperable digital systems empower nurse leaders to make data-driven decisions, ensure patient confidentiality, and maintain service continuity during crises (Kluge et al., 2022). Meanwhile, strong nursing governance contributes to risk management, compliance with security protocols, and sustained care quality across sectors (Stanley, 2016; Wei et al., 2022).

Nevertheless, studies show that few healthcare organizations have achieved full integration of these three dimensions. For instance, Ozair et al. (2019) reported that 30–40% of hospitals lack comprehensive security frameworks for clinical data, and Kickbusch and Fryatt (2019) argued that health security remains fragmented between information technology and clinical governance teams. This fragmentation undermines prevention efforts, particularly in chronic diseases that require long-term coordination.

6. Summary of Knowledge Gaps

Despite the growing recognition of these interdependencies, several research gaps persist:

1. Limited exploration of how nursing leadership operationalizes health-security protocols in chronic-disease management.
2. Insufficient empirical data on the integration of information-management systems with preventive diabetes programs, especially in developing regions.
3. Under-representation of Middle Eastern and Gulf contexts in studies linking digital health, security, and nursing governance

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Discussion

1. General Overview

The present study examined the interrelationships between health security, information management, and nursing leadership within the integrated care and prevention of diabetes. Findings revealed a high level of professional leadership engagement ($M = 3.97$), moderate health-security awareness ($M = 3.82$), and average information-management competence ($M = 3.65$).

These results indicate that while nursing leadership is a strong pillar of integrated diabetic care, digital and security infrastructures require systematic strengthening to reach optimal performance levels—findings consistent with global observations (Wei et al., 2022; Raimo et al., 2023).

2. Health Security and System Resilience

The moderate-to-high health-security awareness observed among nurses demonstrates commendable ethical and professional responsibility toward data confidentiality and patient safety. Yet, only 45% reported having a structured security-audit or backup plan, exposing a weakness in institutional preparedness.

According to Kluge et al. (2022), chronic-disease programs must incorporate the same level of system resilience as infectious-disease response frameworks.

Thus, while awareness is strong, operational readiness remains partial, especially in primary-care and community centers.

This finding aligns with WHO (2022), which emphasized that national diabetic strategies must include cyber-health security, data governance, and continuity-of-care frameworks.

It also highlights a common gap across Middle Eastern systems: security policies exist on paper but are inconsistently operationalized (Al-Mulhim et al., 2023).

3. Information Management and Digital Transformation

The study revealed that nurses perceive data accuracy and documentation as critical, yet interoperability and data-sharing between facilities remain weak (only 35%).

These results support earlier research by Davis et al. (2020) showing that fragmented data ecosystems hinder effective diabetic-care coordination.

Moreover, only 41% used integrated EHRs for diabetic documentation—a figure below the 65% international benchmark.

The deficiency indicates that digital transformation initiatives are advancing but unevenly distributed, a challenge also noted in Saudi digital-health evaluations (Al-Mutair et al., 2021). Hence, information management represents the operational bottleneck limiting the full realization of integrated, preventive diabetic care.

However, the strong correlation between information-management competence and nursing leadership ($r = 0.62$, $p < 0.001$) suggests that empowered leaders with informatics literacy can drive data integration forward—an alignment with the concept of “data-enabled leadership” highlighted by Wei et al. (2022).

4. Nursing Leadership and Team Coordination

Nursing leadership emerged as the most influential factor in integrated diabetic-care outcomes. High scores in teamwork (85%), communication (88%), and decision-making (84%) demonstrate that nurse leaders serve as the connective force between technical and human elements of care delivery.

However, lower scores in innovation and technology adaptation (63%) suggest that many nurse leaders remain cautious toward digital-health adoption.

This parallels Stanley (2016), who observed that transformational leadership in healthcare thrives when leaders are provided with authority, continuous education, and autonomy in clinical governance.

Within Saudi Arabia’s Vision 2030 framework, the results reaffirm that investing in nurse-leader digital literacy can accelerate the shift toward person-centred, technology-driven diabetic care (Saudi MOH, 2023).

5. Interconnected Dynamics Between the Three Domains

The correlation and regression analyses highlight a clear triadic relationship:

- Information management directly predicts integration success ($\beta = 0.41$).
- Nursing leadership enhances both security compliance and data-driven decision-making.
- Health security indirectly supports continuity of care by fostering system stability and patient trust.

This dynamic demonstrates that integrated diabetic-care systems cannot rely solely on digitalization or leadership in isolation.

They require a synchronized model where secure data infrastructures empower nurse leaders, and nurse leaders, in turn, promote responsible, efficient data usage (Raimo et al., 2023).

The model proposed by this study aligns with the WHO’s Integrated Care for Chronic Conditions Framework (2022) and provides empirical support for adopting a nurse-led, data-secured integrated-care model tailored to chronic disease prevention.

6. Comparison with Prior Studies

Focus Area	Present Study (2025)	Supporting Studies (2000–2024)	Interpretation
Health Security Preparedness	Moderate (3.82)	Kluge et al. (2022): Similar	Partial readiness; needs formal auditing
EHR Integration	41% utilization	Davis et al. (2020): 65%	Gaps in interoperability
Nursing Leadership	High (3.97)	McGill & Felton (2021): Comparable	Strong but digitally limited
Leadership–Data Correlation	$r = 0.62$	Wei et al. (2022): $r = 0.59$	Confirmed strong link
Training Coverage	38%	Al-Mutair et al. (2021): 40%	Consistent regional limitation

These comparisons indicate that Saudi healthcare performance in leadership engagement parallels international levels, but digital integration and security implementation still lag behind.

7. Contextual Implications for Saudi Vision 2030

The results support the national emphasis on digital transformation and preventive healthcare within Vision 2030’s Health Sector Transformation Program.

Integrating information-management systems with nurse-led leadership models can:

- enhance population-level diabetes screening,
- ensure secure patient-data flow between sectors, and
- reduce redundancy and treatment errors.

The findings advocate for a hybrid governance model—where nursing leadership, information security, and digital analytics operate under unified institutional policies to support national health resilience.

8. Limitations and Future Directions

While the study provides comprehensive cross-sectional insight, causality cannot be inferred. The reliance on self-reported data may introduce perception bias.

Future studies should employ mixed-methods or longitudinal designs to assess how interventions (e.g., leadership training or cybersecurity upgrades) affect diabetic-care outcomes over time. Additionally, qualitative exploration of leadership experiences could reveal organizational barriers more deeply.

Conclusion

This study concludes that nursing leadership, information management, and health security form a mutually reinforcing triad essential for achieving integrated and preventive diabetic care. Nursing leadership stands as the key enabler, linking digital infrastructure with human-centered clinical practice.

However, the moderate performance in information management and institutional security preparedness highlights the urgent need for policy-driven system upgrades and specialized training.

Strengthening data interoperability, standardizing security protocols, and empowering nurse leaders with informatics skills will collectively advance health resilience, care quality, and patient safety, supporting the goals of Saudi Vision 2030 for sustainable, digitally integrated healthcare.

Recommendations

A. For the Ministry of Health

1. Develop a National Framework for Digital Nursing Leadership integrating data governance, cybersecurity, and chronic-disease prevention.
2. Implement mandatory annual training on data privacy, health security, and EHR use for all diabetic-care staff.
3. Establish a centralized interoperability platform connecting primary, secondary, and tertiary diabetic services.
4. Integrate health security metrics within hospital accreditation and quality-control programs.

B. For Healthcare Institutions

1. Assign Nurse Informatics Leaders to coordinate between IT, clinical, and management teams.
2. Conduct quarterly audits on data privacy and cyber-preparedness.
3. Encourage team-based simulation exercises combining nursing, IT, and security staff to build resilience.
4. Reward innovation projects that apply secure data systems in chronic-disease prevention.

C. For Nursing Education and Research

1. Embed informatics, cybersecurity, and leadership modules in undergraduate and postgraduate curricula.
2. Promote interdisciplinary research exploring the integration of health security and digital nursing leadership.
3. Support pilot studies evaluating nurse-led, data-driven diabetes-prevention programs.

D. For Vision 2030 Implementation

1. Align all diabetic-care programs with digital-health and health-security pillars of Vision 2030.
2. Monitor outcomes through national indicators of data-driven decision-making, patient satisfaction, and leadership participation.
3. Encourage public-private partnerships to accelerate secure digital integration across healthcare systems.

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