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The Role of Nursing and Laboratory professionals in Improving Screening Accessibility and Quality: A Systematic Review of Saudi Arabia's Vision 2030 Implementation

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Abstract
The Saudi Vision 2030 strategic plan aims to transform the healthcare system and improve population health outcomes through various initiatives, including expanding access to preventive services and enhancing the quality of screening programs. Nursing and laboratory technicians play a crucial role in delivering these services and ensuring their effectiveness. This systematic review aimed to synthesize the evidence on the role of nursing and laboratory technicians in improving screening accessibility and quality in Saudi Arabia, in the context of the Vision 2030 implementation. A comprehensive search of PubMed, CINAHL, Scopus, and Google Scholar databases was conducted for studies published between 2016 and 2024. A total of 30 studies met the inclusion criteria and were analyzed using a narrative synthesis approach. The findings revealed that nursing and laboratory technicians contribute to various aspects of screening programs, such as patient education, sample collection, result interpretation, and follow-up. However, several challenges were identified, including the lack of standardized training and competency assessment, limited resources and infrastructure, and inadequate coordination and communication among healthcare providers. The implications for practice and policy included the need for developing a national framework for the education, regulation, and integration of nursing and laboratory technicians in the healthcare system, investing in technology and innovation to enhance screening efficiency and accuracy, and promoting interprofessional collaboration and patient-centered care. The review highlights the importance of recognizing and optimizing the contributions of nursing and laboratory technicians in achieving the screening-related goals of Saudi Vision 2030.
Keywords: nursing technicians, laboratory technicians, screening, accessibility, quality, Saudi Arabia, Vision 2030, systematic review

1. Introduction

The healthcare system in Saudi Arabia is undergoing a major transformation as part of the Vision 2030 strategic plan, which aims to improve the quality, efficiency, and sustainability of healthcare services and to enhance the health and well-being of the population (Rahman & Al-Borie, 2020; Saudi Vision 2030, 2016). One of the key priorities of Vision 2030 is to expand access to preventive services and to enhance the quality of screening programs for various health conditions, such as cancer, diabetes, and cardiovascular diseases (Alasiri& Mohammed, 2022; Almutairi & Shamsi, 2018). Nursing and laboratory technicians are important members of the healthcare workforce in Saudi Arabia, who play a vital role in delivering these services and ensuring their effectiveness (Alnowibet et al., 2021; Fostering Job Satisfaction and Sustainability in Allied Health Technician Roles in Saudi Arabia, 2023).

Registered nurses (Aljohani, 2020). They perform various patient care tasks, such as measuring vital signs, administering medications, collecting specimens, and providing patient education (Aljohani et al., 2022; Alkhunaizi&Aboshaiqah, 2023). Laboratory technicians, also known as medical laboratory technicians or clinical laboratory technicians, are healthcare professionals who have completed a diploma or associate degree program in medical laboratory science and are certified to perform various laboratory tests and procedures (Khan et al., 2017). They are responsible for collecting, processing, and analyzing biological specimens, such as blood, urine, and tissue samples, and reporting the results to physicians and other healthcare providers (Almutairi, Hessa et al., 2020; Sheerah et al., 2024).

The role of nursing and laboratory technicians in improving screening accessibility and quality has been increasingly recognized in the healthcare literature (Al-Otaibi et al., 2024; Alduaig et al., 2016). Screening refers to the process of identifying individuals who are at risk of developing a specific health condition or who have early signs or symptoms of the condition, but who do not yet have a confirmed diagnosis (Aljarallah et al., 2023). The goal of screening is to detect the condition early, when it is more treatable or manageable, and to prevent or delay its progression and complications (Alshammary et al., 2024). Nursing and laboratory technicians can contribute to screening accessibility by providing information and education to patients about the importance and availability of screening services, by assisting with the logistics and coordination of screening appointments and referrals, and by performing some of the screening tests and procedures, such as blood pressure measurement, blood glucose testing, and Pap smears (Bagedo et al., 2023; Leufer et al., 2021). They can also contribute to screening quality by following standardized protocols and guidelines for sample collection, processing, and analysis, by ensuring the accuracy and reliability of the screening results, and by communicating the results and implications to patients and healthcare providers in a timely and effective manner (Al-Dossary, 2022; Alshammari et al., 2019).

However, there are also challenges and barriers that can impact the ability of nursing and laboratory technicians to improve screening accessibility and quality in Saudi Arabia, such as the lack of standardized education and training programs, the shortage of qualified and motivated personnel, the limited resources and infrastructure for screening services, and the inadequate coordination and communication among healthcare providers and sectors (Aboshaiqah, 2016; Alharbi et al., 2022). In the context of Vision 2030, there is a need to explore the role of nursing and laboratory technicians in improving screening accessibility and quality, and to identify the facilitators and barriers for their optimal utilization and integration in the healthcare system, particularly in light of the healthcare transformation initiatives and the nursing profession's strategic priorities (Alkhunaizi&Aboshaiqah, 2023; Almutairi, H. & Bahari, 2021).

This systematic review aimed to address this gap by synthesizing the evidence on the role of nursing and laboratory technicians in improving screening accessibility and quality in Saudi Arabia, in the context of the Vision 2030 implementation. The specific objectives of the review were:

1. To identify the contributions of nursing and laboratory technicians to screening accessibility and quality in various healthcare settings in Saudi Arabia.
2. To explore the facilitators and barriers for the optimal utilization and integration of nursing and laboratory technicians in the screening programs in Saudi Arabia.
3. To examine the implications of the findings for nursing and laboratory practice, education, and policy in the context of Vision 2030 and the healthcare transformation in Saudi Arabia.
4. To provide recommendations for future research and development to optimize the role of nursing and laboratory technicians in improving screening accessibility and quality in Saudi Arabia.

The findings of this review can inform the development and implementation of strategies and interventions to support the education, regulation, and integration of nursing and laboratory technicians in the healthcare system, and to leverage their contributions to screening accessibility and quality in line with the Vision 2030 goals and the healthcare workforce's aspirations in Saudi Arabia.

2. Methods

2.1 Search Strategy and Eligibility Criteria

A comprehensive search of four electronic databases (PubMed, CINAHL, Scopus, and Google Scholar) was conducted in May 2024 to identify relevant studies on the role of nursing and laboratory technicians in improving screening accessibility and quality in Saudi Arabia. The search strategy included a combination of keywords and MeSH terms related to nursing technicians, laboratory technicians, screening, accessibility, quality, Saudi Arabia, and Vision 2030, as shown in Table 1.

Table 1. Search Strategy

Database	Search Terms
PubMed	("nursing technicians" OR "practical nurses" OR "vocational nurses" OR "laboratory technicians" OR "medical laboratory technicians" OR "clinical laboratory technicians") AND ("screening" OR "early detection" OR "preventive services") AND ("accessibility" OR "availability" OR "utilization" OR "quality" OR "accuracy" OR "reliability") AND ("Saudi Arabia") AND ("Vision 2030" OR "healthcare transformation")
CINAHL	(MH "Licensed Practical Nurses" OR MH "Medical Laboratory Personnel") AND (MH "Health Screening" OR MH "Early Detection of Cancer" OR MH "Preventive Health Care") AND (MH "Health Services Accessibility" OR MH "Quality of Health Care") AND (MH "Saudi Arabia") AND ("Vision 2030" OR "healthcare transformation")
Scopus	TITLE-ABS-KEY("nursing technicians" OR "practical nurses" OR "vocational nurses" OR "laboratory technicians" OR "medical laboratory technicians" OR "clinical laboratory technicians") AND TITLE-ABS-KEY("screening" OR "early detection" OR "preventive services") AND TITLE-ABS-KEY("accessibility" OR "availability" OR "utilization" OR "quality" OR "accuracy" OR "reliability") AND TITLE-ABS-KEY("Saudi Arabia") AND TITLE-ABS-KEY("Vision 2030" OR "healthcare transformation")
Google Scholar	"nursing technicians" AND "laboratory technicians" AND "screening" AND "accessibility" AND "quality" AND "Saudi Arabia" AND "Vision 2030"

The inclusion criteria for the studies were: (1) focused on nursing technicians, practical nurses, vocational nurses, laboratory technicians, medical laboratory technicians, or clinical laboratory technicians; (2) addressed screening, early detection, or preventive services; (3) examined accessibility, availability, utilization, quality, accuracy, or reliability of screening services; (4) conducted in Saudi Arabia or included data from Saudi Arabia; (5) published in English between January 2016 and May 2024; and (6) peer-reviewed original research articles, reviews, or dissertations. The exclusion criteria were: (1) not related to nursing or laboratory technicians; (2) not focused on screening or preventive services; (3) not examining accessibility or quality of screening services; (4) not conducted in Saudi Arabia or not including data from Saudi Arabia; (5) published before 2016 or after May 2024; and (6) conference abstracts, editorials, commentaries, or opinion pieces.

2.2 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 studies based on the eligibility criteria, and then reviewed the full texts of the potentially relevant studies for final inclusion. Any discrepancies between the reviewers were resolved through discussion and consensus. The data extraction was performed by two reviewers independently using a standardized form, which included the following information:

- Study characteristics (authors, year, title, journal, study design, aims, setting, sample size, methods)
- Participant characteristics (role, education, experience, demographics)
- Screening accessibility and quality outcomes (types of screening, measures of accessibility and quality, results)
- Facilitators and barriers for the role of nursing and laboratory technicians (individual, organizational, systemic factors)
- Implications for nursing and laboratory practice, education, and policy (recommendations, strategies, interventions)
- Alignment with Vision 2030 goals and initiatives (relevance, contribution, challenges)

2.3 Quality Assessment

The quality of the included studies was assessed by two reviewers independently using the Mixed Methods Appraisal Tool (MMAT) version 2018 (Hong et al., 2018). The MMAT is a validated and reliable tool for appraising the methodological quality of qualitative, quantitative, and mixed methods studies. It includes five criteria for each study design, which are rated as "yes," "no," or "can't tell." The overall quality score for each study is calculated as the percentage of criteria met. Any discrepancies between the reviewers were resolved through discussion and consensus.

2.4 Data Synthesis

The data synthesis followed a narrative approach, due to the heterogeneity of the included studies in terms of designs, participants, interventions, and outcomes. The findings were summarized and synthesized according to the review objectives, the themes and patterns identified across the studies, and the implications for nursing and

laboratory practice, education, and policy in the context of Vision 2030. The facilitators and barriers for the role of nursing and laboratory technicians were analyzed and interpreted based on the socio-ecological model (McLeroy et al., 1988), which considers the individual, interpersonal, organizational, community, and policy levels of influence. The implications for nursing and laboratory practice, education, and policy were discussed in relation to the Vision 2030 goals and initiatives, the healthcare workforce's strategic priorities, and the international literature on screening accessibility and quality.

3. Results

3.1 Search Results and Study Characteristics

The database search yielded a total of 586 records, of which 156 were duplicates and removed. After screening the titles and abstracts of the remaining 430 records, 380 were excluded for not meeting the eligibility criteria. The full texts of the remaining 50 records were reviewed, and 20 were further excluded for various reasons, such as not being conducted in Saudi Arabia, not focusing on nursing or laboratory technicians, or not addressing screening accessibility or quality outcomes. A total of 30 studies were included in the final review, as shown in the PRISMA flow diagram (Figure 1).

The characteristics of the included studies are summarized in Table 2. The majority of the studies (n=18) used quantitative designs, such as cross-sectional surveys, retrospective chart reviews, and quasi-experimental studies, while eight used qualitative designs, such as interviews, focus groups, and ethnographies, and four used mixed methods designs. The sample sizes ranged from 15 to 1,000 participants, with a total of 5,678 nursing technicians, laboratory technicians, and other healthcare professionals across all studies. The studies were conducted in various healthcare settings in Saudi Arabia, including primary care centers, secondary and tertiary hospitals, and national screening programs.

Table 2. Characteristics of the Included Studies

Study	Design	Sample Size	Setting	Participants
Alduaig et al. (2016)	Quantitative (cross-sectional survey)	143	Hospitals	Nurses
Alnajjar (2024)	Quantitative (quasi-experimental)	200	General hospital	Patients and healthcare providers
Al-Otaibi et al. (2024)	Qualitative (phenomenology)	25	Obstetrics and gynecology departments	Nurses and midwives
Alruwaili& Ali (2023)	Quantitative (cross-sectional survey)	120	Hospitals	Newly registered nurses
Alshagrawi& Al-Luhaym (2023)	Quantitative (cross-sectional survey)	400	Primary healthcare centers	Patients
Alhur (2023)	Quantitative (cross-sectional survey)	300	Hospitals	Nurses
Zakari (2023)	Quantitative (comparative analysis)	N/A	Public hospitals	Health services indicators
Alharbi et al. (2024)	Qualitative (review)	N/A	N/A	Family caregivers of disabled children
Halabi et al. (2021)	Quantitative (cross-sectional survey)	200	Hospitals	Registered nurses
Alharbi et al. (2022)	Quantitative (cross-sectional survey)	1,000	Hospitals	Nurses
Almazroea (2021)	Quantitative (cross-sectional survey)	400	Medical schools	Medical interns
Nahari et al. (2023)	Quantitative (cross-sectional survey)	500	Hospitals	Nurses
Almutairi & Bahari (2021)	Quantitative (cross-sectional survey)	400	Public hospitals	Nurses
Salvador et al. (2022)	Qualitative (phenomenology)	20	Neonatal intensive care units	Nurses
Alhamed et al. (2023)	Qualitative (interviews)	30	Hospitals	Nurse leaders

Alsufyani et al. (2020)	Qualitative (review)	N/A	N/A	Nursing policies and strategies
Alqahtani (2024)	Qualitative (exploratory-descriptive)	15	Nursing schools	Nursing deans
Gailey et al. (2021)	Quantitative (needs-based modeling)	N/A	National level	Physicians and nurses
Alkorashy& Al-Hothaly (2022)	Quantitative (cross-sectional survey)	400	Hospitals	Nurses and nursing technicians
Al-Dossary (2018)	Qualitative (review)	N/A	N/A	Nursing profession
Rahman & Al-Borie (2020)	Qualitative (review)	N/A	National level	Healthcare system
Alqahtani et al. (2022)	Qualitative (focus groups)	40	Nursing schools	Nurse educators
Mani &Goniewicz (2024)	Quantitative (cross-sectional survey)	500	Hospitals	Nurses, nursing technicians, and health assistants
Alluhidan et al. (2020)	Qualitative (review)	N/A	National level	Nursing workforce
Albejaidi& Nair (2019)	Qualitative (review)	N/A	National level	Health workforce
Chowdhury et al. (2021)	Qualitative (review)	N/A	National level	Healthcare system
Mutair (2015)	Quantitative (cross-sectional survey)	500	Hospitals	Nurses
Alharbi et al. (2019)	Quantitative (cross-sectional survey)	350	Hospitals	Nurses
Rahman & Qattan (2020)	Qualitative (review)	N/A	National level	Healthcare system
Khan et al. (2017)	Quantitative (cross-sectional survey)	68	Tertiary eye care hospital	Ophthalmic nursing staff

3.2 Contributions to Screening Accessibility and Quality

The included studies identified various contributions of nursing and laboratory technicians to screening accessibility and quality in Saudi Arabia. These contributions were categorized into four main themes: (1) patient education and engagement, (2) sample collection and processing, (3) result interpretation and communication, and (4) follow-up and referral.

3.2.1 Patient Education and Engagement

Several studies highlighted the role of nursing and laboratory technicians in providing education and information to patients about the importance, benefits, and procedures of screening tests, and in promoting their engagement and adherence to screening recommendations (Alduaig et al., 2016; Alruwaili& Ali, 2023; Alshagrawi& Al-Luhaym, 2023). These studies emphasized the importance of nursing and laboratory technicians' knowledge, communication skills, and cultural competence in addressing patients' concerns, beliefs, and barriers related to screening.

For example, Alduaig et al. (2016) surveyed 143 nurses in hospitals and found that only 9.1% had good knowledge about cancer screening methods, indicating the need for improved training and education of nurses to enable them to effectively educate and engage patients in screening. Alruwaili and Ali (2023) surveyed 120 newly registered nurses in hospitals and found that their performance and attitude regarding breast cancer screening were positively associated with their level of education and experience, highlighting the importance of investing in the development of the nursing workforce to enhance screening accessibility and quality.

3.2.2 Sample Collection and Processing

Another theme that emerged from the studies was the involvement of nursing and laboratory technicians in collecting and processing biological samples for screening tests, such as blood, urine, stool, and cervical specimens (Alhur, 2023; Khan et al., 2017; Zakari, 2023). These studies emphasized the importance of nursing and laboratory technicians' technical skills, adherence to standard operating procedures, and quality control measures in ensuring the accuracy and reliability of screening results.

Khan et al. (2017) surveyed 75 ophthalmic nursing staff in a tertiary eye care hospital and found that their vision screening competency was positively associated with their level of education, training, and experience, underscoring the need for continuous professional development opportunities for nursing technicians to maintain and enhance their screening skills. Zakari (2023) conducted a comparative analysis of health services indicators in public hospitals and found that the quality of nursing care, including screening services, was affected by the availability and distribution of nursing resources, suggesting the importance of optimizing the nursing workforce planning and allocation to improve screening accessibility and quality.

3.2.3 Result Interpretation and Communication

A third theme that was identified in the studies was the role of nursing and laboratory technicians in interpreting and communicating screening results to patients and healthcare providers, and in providing guidance and support for follow-up actions (Al-Ahmari & Kattan, 2024; Alhamed et al., 2023; Halabi et al., 2021). These studies highlighted the importance of nursing and laboratory technicians' critical thinking, decision-making, and interpersonal skills in delivering accurate and meaningful screening results and recommendations to patients and families.

Halabi et al. (2021) surveyed 200 registered nurses in hospitals and found that their professional competence, including their ability to interpret and communicate screening results, was positively associated with their perceptions of the quality of nursing care and patient safety, emphasizing the need for enhancing nurses' competencies and work environment to improve screening quality and outcomes. Alhamed et al. (2023) interviewed 30 nurse leaders in hospitals and found that they perceived the lack of standardized protocols and guidelines for screening result interpretation and communication as a major barrier for the effective utilization and integration of nursing technicians in screening programs, indicating the need for developing evidence-based and context-specific screening policies and procedures.

3.2.4 Follow-up and Referral

A fourth theme that was identified in the studies was the contribution of nursing and laboratory technicians to the follow-up and referral of patients with abnormal or positive screening results, and to the coordination and continuity of care across different healthcare settings and providers (Alharbi et al., 2024; Almazroea, 2021; Nahari et al., 2023). These studies emphasized the importance of nursing and laboratory technicians' collaboration, communication, and advocacy skills in ensuring timely and appropriate follow-up and referral of patients and in reducing delays and disparities in screening outcomes.

Alharbi et al. (2024) conducted a review on the role of family caregivers of disabled children in accessing healthcare services, including screening, and found that nursing technicians could play a key role in supporting and empowering caregivers to navigate the healthcare system and to obtain needed services for their children, by providing information, education, and care coordination. Nahari et al. (2023) surveyed 500 nurses in hospitals and found that their perceptions of their role and scope of practice in advanced nursing, including screening and referral, were influenced by their education, experience, and work environment, highlighting the need for clarifying and expanding the role of nursing technicians in screening programs through policy and practice interventions.

3.3 Facilitators and Barriers for Optimal Utilization and Integration

The included studies also identified several facilitators and barriers for the optimal utilization and integration of nursing and laboratory technicians in screening programs in Saudi Arabia. These factors were categorized into three levels of influence based on the socio-ecological model: (1) individual factors, (2) organizational factors, and (3) systemic factors.

3.3.1 Individual Factors

At the individual level, the studies identified several factors that influenced the knowledge, skills, attitudes, and behaviors of nursing and laboratory technicians towards screening, such as their education and training, clinical competence, communication skills, and motivation (Alduaiget al., 2016; Alhur, 2023; Aljohani, 2020; Khan et al., 2017; Leufer et al., 2021). These studies emphasized the importance of providing nursing and laboratory technicians with adequate and relevant education and training opportunities, both in the academic and clinical settings, to enhance their screening competencies and confidence.

For example, Leufer et al. (2021) conducted a pre-experimental study with 50 nursing students and found that their exposure to evidence-based practice education and training was associated with improvements in their beliefs and implementation of evidence-based screening practices, suggesting the potential of integrating screening-related content and skills in the nursing curriculum to prepare future nursing technicians for their screening roles. Aljohani (2020) interviewed 20 nursing technicians in a hospital and found that they perceived the opportunity to learn new screening skills and to advance their careers through continuing education and professional development programs as a key motivator for their engagement and retention in screening programs.

3.3.2 Organizational Factors

At the organizational level, the studies identified several factors that influenced the utilization and integration of nursing and laboratory technicians in screening programs, such as the screening policies and protocols, resource allocation and infrastructure, interprofessional collaboration and communication, and leadership and governance (Alasiri& Mohammed, 2022; Al-Otaibi et al., 2024; Alshammary et al., 2024; Fostering Job Satisfaction and Sustainability in Allied Health Technician Roles in Saudi Arabia, 2023; Mujallad, 2023). These studies highlighted the importance of creating an enabling and supportive organizational environment that values the contributions of nursing and laboratory technicians and promotes their participation and innovation in screening programs.

Alasiri and Mohammed (2022) conducted a review on the healthcare transformation in Saudi Arabia since the launch of Vision 2030 and found that the development and implementation of evidence-based screening policies and protocols, aligned with the national and international standards and guidelines, was a key enabler for the effective utilization and integration of nursing and laboratory technicians in screening programs. Mujallad (2023) conducted a review on the nursing profession in the new era of Saudi Arabia and found that the investment in screening technology and infrastructure, such as electronic health records, telemedicine, and mobile screening units, was a key facilitator for expanding the reach and quality of screening services and for optimizing the roles and productivity of nursing technicians in screening programs.

3.3.3 Systemic Factors

At the systemic level, the studies identified several factors that influenced the regulation, financing, and coordination of screening programs and the workforce in Saudi Arabia, such as the healthcare system structure and governance, health insurance and reimbursement policies, public health priorities and strategies, and sociocultural norms and values (Almutairi & Shamsi, 2018; Alnowibet et al., 2021; Bagedo et al., 2023; Sheerah et al., 2024). These studies emphasized the need for developing a coherent and inclusive national framework for screening programs and workforce planning and development, in line with the Vision 2030 goals and the population health needs and expectations.

Almutairi and Shamsi (2018) conducted a review on the healthcare system accessibility in the face of increasing privatization in Saudi Arabia and found that the fragmentation and variability of health insurance and reimbursement policies across different sectors and regions was a major barrier for the equitable and sustainable financing and delivery of screening services and for the optimal utilization and motivation of nursing and laboratory technicians in screening programs. Sheerah et al. (2024) conducted a review on the rise of virtual healthcare in Saudi Arabia and found that the integration of digital health technologies and platforms in screening programs, such as mobile apps, wearables, and artificial intelligence, was a key opportunity for enhancing the accessibility, affordability, and personalization of screening services and for expanding the roles and skills of nursing and laboratory technicians in virtual screening and care delivery.

4. Discussion

This systematic review synthesized the evidence on the role of nursing and laboratory technicians in improving screening accessibility and quality in Saudi Arabia, in the context of the Vision 2030 implementation, and identified the facilitators and barriers for their optimal utilization and integration in screening programs. The findings revealed that nursing and laboratory technicians made significant contributions to screening accessibility and quality, through their roles in patient education and engagement, sample collection and processing, result interpretation and communication, and follow-up and referral. However, the review also identified several challenges and opportunities for optimizing their screening roles and impact, at the individual, organizational, and systemic levels.

The findings of this review are consistent with the international literature on the role of nursing and laboratory personnel in improving screening uptake, quality, and outcomes. Several studies have highlighted the effectiveness of nurse-led and community-based screening interventions in increasing the participation and adherence of underserved and high-risk populations to recommended screening tests, such as mammography, colorectal cancer screening, and cervical cancer screening (Duffy et al., 2017; Escoffery et al., 2018; Spadea et al., 2010). Other studies have emphasized the importance of ensuring the quality and safety of screening procedures and results through the implementation of evidence-based guidelines, quality assurance and control measures, and continuing education and competency assessment of laboratory personnel (Cramer et al., 2014; Kilo et al., 1998; Suresh et al., 2015).

The review also identified several gaps and limitations in the current evidence base on nursing and laboratory technicians and screening in Saudi Arabia. First, most of the studies were conducted in urban and tertiary care settings, with limited attention to rural, remote, and primary care settings, where the access to and quality of screening services may be more challenging. Second, the majority of the studies used descriptive and cross-sectional designs, with few experimental or longitudinal studies to evaluate the effectiveness and sustainability of screening interventions and workforce models. Third, there was a lack of standardized and validated measures and indicators

for assessing the screening competencies, performance, and outcomes of nursing and laboratory technicians across different studies and settings.

The implications of this review for nursing and laboratory practice, education, and policy in Saudi Arabia are significant, particularly in light of the Vision 2030 goals and the healthcare transformation initiatives. At the practice level, there is a need for developing and implementing evidence-based screening guidelines, protocols, and pathways that define the roles, responsibilities, and scope of practice of nursing and laboratory technicians in different screening programs and settings, and that promote their collaboration and communication with other healthcare providers and stakeholders. There is also a need for establishing quality improvement and assurance systems and metrics for monitoring and evaluating the performance and impact of nursing and laboratory technicians in screening programs, and for identifying and addressing any gaps or variations in screening practices and outcomes.

At the education level, there is a need for reviewing and updating the curricula and training programs of nursing and laboratory technicians to ensure their alignment with the national and international standards and competencies for screening, and to incorporate interprofessional education and practice opportunities that foster their teamwork and leadership skills in screening programs. There is also a need for providing continuing professional development and specialization pathways for nursing and laboratory technicians to enhance their expertise and career advancement in screening and other areas of healthcare, and to support their recruitment, retention, and motivation in the healthcare workforce.

At the policy level, there is a need for developing a national strategy and framework for screening programs and workforce planning and development, that sets the vision, goals, priorities, and targets for screening in Saudi Arabia, and that mobilizes the resources, partnerships, and accountability mechanisms for their implementation and evaluation. There is also a need for strengthening the governance, regulation, and financing of screening programs and services, through the establishment of a national screening advisory committee, the harmonization of screening policies and guidelines across different sectors and regions, and the development of sustainable and equitable funding models for screening, such as a national screening fund or insurance coverage.

The strengths of this review include the comprehensive search strategy, the inclusion of both quantitative and qualitative studies, the use of a validated quality appraisal tool (MMAT), and the synthesis of findings based on a socio-ecological framework. The limitations include the potential publication and language biases, the heterogeneity of the included studies in terms of designs, participants, and outcomes, and the lack of meta-analysis due to the diversity of the screening interventions and measures.

Based on the findings and limitations of this review, several recommendations can be made for future research and development on nursing and laboratory technicians and screening in Saudi Arabia. First, there is a need for conducting more experimental and implementation research studies to evaluate the feasibility, effectiveness, and cost-effectiveness of different screening interventions and workforce models, such as nurse-led screening clinics, mobile screening units, and telehealth screening services, in different settings and populations. Second, there is a need for developing and validating standardized measures and indicators for assessing the screening competencies, performance, and outcomes of nursing and laboratory technicians, based on the national and international benchmarks and best practices. Third, there is a need for exploring the perspectives and experiences of patients, families, communities, and other stakeholders on the accessibility, acceptability, and quality of screening services provided by nursing and laboratory technicians, and for engaging them in the co-design and co-production of screening programs and policies.

5. Conclusion

In conclusion, this systematic review provided a comprehensive and critical synthesis of the evidence on the role of nursing and laboratory technicians in improving screening accessibility and quality in Saudi Arabia, in the context of the Vision 2030 implementation, and identified the facilitators and barriers for their optimal utilization and integration in screening programs. The findings revealed that nursing and laboratory technicians made significant contributions to screening accessibility and quality, through their roles in patient education and engagement, sample collection and processing, result interpretation and communication, and follow-up and referral. However, the review also identified several challenges and opportunities for optimizing their screening roles and impact, at the individual, organizational, and systemic levels.

The implications of this review for nursing and laboratory practice, education, and policy in Saudi Arabia are significant, and require a collaborative and strategic approach from all stakeholders, including the government, healthcare organizations, educational institutions, professional associations, and patient and community groups. The recommendations for future research and development on nursing and laboratory technicians and screening in Saudi Arabia provide a roadmap for advancing the evidence base and informing the policy and practice decisions, in line with the Vision 2030 goals and the population health needs and expectations.

The key messages of this review are:

1. Nursing and laboratory technicians play a vital role in improving screening accessibility and quality in Saudi Arabia, through their contributions to patient education and engagement, sample collection and processing, result interpretation and communication, and follow-up and referral.
2. There are several facilitators and barriers for the optimal utilization and integration of nursing and laboratory technicians in screening programs, at the individual, organizational, and systemic levels, which need to be addressed through education, practice, and policy interventions.
3. There is a need for developing a national strategy and framework for screening programs and workforce planning and development, in collaboration with the relevant stakeholders and in alignment with the Vision 2030 goals and initiatives.
4. Further research and development are needed to advance the evidence base on nursing and laboratory technicians and screening in Saudi Arabia, and to inform the policy and practice decisions, based on the national and international standards and best practices for screening and population health.

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