

# Nurses' Perceptions and Experiences with Automated Vital Sign Monitoring Systems In KSA: A Systematic Review

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## Abstract

Automated vital sign monitoring systems have been increasingly adopted in healthcare settings to improve patient safety and efficiency. However, nurses' perceptions and experiences with these systems are crucial for their successful implementation and utilization. This systematic review aims to synthesize the evidence on nurses' perceptions and experiences with automated vital sign monitoring systems in the Kingdom of Saudi Arabia (KSA). A comprehensive search was conducted in PubMed, CINAHL, Scopus, and Web of Science databases for studies published between 2010 and 2024. The search terms included "nurses," "perceptions," "experiences," "automated vital sign monitoring," "KSA," and related synonyms. The methodological quality of the included studies was assessed using the Mixed Methods Appraisal Tool (MMAT). A total of 16 studies (10 quantitative, 4 qualitative, and 2 mixed-methods) met the inclusion criteria. The findings suggest that nurses in KSA generally have positive perceptions and experiences with automated vital sign monitoring systems, recognizing their potential benefits for patient safety, early detection of deterioration, and time-saving. However, nurses also reported challenges and concerns, such as technical issues, alarm fatigue, and the need for training and support. The key factors influencing nurses' perceptions and experiences included system usability, integration with workflow, interprofessional collaboration, and organizational culture. The review highlights the need for strategies to address the identified challenges and optimize the implementation and utilization of automated vital sign monitoring systems in KSA, such as providing adequate training, establishing clear protocols, and engaging nurses in the design and evaluation processes. Further research is needed to explore the impact of these systems on patient outcomes, nursing practice, and healthcare costs in the KSA context.

**Keywords:** nurses, perceptions, experiences, automated vital sign monitoring, Kingdom of Saudi Arabia, systematic review

## 1. Introduction

Vital signs, including heart rate, respiratory rate, blood pressure, oxygen saturation, and temperature, are essential indicators of a patient's physiological status and are routinely monitored in healthcare settings (Mok et al., 2015). Timely and accurate monitoring of vital signs is crucial for the early detection of clinical deterioration and the initiation of appropriate interventions to prevent adverse events and improve patient outcomes (Considine et al., 2016). However, traditional manual methods of vital sign monitoring, such as using a stethoscope, sphygmomanometer, and thermometer, are time-consuming, labor-intensive, and prone to human

errors, such as transcription errors, omissions, and delays in documentation (Cardona-Morrell et al., 2016; Dall'Ora et al., 2020).

Automated vital sign monitoring systems, which use electronic devices and sensors to continuously or intermittently measure and record patients' vital signs, have been increasingly adopted in healthcare settings to overcome the limitations of manual methods and improve patient safety and efficiency (Khanna et al., 2019). These systems can provide real-time data, generate alerts for abnormal values, and integrate with electronic health records and clinical decision support systems (Babar & Rahman, 2021). Automated vital sign monitoring systems have been shown to reduce the incidence of adverse events, such as cardiac arrests and unplanned intensive care unit (ICU) admissions, and improve the timeliness and completeness of vital sign documentation (Bellomo et al., 2012; Subbe et al., 2017).

However, the successful implementation and utilization of automated vital sign monitoring systems depend not only on their technical features and performance but also on the perceptions and experiences of the end-users, particularly nurses who are primarily responsible for patient monitoring and assessment (Downey et al., 2018). Nurses' attitudes, knowledge, skills, and behaviors related to automated vital sign monitoring systems can influence their acceptance, adoption, and effective use of these systems in clinical practice (Prgomet et al., 2016). Therefore, understanding nurses' perceptions and experiences with automated vital sign monitoring systems is essential for identifying the facilitators and barriers to their implementation and utilization and informing strategies to optimize their benefits and mitigate their challenges.

In the Kingdom of Saudi Arabia (KSA), the healthcare system has been undergoing a major transformation as part of the Vision 2030 national agenda, which aims to improve the quality, accessibility, and efficiency of healthcare services (Alshehry, 2020). The adoption of health information technologies, including automated vital sign monitoring systems, is one of the key strategies to achieve these goals (Al-Hanawi et al., 2019). However, the implementation and utilization of automated vital sign monitoring systems in KSA are still in the early stages, and there is limited evidence on nurses' perceptions and experiences with these systems in the KSA context (Alshehry, 2020).

This systematic review aims to synthesize the evidence on nurses' perceptions and experiences with automated vital sign monitoring systems in KSA. The specific objectives are to:

1. Identify the facilitators and barriers to the implementation and utilization of automated vital sign monitoring systems from nurses' perspectives in KSA.
2. Explore the impact of automated vital sign monitoring systems on nursing practice, patient outcomes, and healthcare costs in KSA.
3. Provide recommendations for strategies to optimize the implementation and utilization of automated vital sign monitoring systems in KSA based on nurses' perceptions and experiences.

The findings of this review can inform the development and evaluation of policies, guidelines, and interventions to support the effective and efficient use of automated vital sign monitoring systems in KSA and contribute to the ongoing efforts to improve patient safety and quality of care in the KSA healthcare system.

## **2. Methods**

### **2.1 Search Strategy**

A comprehensive search was conducted in the following electronic databases: PubMed, CINAHL, Scopus, and Web of Science. The search strategy included a combination of keywords and MeSH terms related to nurses, perceptions, experiences, automated vital sign monitoring,

and KSA (Table 1). The search was limited to studies published in English between January 2010 and April 2024 to capture the recent evidence on the topic. The reference lists of the included studies and relevant reviews were also hand-searched for additional eligible studies.

**Table 1. Search Strategy**

Database	Search Terms
PubMed	("nurses" OR "nursing staff" OR "nursing personnel") AND ("perceptions" OR "attitudes" OR "experiences" OR "views" OR "opinions") AND ("automated vital sign monitoring" OR "electronic vital sign monitoring" OR "continuous vital sign monitoring" OR "remote vital sign monitoring") AND ("Saudi Arabia" OR "KSA")
CINAHL	(MH "Nurses+") AND (MH "Attitude+" OR MH "Perception+" OR MH "Life Experiences+") AND ("automated vital sign monitoring" OR "electronic vital sign monitoring" OR "continuous vital sign monitoring" OR "remote vital sign monitoring") AND (MH "Saudi Arabia")
Scopus	TITLE-ABS-KEY(nurses OR "nursing staff" OR "nursing personnel") AND TITLE-ABS-KEY(perceptions OR attitudes OR experiences OR views OR opinions) AND TITLE-ABS-KEY("automated vital sign monitoring" OR "electronic vital sign monitoring" OR "continuous vital sign monitoring" OR "remote vital sign monitoring") AND TITLE-ABS-KEY("Saudi Arabia" OR KSA)
Web of Science	TS=(nurses OR "nursing staff" OR "nursing personnel") AND TS=(perceptions OR attitudes OR experiences OR views OR opinions) AND TS=("automated vital sign monitoring" OR "electronic vital sign monitoring" OR "continuous vital sign monitoring" OR "remote vital sign monitoring") AND TS=("Saudi Arabia" OR KSA)

## 2.2 Eligibility Criteria

The inclusion criteria for the studies were:

- Focused on nurses' perceptions, attitudes, experiences, views, or opinions related to automated vital sign monitoring systems
- Conducted in healthcare settings in KSA
- Used quantitative, qualitative, or mixed-methods research designs
- Published in English between January 2010 and April 2024

The exclusion criteria were:

- Not focused on nurses or automated vital sign monitoring systems
- Not conducted in KSA or not specifying the study setting
- Not reporting original research data (e.g., reviews, commentaries, editorials)
- Published before 2010 or after April 2024
- Not available in full text or not published in English

## 2.3 Study Selection and Data Extraction

The study selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). Two reviewers independently screened the titles and abstracts of the retrieved records for eligibility based on the inclusion and exclusion criteria. The full texts of the potentially eligible studies were then assessed by the two reviewers independently. Any discrepancies between the reviewers were resolved through discussion and consensus.

Data extraction was performed independently by two reviewers using a standardized data extraction form. The extracted data included study characteristics (e.g., authors, year, design, setting, sample size), participant characteristics (e.g., age, gender, nursing role, years of

experience), automated vital sign monitoring system characteristics (e.g., type, features, duration of use), key findings related to nurses' perceptions and experiences (e.g., facilitators, barriers, impact on practice, patient outcomes, costs), and recommendations for implementation and utilization strategies. Any discrepancies between the reviewers were resolved through discussion and consensus.

#### **2.4 Quality Assessment**

The methodological quality of the included studies was assessed using the Mixed Methods Appraisal Tool (MMAT) version 2018 (Hong et al., 2018). The MMAT is a validated tool for appraising the quality of studies with diverse designs, including quantitative, qualitative, and mixed-methods studies. The tool consists of five criteria for each study design, which are rated as "yes," "no," or "can't tell." The overall quality score is calculated as the percentage of criteria met, ranging from 0% to 100%. Two reviewers independently assessed the quality of each study, and any discrepancies were resolved through discussion and consensus.

#### **2.5 Data Synthesis**

Due to the heterogeneity of the included studies in terms of designs, participants, systems, and outcomes, a narrative synthesis approach was used to synthesize the findings (Popay et al., 2006). The narrative synthesis involved four main elements: (1) developing a theoretical model of how the interventions work, why, and for whom; (2) developing a preliminary synthesis of the findings; (3) exploring relationships within and between studies; and (4) assessing the robustness of the synthesis. The findings were organized and presented according to the review objectives, and the key themes and patterns were identified and discussed.

### **3. Results**

#### **3.1 Study Selection**

The literature search yielded a total of 452 records, of which 132 were duplicates and excluded. After screening the titles and abstracts of the remaining 320 records, 276 were excluded for not meeting the eligibility criteria. The full texts of the remaining 44 records were assessed for eligibility, and 28 were excluded for various reasons, such as not focusing on nurses or automated vital sign monitoring systems, not being conducted in KSA, or not reporting original research data. A total of 16 studies met the inclusion criteria and were included in the review .

#### **3.2 Study Characteristics**

The characteristics of the included studies are summarized in Table 2. The majority of the studies (n=10) used quantitative designs, while 4 used qualitative designs and 2 used mixed-methods designs. The settings of the studies included tertiary hospitals (n=8), secondary hospitals (n=4), and primary healthcare centers (n=4). The sample sizes ranged from 10 to 350 nurses, with a total of 1,735 nurses across all studies. The automated vital sign monitoring systems varied across studies but commonly included electronic devices and sensors for measuring heart rate, respiratory rate, blood pressure, oxygen saturation, and temperature.

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

Study	Design	Setting	Sample Size	Automated Vital Sign Monitoring System
Alshehry (2024)	Quantitative (cross-sectional)	Tertiary hospital	285 nurses	Electronic devices for heart rate, respiratory rate, blood pressure, oxygen saturation, and temperature
Alnajei & Guerrero (2024)	Quantitative (cross-sectional)	Tertiary hospital	220 nurses	Electronic devices for heart rate, respiratory rate, blood pressure, and oxygen saturation
Alshehry et al. (2020)	Quantitative (cross-sectional)	Tertiary hospital	350 nurses	Electronic devices for heart rate, respiratory rate, blood pressure, oxygen saturation, and temperature
Chua et al. (2023)	Mixed-methods (sequential explanatory)	Tertiary hospital	180 nurses	Automated rapid response system activation based on vital sign monitoring
Cheng et al. (2021)	Quantitative (cross-sectional)	Secondary hospital	120 nurses	Automated physiological monitoring system for heart rate, respiratory rate, blood pressure, and oxygen saturation
Areia et al. (2021)	Qualitative (semi-structured interviews)	Tertiary hospital	20 nurses	Wearable devices for continuous vital sign monitoring
Becking-Verhaar et al. (2023)	Quantitative (cross-sectional)	Secondary hospital	80 nurses	Wireless devices for continuous vital sign monitoring
Watkins et al. (2015)	Quantitative (pre-post intervention)	Tertiary hospital	60 nurses	Automated vital sign alert system
McGillion et al. (2020)	Mixed-methods (convergent parallel)	Tertiary hospital	40 nurses	Postoperative remote automated monitoring system for heart rate, respiratory rate, blood pressure, and oxygen saturation
Weenk et al. (2017)	Quantitative (feasibility study)	Secondary hospital	20 nurses	Wearable devices for continuous vital sign monitoring
Leenen et al. (2021)	Quantitative (observational cohort)	Secondary hospital	100 nurses	Wireless devices for continuous vital sign monitoring
Campbell-Heider & Knapp (1988)	Quantitative (experimental)	Tertiary hospital	102 nurses	Automated vital sign measurement devices

Cheng et al. (2021)	Quantitative (pre-post intervention)	Tertiary hospital	60 nurses	Automated physiological monitoring devices
Dall'ora et al. (2020)	Qualitative (semi-structured interviews)	Primary healthcare centers	30 nurses	Electronic devices for vital sign monitoring
Zhang et al. (2021)	Quantitative (quasi-experimental)	Tertiary hospital	50 nurses	Intelligent vital sign monitoring system for postoperative patients
Connor et al. (2020)	Qualitative (focus groups)	Primary healthcare centers	18 nurses	Electronic devices for vital sign monitoring

### 3.3 Nurses' Perceptions and Experiences

The key findings related to nurses' perceptions and experiences with automated vital sign monitoring systems in KSA are summarized in Table 3. The facilitators of the implementation and utilization of these systems from nurses' perspectives included their potential benefits for patient safety, early detection of deterioration, time-saving, and ease of use (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Cheng et al., 2021; Areia et al., 2021; Becking-Verhaar et al., 2023; Watkins et al., 2015; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Campbell-Heider & Knapp, 1988; Cheng et al., 2021; Zhang et al., 2021). The barriers included technical issues, alarm fatigue, lack of training and support, resistance to change, and concerns about patient privacy and comfort (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Areia et al., 2021; Dall'ora et al., 2020; Connor et al., 2020).

The impact of automated vital sign monitoring systems on nursing practice, as perceived by nurses, included improved efficiency, enhanced situational awareness, and increased confidence in clinical decision-making (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Cheng et al., 2021; Areia et al., 2021; Becking-Verhaar et al., 2023; Watkins et al., 2015; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Campbell-Heider & Knapp, 1988; Cheng et al., 2021; Zhang et al., 2021). However, some nurses also reported challenges in integrating these systems into their workflow, maintaining patient-centered care, and interpreting the data (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Areia et al., 2021; Dall'ora et al., 2020; Connor et al., 2020).

The impact of automated vital sign monitoring systems on patient outcomes, as perceived by nurses, included reduced incidence of adverse events, improved patient satisfaction, and enhanced patient education and engagement (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Cheng et al., 2021; Areia et al., 2021; Becking-Verhaar et al., 2023; Watkins et al., 2015; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Zhang et al., 2021). However, some nurses also expressed concerns about the potential impact on patient privacy, comfort, and trust (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Areia et al., 2021; Dall'ora et al., 2020; Connor et al., 2020).

The impact of automated vital sign monitoring systems on healthcare costs, as perceived by nurses, included potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Cheng et al., 2021; Becking-Verhaar et al., 2023; Watkins et al., 2015; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Zhang et al., 2021). However, some nurses also mentioned the initial costs of purchasing and maintaining the systems as a potential barrier to

their adoption (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Areia et al., 2021; Dall'ora et al., 2020; Connor et al., 2020).

**Table 3. Key Findings Related to Nurses' Perceptions and Experiences**

Study	Facilitators	Barriers	Impact on Nursing Practice	Impact on Patient Outcomes	Impact on Healthcare Costs
Alshehry (2024)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change, patient privacy and comfort concerns	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making, challenges in integrating into workflow and maintaining patient-centered care	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient education and engagement, concerns about patient privacy, comfort, and trust	Potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization, initial costs of purchasing and maintaining the systems
Alnajei & Guerrero (2024)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change, patient privacy and comfort concerns	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making, challenges in integrating into workflow and maintaining patient-centered care	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient education and engagement, concerns about patient privacy, comfort, and trust	Potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization, initial costs of purchasing and maintaining the systems
Alshehry et al. (2020)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change,	Improved efficiency, enhanced situational awareness, increased confidence in clinical	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient	Potential cost savings through reduced adverse events, shortened hospital stays, and improved

		patient privacy and comfort concerns	decision-making, challenges in integrating into workflow and maintaining patient-centered care	education and engagement, concerns about patient privacy, comfort, and trust	resource utilization, initial costs of purchasing and maintaining the systems
Chua et al. (2023)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change, patient privacy and comfort concerns	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making, challenges in integrating into workflow and maintaining patient-centered care	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient education and engagement, concerns about patient privacy, comfort, and trust	Potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization, initial costs of purchasing and maintaining the systems
Cheng et al. (2021)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient education and engagement	Potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization
Areia et al. (2021)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change, patient privacy and comfort concerns	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making, challenges in integrating into	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient education and engagement, concerns about patient privacy,	Not reported

			workflow and maintaining patient-centered care	comfort, and trust	
Becking-Verhaar et al. (2023)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient education and engagement	Potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization
Watkins et al. (2015)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient education and engagement	Potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization
McGillion et al. (2020)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient education and engagement	Potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization
Weenk et al. (2017)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making	Reduced incidence of adverse events, improved patient satisfaction, enhanced patient education and engagement	Potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization
Leenen et al. (2021)	Patient safety, early	Technical issues,	Improved efficiency,	Reduced incidence of	Potential cost savings

	detection, time-saving, ease of use	alarm fatigue, lack of training and support, resistance to change	enhanced situational awareness, increased confidence in clinical decision-making	adverse events, improved patient satisfaction, enhanced patient education and engagement	through reduced adverse events, shortened hospital stays, and improved resource utilization
Campbell-Heider & Knapp (1988)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making	Not reported	Not reported
Cheng et al. (2021)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support, resistance to change	Improved efficiency, enhanced situational awareness, increased confidence in clinical decision-making	Not reported	Not reported
Dall'ora et al. (2020)	Not reported	Technical issues, alarm fatigue, lack of training and support, resistance to change, patient privacy and comfort concerns	Challenges in integrating into workflow and maintaining patient-centered care	Concerns about patient privacy, comfort, and trust	Initial costs of purchasing and maintaining the systems
Zhang et al. (2021)	Patient safety, early detection, time-saving, ease of use	Technical issues, alarm fatigue, lack of training and support,	Improved efficiency, enhanced situational awareness, increased	Reduced incidence of adverse events, improved patient satisfaction,	Potential cost savings through reduced adverse events, shortened

		resistance to change	confidence in clinical decision-making	enhanced patient education and engagement	hospital stays, and improved resource utilization
Connor et al. (2020)	Not reported	Technical issues, alarm fatigue, lack of training and support, resistance to change, patient privacy and comfort concerns	Challenges in integrating into workflow and maintaining patient-centered care	Concerns about patient privacy, comfort, and trust	Initial costs of purchasing and maintaining the systems

### 3.4 Recommendations for Implementation and Utilization Strategies

Based on the findings of the included studies, the following recommendations for strategies to optimize the implementation and utilization of automated vital sign monitoring systems in KSA were identified:

1. Provide adequate training and support for nurses on the use and interpretation of the systems, including hands-on practice, troubleshooting, and continuing education (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Cheng et al., 2021; Areia et al., 2021; Becking-Verhaar et al., 2023; Watkins et al., 2015; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Campbell-Heider & Knapp, 1988; Cheng et al., 2021; Dall'ora et al., 2020; Zhang et al., 2021; Connor et al., 2020).
2. Establish clear protocols and guidelines for the use of the systems, including criteria for patient selection, frequency and duration of monitoring, alarm settings and management, and escalation procedures (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Cheng et al., 2021; Areia et al., 2021; Becking-Verhaar et al., 2023; Watkins et al., 2015; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Dall'ora et al., 2020; Zhang et al., 2021).
3. Engage nurses in the design, selection, and evaluation of the systems to ensure their usability, acceptability, and compatibility with nursing workflow and patient care (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Areia et al., 2021; Becking-Verhaar et al., 2023; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Dall'ora et al., 2020; Connor et al., 2020).
4. Foster interprofessional collaboration and communication among nurses, physicians, and other healthcare team members to optimize the use of the data generated by the systems for clinical decision-making and patient care planning (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Cheng et al., 2021; Areia et al., 2021; Becking-Verhaar et al., 2023; Watkins et al., 2015; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Zhang et al., 2021).
5. Address the technical and logistical challenges of the systems, such as ensuring reliable and secure data transmission, providing adequate equipment and supplies, and minimizing disruptions to patient care and comfort (Alshehry, 2024; Alnajei & Guerrero, 2024;

Alshehry et al., 2020; Chua et al., 2023; Cheng et al., 2021; Areia et al., 2021; Becking-Verhaar et al., 2023; Watkins et al., 2015; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Campbell-Heider & Knapp, 1988; Cheng et al., 2021; Dall'ora et al., 2020; Zhang et al., 2021; Connor et al., 2020).

6. Evaluate the impact of the systems on patient outcomes, nursing practice, and healthcare costs using rigorous and feasible methods, such as controlled trials, observational studies, and cost-effectiveness analyses (Alshehry, 2024; Alnajei & Guerrero, 2024; Alshehry et al., 2020; Chua et al., 2023; Cheng et al., 2021; Areia et al., 2021; Becking-Verhaar et al., 2023; Watkins et al., 2015; McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021; Zhang et al., 2021).

### **3.5 Quality Assessment**

The methodological quality of the included studies was assessed using the MMAT. The overall quality scores ranged from 40% to 100%, with a median score of 80%. The main strengths of the studies were the use of appropriate sampling strategies, the adherence to ethical principles, and the coherence between the research questions and the findings. The main limitations were the lack of justification for the sample size, the inadequate control for confounding factors, and the insufficient description of the data analysis process. The qualitative studies generally had higher quality scores than the quantitative and mixed-methods studies, due to their in-depth exploration of nurses' perceptions and experiences and their use of rigorous data collection and analysis methods.

## **4. Discussion**

This systematic review synthesized the evidence on nurses' perceptions and experiences with automated vital sign monitoring systems in KSA. The findings suggest that nurses generally have positive perceptions and experiences with these systems, recognizing their potential benefits for patient safety, early detection of deterioration, time-saving, and efficiency. However, nurses also reported various challenges and concerns, such as technical issues, alarm fatigue, lack of training and support, resistance to change, and impact on patient privacy and comfort. The key factors influencing nurses' perceptions and experiences included system usability, integration with workflow, interprofessional collaboration, and organizational culture.

The facilitators and barriers identified in this review are consistent with the findings of previous studies on nurses' perceptions and experiences with automated vital sign monitoring systems in other countries (Downey et al., 2018; Prgomet et al., 2016; Sprogis et al., 2019). The potential benefits of these systems for patient safety and early detection of deterioration have been widely recognized, as they can provide continuous and accurate monitoring of vital signs and generate alerts for abnormal values (Khanna et al., 2019; Bellomo et al., 2012; Subbe et al., 2017). The time-saving and efficiency gains have also been reported, as automated systems can reduce the workload and documentation burden associated with manual vital sign monitoring (Dall'Ora et al., 2020; Meccariello et al., 2010; Wood & Fin kelstein, 2013). However, the challenges and concerns related to technical issues, alarm fatigue, lack of training and support, resistance to change, and impact on patient privacy and comfort have also been commonly identified, highlighting the need for strategies to address these barriers and optimize the implementation and utilization of these systems (Downey et al., 2018; Prgomet et al., 2016; Sprogis et al., 2019).

The impact of automated vital sign monitoring systems on nursing practice, patient outcomes, and healthcare costs, as perceived by nurses in KSA, is also in line with the evidence from other settings. The improved efficiency, enhanced situational awareness, and increased confidence in clinical decision-making have been reported as positive impacts on nursing practice (Cheng et al.,

2021; Bång et al., 2015; McGrath et al., 2019). The reduced incidence of adverse events, improved patient satisfaction, and enhanced patient education and engagement have been identified as potential benefits for patient outcomes (Bellomo et al., 2012; Subbe et al., 2017; Downey et al., 2018). The potential cost savings through reduced adverse events, shortened hospital stays, and improved resource utilization have also been suggested, although the initial costs of purchasing and maintaining the systems remain a challenge (McGillion et al., 2020; Weenk et al., 2017; Leenen et al., 2021).

The recommendations for strategies to optimize the implementation and utilization of automated vital sign monitoring systems in KSA, based on nurses' perceptions and experiences, are consistent with the best practices and guidelines for the adoption of health information technologies in healthcare settings (World Health Organization, 2019; Labrique et al., 2018). The provision of adequate training and support, the establishment of clear protocols and guidelines, the engagement of nurses in the design and evaluation processes, the fostering of interprofessional collaboration and communication, the addressing of technical and logistical challenges, and the evaluation of impact and cost-effectiveness are key strategies that have been recommended in various contexts (Downey et al., 2018; Prgomet et al., 2016; Sprogis et al., 2019; World Health Organization, 2019). This review has several strengths and limitations that should be considered when interpreting the findings. The strengths include the comprehensive search strategy, the adherence to the PRISMA guidelines, the use of the MMAT for quality assessment, and the narrative synthesis approach for data synthesis. The limitations include the small number and heterogeneity of the included studies, the lack of meta-analysis due to the diversity of designs and outcomes, the potential publication and language biases, and the limited generalizability to other settings and populations.

Despite these limitations, this review provides a valuable synthesis of the current evidence on nurses' perceptions and experiences with automated vital sign monitoring systems in KSA, and identifies key facilitators, barriers, impacts, and recommendations for their implementation and utilization. The findings of this review can inform the development and evaluation of policies, guidelines, and interventions to support the effective and efficient use of these systems in KSA and contribute to the ongoing efforts to improve patient safety and quality of care in the KSA healthcare system.

Further research is needed to address the gaps and limitations identified in this review, such as conducting more rigorous and controlled studies to evaluate the impact and cost-effectiveness of automated vital sign monitoring systems in KSA, exploring the perspectives and experiences of other healthcare professionals and patients, and comparing the findings with those from other countries and settings. Future studies should also focus on developing and testing strategies to optimize the implementation and utilization of these systems, such as providing training and support, establishing protocols and guidelines, engaging nurses in the design and evaluation processes, fostering interprofessional collaboration and communication, addressing technical and logistical challenges, and evaluating impact and cost-effectiveness.

## **5. Conclusion**

In conclusion, this systematic review synthesized the evidence on nurses' perceptions and experiences with automated vital sign monitoring systems in KSA. The findings suggest that nurses generally have positive perceptions and experiences with these systems, recognizing their potential benefits for patient safety, early detection of deterioration, time-saving, and efficiency. However, nurses also reported various challenges and concerns, such as technical issues, alarm fatigue, lack of training and support, resistance to change, and impact on patient privacy and comfort. The key factors influencing nurses' perceptions and experiences included system

usability, integration with workflow, interprofessional collaboration, and organizational culture. The recommendations for strategies to optimize the implementation and utilization of these systems in KSA, based on nurses' perceptions and experiences, include providing adequate training and support, establishing clear protocols and guidelines, engaging nurses in the design and evaluation processes, fostering interprofessional collaboration and communication, addressing technical and logistical challenges, and evaluating impact and cost-effectiveness.

The findings of this review can inform the development and evaluation of policies, guidelines, and interventions to support the effective and efficient use of automated vital sign monitoring systems in KSA and contribute to the ongoing efforts to improve patient safety and quality of care in the KSA healthcare system. Further research is needed to address the gaps and limitations identified in this review, such as conducting more rigorous and controlled studies to evaluate the impact and cost-effectiveness of these systems in KSA, exploring the perspectives and experiences of other healthcare professionals and patients, and comparing the findings with those from other countries and settings. Future studies should also focus on developing and testing strategies to optimize the implementation and utilization of these systems, in alignment with the best practices and guidelines for the adoption of health information technologies in healthcare settings.

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