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The Technician Triad In Chronic Disease Management: Systematic Review Of Pharmacy, Laboratory, And Nursing Technician Roles In Diabetes And Cardiovascular Care In Saudi Arabia

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Abstract
The increasing prevalence of diabetes and cardiovascular disease in Saudi Arabia has necessitated a comprehensive evaluation of healthcare workforce contributions, particularly those of allied health technicians. This systematic review examines the roles, responsibilities, and clinical impact of pharmacy technicians, laboratory technicians, and nursing technicians in chronic disease management within the Saudi healthcare context. A systematic search of peer-reviewed literature was conducted across multiple databases, focusing on technician-specific contributions to diabetes and cardiovascular care. Results indicate that while clinical pharmacist roles have been extensively documented, pharmacy technician contributions remain underutilized and poorly defined in Saudi practice. Laboratory technicians demonstrate critical roles in point-of-care testing and quality assurance, though workforce challenges persist. Nursing technicians contribute substantially to patient education and monitoring, yet face role ambiguity and limited recognition. Findings reveal significant gaps in interprofessional collaboration frameworks and regulatory clarity regarding technician scope of practice. This review underscores the need for policy reforms, enhanced training programs, and integrated care models that optimize technician contributions to chronic disease management aligned with Saudi Vision 2030 healthcare transformation objectives.

Keywords: pharmacy technicians, laboratory technicians, nursing technicians, chronic disease management, diabetes mellitus, cardiovascular disease, Saudi Arabia.

1. Introduction

Chronic non-communicable diseases represent a substantial and growing public health challenge in Saudi Arabia, with diabetes mellitus and cardiovascular diseases accounting for significant morbidity, mortality, and healthcare expenditure (Alhabib et al., 2016; Alqurashi et al., 2011). The prevalence of diabetes in Saudi Arabia has reached epidemic proportions, with estimates indicating that approximately 23.9% of adults are affected, alongside widespread issues of inadequate disease awareness, treatment, and glycemic control (Alqurashi et al., 2011). Similarly, cardiovascular disease burden continues to escalate, driven by risk factors including hypertension, dyslipidemia, obesity, and sedentary lifestyles (Alhabib et al., 2016; Al-Nozha et al., 2007). These epidemiological trends have placed considerable strain on healthcare systems and necessitate innovative, sustainable approaches to chronic disease management.

The Saudi healthcare system has undergone substantial transformation initiatives, particularly under the Vision 2030 strategic framework, which emphasizes health system optimization, workforce development, and quality improvement (Almalki et al., 2022). Within this evolving landscape, there is growing recognition of the critical contributions made by allied health professionals, including pharmacy, laboratory, and nursing technicians, who constitute a substantial proportion of the healthcare

workforce yet remain underrepresented in research literature (Aboshaiqah, 2016; Aljadhey et al., 2012). While considerable attention has been directed toward physician and pharmacist roles in chronic disease management, the specific contributions of technicians—who provide frontline support in medication dispensing, laboratory diagnostics, and patient care—have received comparatively limited scholarly examination.

Interprofessional collaboration and team-based care models have demonstrated effectiveness in improving chronic disease outcomes internationally (Reeves et al., 2017; Zwar et al., 2006). However, the operationalization of such models requires clear delineation of roles, competencies, and collaborative frameworks across all healthcare team members, including technician-level personnel. Previous research has documented the expanding roles of pharmacy technicians in medication therapy management, laboratory technicians in point-of-care testing, and nursing technicians in patient education and monitoring in various healthcare contexts (Kelling et al., 2016; Nichols et al., 2007; Valaitis et al., 2012). Yet, the applicability of these models to the Saudi Arabian healthcare environment, with its unique workforce composition, regulatory framework, and cultural considerations, remains inadequately explored.

This systematic review addresses this knowledge gap by synthesizing available evidence on the roles, responsibilities, and clinical contributions of pharmacy technicians, laboratory technicians, and nursing technicians specifically within diabetes and cardiovascular disease management in Saudi Arabia. The objective is to critically evaluate current practice patterns, identify barriers and facilitators to optimal technician utilization, and provide evidence-based recommendations for enhancing technician integration into chronic disease care teams in alignment with national healthcare transformation goals.

2. Literature Review

2.1 Chronic Disease Burden and Healthcare Context in Saudi Arabia

The epidemiological transition in Saudi Arabia has been characterized by a dramatic increase in chronic non-communicable diseases, with diabetes mellitus and cardiovascular conditions emerging as leading causes of morbidity and mortality (Alhabib et al., 2016). National surveys have documented diabetes prevalence rates exceeding 20% among adults, accompanied by alarmingly low rates of disease awareness, treatment adherence, and adequate glycemic control (Alqurashi et al., 2011). Specifically, studies have revealed that only a minority of diagnosed diabetic patients achieve recommended HbA1c targets, reflecting systemic challenges in disease management infrastructure and patient engagement (Alramadan et al., 2018). Similarly, cardiovascular disease prevalence continues to rise, with hypertension affecting approximately one-third of the adult population, yet management and control rates remain suboptimal (Al-Nozha et al., 2007).

These challenges occur within a healthcare system undergoing significant transformation. The Saudi Vision 2030 initiative has catalyzed comprehensive reforms aimed at improving healthcare quality, accessibility, and efficiency, including emphasis on preventive care, chronic disease management programs, and workforce capacity building (Almalki et al., 2022). However, barriers to effective diabetes care persist, including fragmented service delivery, inadequate health education, limited patient self-management support, and workforce constraints (Alhowaish, 2013). Systematic reviews have identified substantial variability in diabetes care quality across Saudi healthcare facilities, with notable deficiencies in structured follow-up, complications screening, and multidisciplinary team involvement (Alramadan et al., 2018).

2.2 Pharmacy Technician Roles in Chronic Disease Management

The evolution of pharmacy practice toward patient-centered care has been documented extensively in international literature, with clinical pharmacy services demonstrating positive impacts on diabetes and cardiovascular disease outcomes (Chung et al., 2014; Santschi et al., 2011). In Saudi Arabia, pharmacy practice has traditionally been product-focused, though gradual shifts toward clinical services have been observed, particularly in tertiary care facilities (Aljadhey et al., 2012). Systematic reviews of clinical pharmacy services in the Kingdom have identified improvements in medication adherence, glycemic control, and cardiovascular risk factor management when pharmacist interventions are implemented (Alomi et al., 2016; Alshammari et al., 2017).

However, the specific contributions of pharmacy technicians—as distinct from pharmacists—remain poorly characterized in Saudi literature. Internationally, pharmacy technicians have assumed expanded

roles including medication therapy management support, chronic disease monitoring, patient education reinforcement, and medication reconciliation (Mattingly & Mattingly, 2018). Evidence suggests that appropriately trained pharmacy technicians can effectively perform medication history interviews, identify drug therapy problems, conduct adherence assessments, and provide structured patient counseling under pharmacist supervision (Kelling et al., 2016). Furthermore, technician involvement in patient-centered medical home models has been associated with improved workflow efficiency and enhanced pharmacist capacity to engage in direct clinical activities (Helling & Johnson, 2014).

Despite these potential contributions, pharmacy technician roles in Saudi Arabia remain largely confined to traditional dispensing and inventory management tasks, with limited integration into clinical care teams (Al-Arifi, 2011; Aljadhey et al., 2012). Regulatory frameworks and scope of practice definitions for pharmacy technicians have not evolved proportionally with international trends, contributing to underutilization of this workforce segment (Alshammari et al., 2017). Workforce analyses indicate that pharmacy technicians constitute a substantial proportion of pharmacy department personnel, yet role clarity, standardized training, and professional recognition remain inadequate (Desselle & Holmes, 2017).

2.3 Laboratory Technician Contributions to Diabetes and Cardiovascular Care

Laboratory diagnostics represent a cornerstone of chronic disease management, providing essential data for diagnosis, monitoring, treatment adjustment, and complications screening (Sacks, 2011). In diabetes management specifically, laboratory testing including HbA1c, lipid profiles, renal function markers, and urine albumin measurements are critical for assessing glycemic control and detecting microvascular complications (Sacks et al., 2011). Similarly, cardiovascular disease management relies heavily on laboratory biomarkers for risk stratification and therapeutic monitoring.

The role of laboratory technicians extends beyond technical test performance to encompass quality assurance, pre-analytical error prevention, result interpretation support, and increasingly, point-of-care testing coordination (Nichols et al., 2007). Point-of-care testing has emerged as a valuable tool in chronic disease management, enabling rapid clinical decision-making and enhanced patient engagement, with laboratory technicians serving as essential facilitators of quality and accuracy in decentralized testing environments (Nichols et al., 2007). Clinical laboratory services in Saudi Arabia have expanded substantially, though challenges related to workforce supply, standardization, and integration with clinical care teams persist (Azhar, 2010; Alqahtani & Alsultan, 2019).

Medical laboratory sciences professionals in Saudi Arabia face workforce challenges including recruitment difficulties, retention issues, high workload, and limited career advancement opportunities, factors that potentially compromise service quality and innovation (Alqahtani & Alsultan, 2019). Internationally, clinical laboratory workforce analyses have identified similar concerns, alongside emerging needs for competencies in molecular diagnostics, bioinformatics, and personalized medicine (Garcia et al., 2020). The integration of laboratory technicians into multidisciplinary chronic disease management teams represents an underexplored opportunity for enhancing diagnostic service responsiveness and clinical-laboratory communication.

2.4 Nursing Technician Roles in Chronic Disease Care

Nursing personnel constitute the largest component of the healthcare workforce globally and in Saudi Arabia, with nursing technicians (also termed nursing assistants or auxiliary nurses) providing essential bedside care, patient monitoring, and care coordination support (Aboshaiqah, 2016). In chronic disease management contexts, nursing roles encompass patient education, self-management support, medication administration, symptom monitoring, and care coordination (Mensing et al., 2003). Systematic reviews have demonstrated that nurse-led chronic disease management interventions can significantly improve clinical outcomes, patient satisfaction, and healthcare utilization patterns (Donald et al., 2013).

Specifically in diabetes care, nursing personnel have been shown to effectively deliver structured education programs, conduct diabetes self-management training, provide insulin initiation and titration support, and facilitate behavioral change interventions (Strawbridge et al., 2015). The role of nurses in chronic disease management has evolved from primarily assistive functions to encompass autonomous clinical responsibilities including assessment, care planning, and outcome monitoring (Valaitis et al.,

2012). However, role differentiation between registered nurses, practical nurses, and nursing technicians varies considerably across healthcare systems and regulatory jurisdictions.

In Saudi Arabia, the nursing workforce includes substantial numbers of expatriate personnel alongside growing numbers of Saudi nationals entering the profession (Aboshaiqah, 2016). Nursing technicians perform a range of functions including vital signs monitoring, patient hygiene support, specimen collection, and basic patient education, yet their specific contributions to chronic disease management teams remain poorly documented in research literature. Role clarity, scope of practice definitions, and educational preparation for nursing technicians vary across healthcare facilities, potentially limiting optimal workforce utilization (Aboshaiqah, 2016).

2.5 Team-Based and Interprofessional Care Models

The complexity of chronic disease management necessitates coordinated, multidisciplinary approaches that leverage diverse professional competencies (Zwar et al., 2006). Systematic reviews have demonstrated that team-based care models improve clinical outcomes, enhance care coordination, and increase patient satisfaction compared to traditional physician-centered models (Lemieux-Charles & McGuire, 2006). Interprofessional collaboration in diabetes management specifically has been associated with improved glycemic control, better cardiovascular risk factor management, and enhanced patient quality of life (Reeves et al., 2017).

Effective team-based care requires clear role delineation, structured communication processes, shared decision-making frameworks, and organizational support including leadership commitment and resource allocation (Zwar et al., 2006). Collaborative care models integrating mental health support into diabetes and cardiovascular disease management have shown effectiveness in improving both psychological and metabolic outcomes (Atlantis et al., 2014). However, implementation challenges include professional boundary disputes, hierarchical organizational cultures, inadequate training in collaborative competencies, and insufficient reimbursement structures that incentivize team-based approaches (Lemieux-Charles & McGuire, 2006).

The integration of technician-level personnel into interprofessional chronic disease management teams represents both an opportunity and a challenge. While technicians provide essential operational support and patient contact, their participation in care planning, clinical decision-making, and interprofessional communication may be limited by hierarchical dynamics, role ambiguity, and inadequate recognition of their contributions (Desselle, 2005). Optimal utilization of pharmacy, laboratory, and nursing technicians within team-based models requires deliberate attention to role design, competency development, supervision structures, and organizational culture.

3. Methods

This systematic review was conducted following established guidelines for literature synthesis to comprehensively evaluate the roles of pharmacy, laboratory, and nursing technicians in diabetes and cardiovascular disease management within the Saudi Arabian healthcare context. A structured search strategy was developed to identify relevant peer-reviewed publications addressing technician contributions to chronic disease care.

3.1 Search Strategy and Data Sources

A systematic literature search was conducted across multiple academic databases including PubMed, Scopus, Web of Science, and specialized healthcare databases. Search terms included combinations of keywords related to pharmacy technicians, laboratory technicians, nursing technicians, medical laboratory technologists, auxiliary nursing personnel, diabetes mellitus, cardiovascular disease, chronic disease management, Saudi Arabia, and team-based care. Boolean operators were employed to optimize search sensitivity and specificity. The search was limited to peer-reviewed journal articles and academic books published in English.

3.2 Inclusion and Exclusion Criteria

Inclusion criteria encompassed studies that addressed: (1) roles, responsibilities, or contributions of pharmacy, laboratory, or nursing technicians; (2) diabetes mellitus or cardiovascular disease management; (3) healthcare delivery in Saudi Arabia or comparable healthcare systems; (4) team-based or interprofessional care models; and (5) workforce issues affecting technician-level personnel.

Exclusion criteria included non-peer-reviewed publications, studies focusing exclusively on physicians or pharmacists without addressing technician roles, and studies unrelated to chronic disease management.

3.3 Data Extraction and Synthesis

Retrieved articles were systematically reviewed, and relevant data were extracted regarding technician roles, practice settings, clinical contributions, barriers and facilitators, and outcomes associated with technician involvement. Given the heterogeneity of study designs and limited technician-specific research in the Saudi context, a narrative synthesis approach was employed to integrate findings across pharmacy, laboratory, and nursing technician domains. Thematic analysis was used to identify recurring patterns, gaps, and implications for practice and policy.

4. Results

4.1 Overview of Literature

The systematic literature search yielded substantial evidence regarding clinical pharmacy and nursing roles in chronic disease management, with more limited evidence specifically addressing technician-level contributions. The majority of Saudi-focused research has examined physician and pharmacist roles, with pharmacy technicians, laboratory technicians, and nursing technicians receiving minimal dedicated attention. International literature provided broader evidence of technician contributions, which informed analysis of potential applications to the Saudi healthcare context.

4.2 Pharmacy Technician Roles and Contributions

Pharmacy practice in Saudi Arabia has evolved gradually toward clinical service models, though implementation remains variable across healthcare facilities (Aljadhey et al., 2012; Al-Arifi, 2012). Clinical pharmacy services, when implemented, have demonstrated positive impacts on medication adherence, therapeutic outcomes, and healthcare costs in chronic disease populations (Alomi et al., 2016). However, pharmacy technician roles remain predominantly confined to traditional dispensing functions including prescription processing, medication preparation, inventory management, and basic administrative tasks (Aljadhey et al., 2012).

International evidence demonstrates that pharmacy technicians can assume expanded responsibilities including medication therapy management support, patient medication histories, adherence monitoring, and structured patient education (Mattingly & Mattingly, 2018). Systematic reviews indicate that pharmacy technician involvement in chronic disease management programs enhances pharmacist productivity, improves workflow efficiency, and contributes to positive patient outcomes when appropriate training and supervision are provided (Kelling et al., 2016). Specific applications include technician-led medication adherence programs, chronic disease registry maintenance, appointment scheduling and follow-up coordination, and insurance navigation assistance (Helling & Johnson, 2014). Despite this potential, regulatory and organizational barriers limit pharmacy technician role expansion in Saudi Arabia. Scope of practice definitions remain restrictive, standardized national training programs are limited, and professional recognition of technician contributions is inadequate (Alshammari et al., 2017). Pharmacists have expressed support for enhanced technician roles but cite concerns regarding training adequacy, liability, and supervision requirements (Al-Arifi, 2011). Workforce analyses indicate that pharmacy technicians face challenges including limited career advancement opportunities, inadequate compensation, and ambiguous role expectations (Desselle & Holmes, 2017).

4.3 Laboratory Technician Roles and Contributions

Laboratory diagnostics constitute an essential component of diabetes and cardiovascular disease management, with laboratory technicians performing critical functions in specimen processing, test execution, quality control, and result reporting (Sacks, 2011). The Saudi clinical laboratory sector has expanded substantially in recent decades, encompassing hospital laboratories, reference laboratories, and point-of-care testing sites, though workforce and quality standardization challenges persist (Azhar, 2010).

Laboratory medicine plays a central role in diabetes management through HbA1c monitoring, glucose testing, lipid profiling, renal function assessment, and microalbuminuria screening, with laboratory technicians ensuring analytical accuracy and timeliness (Sacks et al., 2011). Point-of-care testing for glucose and HbA1c has become increasingly prevalent, requiring laboratory technician involvement in device training, quality assurance, competency assessment, and connectivity management (Nichols et al., 2007). Similarly, cardiovascular disease management relies on laboratory biomarkers including lipid panels, cardiac enzymes, and inflammatory markers, necessitating reliable technical performance and quality oversight.

Medical laboratory sciences professionals in Saudi Arabia face workforce challenges including recruitment difficulties, particularly in remote regions, high turnover, workload pressures, and limited integration into clinical care teams (Alqahtani & Alsultan, 2019). The role of laboratory technicians in chronic disease management extends beyond bench work to encompass patient interaction in specimen collection, pre-analytical quality assurance, result interpretation support, and participation in multidisciplinary quality improvement initiatives (Garcia et al., 2020). However, organizational structures often isolate laboratory services from clinical teams, limiting communication, consultation, and collaborative care planning.

4.4 Nursing Technician Roles and Contributions

Nursing personnel constitute the largest healthcare workforce segment in Saudi Arabia, including registered nurses, practical nurses, and nursing technicians who provide direct patient care across settings (Aboshaiqah, 2016). Nursing roles in chronic disease management encompass patient assessment, medication administration, education delivery, self-management support, and care coordination (Mensing et al., 2003). Systematic reviews demonstrate that nurse-led interventions significantly improve diabetes and cardiovascular disease outcomes including glycemic control, blood pressure management, lipid levels, and patient quality of life (Donald et al., 2013; Strawbridge et al., 2015).

Nursing technicians specifically contribute to chronic disease care through vital signs monitoring, medication administration assistance, patient hygiene and comfort support, specimen collection, basic patient education, and documentation (Valaitis et al., 2012). In diabetes management contexts, nursing technicians may assist with glucose monitoring, insulin administration supervision, foot care, dietary education reinforcement, and appointment coordination. In cardiovascular care, nursing technicians support blood pressure monitoring, lifestyle modification education, cardiac rehabilitation assistance, and symptom surveillance.

The Saudi nursing workforce includes substantial numbers of expatriate personnel alongside increasing Saudi national representation, with nursing technicians often receiving variable educational preparation and role definition (Aboshaiqah, 2016). Role ambiguity, limited professional recognition, and hierarchical organizational cultures may constrain nursing technician contributions to interprofessional chronic disease teams. Furthermore, nursing workforce challenges including retention difficulties, workload pressures, and inadequate career development opportunities affect service delivery quality and sustainability.

4.5 Barriers and Facilitators to Technician Integration

Multiple barriers impede optimal utilization of pharmacy, laboratory, and nursing technicians in chronic disease management in Saudi Arabia. Regulatory barriers include restrictive scope of practice definitions, absence of standardized national credentialing for technician roles, and limited legal clarity regarding delegation and supervision (Aljadhey et al., 2012; Alshammari et al., 2017). Organizational barriers encompass hierarchical structures that marginalize technician input, inadequate staffing ratios, limited access to continuing education, and insufficient integration into care team meetings and decision-making processes (Aboshaiqah, 2016; Alqahtani & Alsultan, 2019).

Educational and professional development barriers include variability in technician training programs, limited emphasis on chronic disease management competencies, absence of structured career pathways, and inadequate mentorship and supervision (Desselle & Holmes, 2017; Garcia et al., 2020). Cultural and interprofessional barriers involve traditional professional hierarchies, limited recognition of

technician expertise, communication gaps between professions, and resistance to role redesign (Lemieux-Charles & McGuire, 2006).

Facilitators of enhanced technician integration include healthcare transformation initiatives under Vision 2030 that emphasize workforce optimization and quality improvement (Almalki et al., 2022). International evidence of successful technician role expansion provides models for adaptation to the Saudi context (Kelling et al., 2016; Mattingly & Mattingly, 2018). Growing recognition of team-based care effectiveness in chronic disease management creates opportunities for interprofessional collaboration frameworks that include technician-level personnel (Reeves et al., 2017; Zwar et al., 2006).

4.6 Summary Tables

Table 1.Pharmacy, Laboratory, and Nursing Technician Roles in Chronic Disease Management*

Technician Type	Current Roles	Potential Expanded Roles	Evidence Strength
Pharmacy Technician	Prescription processing, medication dispensing, inventory management	Medication therapy management support, adherence monitoring, patient education, medication histories, care coordination	Moderate (international); Limited (Saudi)
Laboratory Technician	Specimen processing, test execution, quality control, result reporting	Point-of-care testing coordination, pre-analytical consultation, patient specimen education, interprofessional quality improvement	Moderate (international); Limited (Saudi)
Nursing Technician	Vital signs monitoring, basic patient care, specimen collection, documentation	Structured diabetes education support, medication administration, self-management coaching, symptom surveillance	Strong (international); Moderate (Saudi)

Note. Evidence strength classifications based on availability and quality of peer-reviewed research specific to technician roles in chronic disease management.

Table 2.Barriers and Facilitators to Technician Integration in Saudi Arabian Chronic Disease Management

Domain	Barriers	Facilitators
Regulatory	Restrictive scope of practice, absence of national credentialing, unclear delegation frameworks	Vision 2030 healthcare reforms, policy attention to workforce optimization
Organizational	Hierarchical structures, inadequate staffing, limited care team integration, insufficient continuing education access	Team-based care initiatives, quality improvement programs, clinical pharmacy expansion
Educational	Variable training standards, limited chronic disease competencies, absence of career pathways	Growing educational institutions, international partnerships, emphasis on professional development

Interprofessional	Professional hierarchies, role ambiguity, communication gaps, resistance to change	Evidence of interprofessional effectiveness, collaborative care models, patient-centered care emphasis
Workforce	Recruitment challenges, retention difficulties, workload pressures, inadequate compensation	Large technician workforce, growing Saudi national participation, demographic transition

Note. Barriers and facilitators identified through synthesis of literature addressing pharmacy, laboratory, and nursing technician roles in Saudi healthcare contexts.

5. Discussion

5.1 Synthesis of Findings

This systematic review reveals a substantial gap between the potential contributions of pharmacy, laboratory, and nursing technicians to chronic disease management and their current utilization in Saudi Arabian healthcare settings. While international evidence demonstrates that appropriately trained and supervised technicians can meaningfully enhance diabetes and cardiovascular disease care quality, efficiency, and outcomes, Saudi practice patterns reflect persistent underutilization of this workforce segment (Kelling et al., 2016; Mattingly & Mattingly, 2018; Valaitis et al., 2012). The predominant focus of existing research on physician and pharmacist roles has inadvertently marginalized examination of technician contributions, despite their numerical prominence and frontline patient contact.

The concept of a "technician triad" encompassing pharmacy, laboratory, and nursing technicians as an integrated workforce component in chronic disease management represents an innovative framework for healthcare delivery optimization. Each technician type contributes distinct but complementary competencies: pharmacy technicians facilitate medication management processes and adherence support; laboratory technicians ensure diagnostic accuracy, timeliness, and quality; nursing technicians provide continuous patient monitoring, education reinforcement, and care coordination support (Mensing et al., 2003; Nichols et al., 2007; Helling & Johnson, 2014). The synergistic integration of these roles within interprofessional care teams could substantially enhance chronic disease management capacity, particularly given the escalating disease burden and workforce constraints facing Saudi healthcare systems (Alhabib et al., 2016; Alramadan et al., 2018).

Comparison with international models reveals that countries with advanced pharmacy practice, robust laboratory systems, and evolved nursing roles have deliberately invested in technician workforce development, role definition, and regulatory frameworks that enable expanded practice (Desselle & Holmes, 2017; Garcia et al., 2020). For example, pharmacy technician roles in the United States, United Kingdom, and Canada have progressively expanded to include clinical support functions, with corresponding educational standards, certification requirements, and scope of practice guidelines (Mattingly & Mattingly, 2018). Similarly, laboratory technologist roles in these jurisdictions increasingly encompass interpretive consultation and point-of-care testing coordination, supported by professional recognition and continuing education systems (Nichols et al., 2007).

5.2 Implications for Saudi Healthcare Practice

The findings of this review have several important implications for Saudi healthcare policy and practice. First, there is urgent need for regulatory clarity and expansion of technician scope of practice definitions to align with international standards and evidence-based models (Alshammari et al., 2017). Current restrictive frameworks limit innovation and workforce optimization, contributing to inefficient resource utilization and missed opportunities for enhanced patient care. Developing national standards for pharmacy, laboratory, and nursing technician credentialing, competency assessment, and continuing education would establish a foundation for role expansion and professional development.

Second, healthcare organizations must deliberately design interprofessional care models that integrate technician-level personnel as valued team members with defined roles, responsibilities, and participation in care planning and quality improvement activities (Reeves et al., 2017; Zwar et al., 2006). This requires cultural change from hierarchical structures toward collaborative frameworks,

supported by leadership commitment, structured communication processes, and recognition of diverse professional contributions. Chronic disease management programs, including diabetes clinics and cardiovascular risk reduction initiatives, represent ideal settings for piloting enhanced technician roles and evaluating impact on outcomes, efficiency, and patient satisfaction.

Third, educational institutions and training programs must enhance technician preparation in chronic disease management competencies, including pathophysiology, pharmacotherapy, patient education methods, behavioral change strategies, and interprofessional collaboration skills (Desselle, 2005; Sacks et al., 2011). Curriculum development should incorporate evidence-based models and align with Vision 2030 healthcare transformation objectives, ensuring that emerging graduates are equipped to assume expanded roles in team-based care environments (Almalki et al., 2022).

Fourth, workforce planning must address recruitment, retention, and career development challenges affecting technician personnel (Aboshaiqah, 2016; Alqahtani & Alsultan, 2019; Garcia et al., 2020). Competitive compensation, professional recognition, structured career pathways, and workplace conditions that enable meaningful contributions to patient care are essential for sustaining adequate technician supply and quality. The growing emphasis on healthcare workforce Saudization presents opportunities to develop domestic technician capacity, provided that educational infrastructure, professional attractiveness, and role satisfaction are simultaneously addressed.

5.3 Comparison with Existing Literature

The findings of this review align with broader literature demonstrating the effectiveness of team-based approaches to chronic disease management and the importance of optimizing all healthcare team members' contributions (Lemieux-Charles & McGuire, 2006; Zwar et al., 2006). Systematic reviews of interprofessional collaboration in diabetes care have consistently shown improved clinical outcomes when diverse professionals work collaboratively with clear role definitions and shared goals (Reeves et al., 2017). This review extends existing knowledge by specifically focusing on technician-level contributions, a workforce segment that has received limited scholarly attention despite its numerical significance and operational importance.

The identification of regulatory, organizational, educational, and interprofessional barriers to technician integration resonates with challenges documented in healthcare workforce literature more broadly (Desselle & Holmes, 2017; Garcia et al., 2020). Role ambiguity, scope of practice restrictions, hierarchical professional relationships, and inadequate training have been identified as persistent obstacles to healthcare workforce optimization across multiple contexts. The Saudi Arabian healthcare transformation under Vision 2030 provides a strategic window of opportunity to address these barriers systematically through policy reform, organizational redesign, and professional development initiatives (Almalki et al., 2022).

The limited availability of Saudi-specific research on technician roles in chronic disease management represents a critical gap that this review highlights. While substantial evidence documents clinical pharmacy service impacts in Saudi Arabia (Alomi et al., 2016; Alshammari et al., 2017), pharmacy technician contributions remain underexplored. Similarly, nursing workforce research has focused primarily on registered nurses, with limited attention to nursing technicians (Aboshaiqah, 2016). Laboratory technician roles have received minimal research attention despite their critical diagnostic functions (Alqahtani & Alsultan, 2019). This evidence gap limits informed policy-making and workforce planning, underscoring the need for dedicated research examining technician contributions, optimal role designs, and implementation strategies.

5.4 Limitations

Several limitations warrant consideration in interpreting this review's findings. First, the paucity of Saudi-specific research on technician roles necessitated reliance on international literature, which may not fully account for unique contextual factors including regulatory frameworks, healthcare system structures, cultural considerations, and workforce characteristics of the Saudi Arabian environment. While international evidence provides valuable models, direct transferability assumptions must be made cautiously.

Second, the heterogeneity of technician role definitions across healthcare systems and limited standardization of terminology complicated literature synthesis. Pharmacy technicians, laboratory technicians, and nursing technicians encompass diverse educational backgrounds, responsibilities, and

scope of practice across jurisdictions, limiting precise comparisons and generalizations. Third, the majority of available evidence addresses pharmacist and nurse-led interventions rather than technician-specific contributions, requiring inference regarding potential technician roles based on task components amenable to delegation or support.

Fourth, this review's focus on diabetes and cardiovascular disease management, while addressing the most prevalent chronic conditions, does not encompass the full spectrum of chronic disease contexts where technician contributions may be relevant, including respiratory diseases, chronic kidney disease, and mental health conditions. Finally, the absence of implementation research examining technician role expansion initiatives in Saudi Arabia limits understanding of practical feasibility, sustainability, and contextual facilitators and barriers.

5.5 Future Research Directions

Multiple research priorities emerge from this systematic review. First, rigorous evaluation of pilot initiatives implementing expanded pharmacy, laboratory, and nursing technician roles in Saudi chronic disease management programs is essential. Implementation research employing mixed methods approaches could examine feasibility, acceptability, fidelity, clinical outcomes, cost-effectiveness, and factors influencing successful integration. Specific outcomes of interest include glycemic control, cardiovascular risk factor management, medication adherence, patient satisfaction, healthcare utilization, and team functioning.

Second, workforce research is needed to comprehensively assess current technician practice patterns, role perceptions, educational preparation, career satisfaction, and professional development needs across Saudi healthcare settings. Such research would inform evidence-based workforce planning, educational curriculum development, and policy reform. Third, comparative effectiveness research examining different technician role designs, supervision models, and interprofessional collaboration frameworks would provide guidance for optimal implementation strategies.

Fourth, research addressing regulatory and policy dimensions of technician scope of practice expansion is necessary, including examination of liability considerations, quality assurance mechanisms, credentialing approaches, and international regulatory models applicable to the Saudi context. Finally, research exploring patient perspectives on technician involvement in chronic disease care, including acceptability, trust, communication quality, and perceived value, would ensure patient-centeredness in care model redesign.

5.6 Conclusion

This systematic review demonstrates that pharmacy, laboratory, and nursing technicians represent an underutilized workforce resource with substantial potential to enhance chronic disease management in Saudi Arabia. International evidence supports expanded technician roles in medication management support, diagnostic services coordination, patient education, and monitoring, yet Saudi practice patterns remain predominantly traditional. Barriers including regulatory restrictions, organizational hierarchies, educational gaps, and interprofessional challenges impede optimal technician integration into chronic disease care teams. The Saudi Vision 2030 healthcare transformation provides a strategic opportunity to address these barriers through policy reform, workforce development, and implementation of evidence-based team-based care models. Realizing the potential of the "technician triad" requires deliberate attention to role definition, competency development, interprofessional collaboration frameworks, and organizational culture change. Future research evaluating implementation strategies and outcomes will be essential for evidence-informed optimization of technician contributions to diabetes and cardiovascular disease management.

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