

# Integrating Radiography, Epidemiology, and Pharmacy Services in Primary Healthcare Centers: A Comprehensive Approach to Improving Patient Care in Najran, Saudi Arabia

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10. Midwife

## Abstract

Primary healthcare centers (PHCs) in Saudi Arabia are undergoing a transformation as part of the Vision 2030 strategic plan, which aims to improve the quality, accessibility, and efficiency of healthcare services. Integrating radiography, epidemiology, and pharmacy services in PHCs can provide a comprehensive and coordinated approach to patient care, particularly in underserved regions such as Najran. This systematic review aimed to synthesize the evidence on the benefits, challenges, and strategies for integrating these services in PHCs, and to identify the implications for practice, policy, and research in the context of Saudi Vision 2030. A comprehensive search of PubMed, CINAHL, Scopus, and Google Scholar databases was conducted for studies published between 2010 and 2024. A total of 25 studies met the inclusion criteria and were analyzed using a narrative synthesis approach. The findings revealed that integrating radiography, epidemiology, and pharmacy services in PHCs can improve the accessibility, quality, and continuity of care for patients, as well as the efficiency and sustainability of the healthcare system. However, several barriers were identified, including the lack of infrastructure, resources, and training, as well as the limited collaboration and communication among healthcare professionals. The implications for practice and policy included the need for developing a national framework for integrated care, investing in technology and workforce development, and promoting patient-centered and evidence-based care. The review highlights the importance of a multidisciplinary and collaborative approach to healthcare delivery in achieving the goals of Saudi Vision 2030.

**Keywords:** primary healthcare centers, radiography, epidemiology, pharmacy, integrated care, patient care, Saudi Arabia, Vision 2030, systematic review

## 1. Introduction

Primary healthcare centers (PHCs) are the cornerstone of the healthcare system in Saudi Arabia, providing essential and preventive services to the population, especially in rural and underserved areas (Alsayali et al., 2019). However, the quality and accessibility of PHC services have been facing challenges, such as the shortage of healthcare professionals, the fragmentation of care, and the limited use of technology and innovation (Alshalawi et al., 2023). As part of the Vision 2030 strategic plan, the Saudi government has launched several initiatives to transform and

strengthen the PHC system, with the aim of improving the health and well-being of the population and achieving universal health coverage (Dudley & Garner, 2011; Mazhar et al., 2016).

One of the key strategies for enhancing the quality and value of PHC services is the integration of different healthcare disciplines and services, such as radiography, epidemiology, and pharmacy, which can provide a comprehensive and coordinated approach to patient care (Baxter et al., 2018; Dudley & Garner, 2011). Radiography services, including X-ray, ultrasound, and mammography, are essential for the diagnosis and monitoring of various health conditions, such as fractures, lung diseases, and breast cancer (Alshalawi et al., 2023). Epidemiology services, including disease surveillance, outbreak investigation, and health promotion, are crucial for preventing and controlling communicable and non-communicable diseases, as well as for informing public health policies and programs (Alshalawi et al., 2023). Pharmacy services, including medication management, patient education, and chronic disease management, are vital for ensuring the safe and effective use of medications, as well as for improving patient outcomes and reducing healthcare costs (Dilshad et al., 2019; Mohiuddin et al., 2021).

Despite the potential benefits of integrating these services in PHCs, there are also challenges and barriers that can hinder their implementation and sustainability, such as the lack of infrastructure, resources, and training, as well as the limited collaboration and communication among healthcare professionals (Bates et al., 2019; Mazhar et al., 2016). Moreover, there is a paucity of evidence on the effectiveness and feasibility of integrated care models in the context of Saudi Arabia, particularly in underserved regions such as Najran, which face additional challenges related to geography, culture, and socioeconomic factors (Alsayali et al., 2019; Alshalawi et al., 2023).

This systematic review aimed to address this gap by synthesizing the evidence on the benefits, challenges, and strategies for integrating radiography, epidemiology, and pharmacy services in PHCs, and to identify the implications for practice, policy, and research in the context of Saudi Vision 2030. The specific objectives of the review were:

1. To identify the types and scope of integrated radiography, epidemiology, and pharmacy services provided in PHCs in different settings and populations.
2. To explore the perceptions, attitudes, and experiences of healthcare professionals, patients, and other stakeholders regarding the integration of these services in PHCs.
3. To examine the impact and outcomes of integrated radiography, epidemiology, and pharmacy services on patient care, health system performance, and public health in PHCs.
4. To identify the facilitators, barriers, and strategies for implementing and sustaining integrated care models in PHCs, particularly in the context of Saudi Arabia and Vision 2030.

The findings of this review can inform the development and evaluation of interventions and policies to support the integration of radiography, epidemiology, and pharmacy services in PHCs, and to leverage their potential for improving patient care and population health 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 April 2024 to identify relevant studies on the integration of radiography, epidemiology, and pharmacy services in PHCs. The search strategy included a combination of keywords and MeSH terms related to primary healthcare centers, radiography, epidemiology, pharmacy, integrated care, patient care, Saudi Arabia, and Vision 2030, as shown in Table 1.

**Table 1. Search Strategy**

Database	Search Terms
PubMed	("primary health care" OR "primary healthcare" OR "primary care" OR "community health centers" OR "community healthcare") AND ("radiography" OR "radiology" OR "X-ray" OR "ultrasound" OR "mammography") AND ("epidemiology" OR "disease surveillance" OR "outbreak investigation" OR "health promotion") AND ("pharmacy" OR "pharmacists" OR "pharmaceutical services" OR "medication management" OR "patient education") AND ("integrated care" OR "integrated services" OR "collaborative care" OR "multidisciplinary care" OR "interprofessional care") AND ("patient care" OR "quality of care" OR "access to care" OR "continuity of care" OR "patient outcomes" OR "health system performance") AND ("Saudi Arabia") AND ("Vision 2030" OR "healthcare transformation")
CINAHL	(MH "Primary Health Care" OR MH "Community Health Centers") AND (MH "Radiography" OR MH "Radiology" OR MH "Ultrasonography" OR MH "Mammography") AND (MH "Epidemiology" OR MH "Disease Surveillance" OR MH "Outbreak Investigation" OR MH "Health Promotion") AND (MH "Pharmacy Service" OR MH "Pharmacists" OR MH "Medication Management" OR MH "Patient Education") AND (MH "Multidisciplinary Care Team" OR MH "Interprofessional Relations" OR MH

## Database Search Terms

"Collaborative Practice") AND (MH "Quality of Health Care" OR MH "Health Services Accessibility" OR MH "Continuity of Patient Care" OR MH "Patient-Centered Care" OR MH "Treatment Outcomes") AND (MH "Saudi Arabia") AND ("Vision 2030" OR "healthcare transformation")

TITLE-ABS-KEY("primary health care" OR "primary healthcare" OR "primary care" OR "community health centers" OR "community healthcare") AND TITLE-ABS-KEY("radiography" OR "radiology" OR "X-ray" OR "ultrasound" OR "mammography") AND TITLE-ABS-KEY("epidemiology" OR "disease surveillance" OR "outbreak investigation" OR "health promotion") AND TITLE-ABS-KEY("pharmacy" OR "pharmacists" OR "pharmaceutical services" OR "medication management" OR "patient education") AND TITLE-ABS-KEY("integrated care" OR "integrated services" OR "collaborative care" OR "multidisciplinary care" OR "interprofessional care") AND TITLE-ABS-KEY("patient care" OR "quality of care" OR "access to care" OR "continuity of care" OR "patient outcomes" OR "health system performance") AND TITLE-ABS-KEY("Saudi Arabia") AND TITLE-ABS-KEY("Vision 2030" OR "healthcare transformation")

Scopus

Google Scholar "primary healthcare centers" AND "radiography" AND "epidemiology" AND "pharmacy" AND "integrated care" AND "patient care" AND "Saudi Arabia" AND "Vision 2030"

The inclusion criteria for the studies were: (1) focused on primary healthcare centers, community health centers, or primary care clinics; (2) addressed the integration of radiography, epidemiology, and/or pharmacy services; (3) examined patient care, health system performance, or public health outcomes; (4) conducted in Saudi Arabia or included data from Saudi Arabia; (5) published in English between January 2010 and April 2024; and (6) peer-reviewed original research articles, reviews, or dissertations. The exclusion criteria were: (1) not related to primary healthcare settings; (2) not focused on the integration of radiography, epidemiology, and/or pharmacy services; (3) not examining patient care, health system performance, or public health outcomes; (4) not conducted in Saudi Arabia or not including data from Saudi Arabia; (5) published before 2010 or after April 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)
- Integrated care model (types of services, providers, activities, resources, technologies)
- Patient care outcomes (access, quality, continuity, safety, effectiveness, patient experience)
- Health system outcomes (efficiency, coordination, communication, collaboration, sustainability)
- Public health outcomes (disease prevention, health promotion, population health, health equity)
- Facilitators and barriers (individual, organizational, technological, financial, legal, cultural factors)
- Implementation strategies (training, education, leadership, partnerships, policies, incentives)
- Implications for practice, policy, and research (recommendations, lessons learned, future directions)
- Alignment with Vision 2030 goals and initiatives (relevance, contribution, challenges, opportunities)

## 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 practice, policy, and research in the context of Saudi Vision 2030. The types and scope of integrated care models were analyzed and

categorized based on the Rainbow Model of Integrated Care (Valentijn et al., 2015), which includes six dimensions of integration: clinical, professional, organizational, system, functional, and normative. The perceptions, attitudes, and experiences of stakeholders were analyzed and interpreted based on the Theoretical Domains Framework (Cane et al., 2012), which includes 14 domains influencing behavior change, such as knowledge, skills, beliefs, intentions, and emotions. The facilitators, barriers, and strategies for implementation were analyzed and interpreted based on the Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2009), which includes five domains: intervention characteristics, outer setting, inner setting, characteristics of individuals, and process. The implications for practice, policy, and research were discussed in relation to the Saudi Vision 2030 goals and initiatives, the WHO Framework on Integrated People-Centred Health Services (WHO, 2016), and the Quadruple Aim of healthcare (Bodenheimer & Sinsky, 2014).

### 3. Results

#### 3.1 Search Results and Study Characteristics

The database search yielded a total of 472 records, of which 156 were duplicates and removed. After screening the titles and abstracts of the remaining 316 records, 276 were excluded for not meeting the eligibility criteria. The full texts of the remaining 40 records were reviewed, and 15 were further excluded for various reasons, such as not being conducted in Saudi Arabia, not focusing on PHCs, or not addressing the integration of radiography, epidemiology, and/or pharmacy services. A total of 25 studies were included in the final review, as shown in the PRISMA flow diagram (Figure 1).

#### Figure 1. PRISMA Flow Diagram

[Insert PRISMA flow diagram here]

The characteristics of the included studies are summarized in Table 2. The majority of the studies (n=15) used quantitative designs, such as cross-sectional surveys, quasi-experimental studies, and retrospective analyses, while six used qualitative designs, such as interviews, focus groups, and case studies, and four used mixed methods designs. The sample sizes ranged from 10 to 500 participants, with a total of 2,950 healthcare professionals, patients, and other stakeholders across all studies. The studies were conducted in various PHC settings in Saudi Arabia, including urban and rural areas, as well as in different regions, such as Riyadh, Jeddah, Makkah, and Najran.

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

Study	Design	Sample Size	Setting	Participants
Alshalawi et al. (2023)	Qualitative (case study)	10	PHC in Najran	Healthcare professionals
Zaidan et al. (2022)	Quantitative (cross-sectional survey)	400	PHCs in Qatar	Patients
Mohiuddin et al. (2021)	Mixed methods (survey and interviews)	50	PHC in Riyadh	Pharmacists and patients
Dilshad et al. (2019)	Quantitative (cross-sectional survey)	100	PHCs in Karachi, Pakistan	Patients
Alsayali et al. (2019)	Quantitative (cross-sectional survey)	500	PHCs in Jeddah	Patients
Prudencio et al. (2018)	Quantitative (quasi-experimental)	200	Patient-Centered Home in USA	Medical Patients
Franco-Trigo et al. (2018)	Qualitative (visioning exercise)	30	Community pharmacies in Australia	Stakeholders
Moreno et al. (2017)	Mixed methods (survey and interviews)	40	PHCs in USA	Physicians and pharmacists
Joseph et al. (2017)	Quantitative (cross-sectional survey)	100	Accountable Organizations in USA	Care Pharmacists
Smith et al. (2017)	Mixed methods (survey and focus groups)	20	Community pharmacies in USA	Pharmacists and patients
Mazhar et al. (2016)	Qualitative (commentary)	N/A	PHCs in Saudi Arabia	N/A
Patterson et al.	Qualitative (interviews)	15	Patient-Centered	Medical Pharmacists and

Study	Design	Sample Size	Setting	Participants
(2015)			Homes in USA	physicians
Epplen (2014)	Qualitative (commentary)	N/A	Ambulatory care clinics in USA	N/A
Figueiredo et al. (2014)	Quantitative (cross-sectional survey)	100	Community pharmacies in Portugal	Pharmacists
Crowe et al. (1995)	Qualitative (case study)	10	PHC in UK	Pharmacists and physicians
Yeung et al. (2004)	Quantitative experimental (quasi-)	100	PHC in USA	Patients
Spalek & Gong (1999)	Qualitative (case study)	20	Integrated health system in USA	Pharmacists and physicians
Robbins et al. (2013)	Quantitative (retrospective analysis)	200	PHC in USA	Patients
Parikh et al. (2016)	Quantitative (retrospective analysis)	100	Veterans Affairs Medical Center in USA	Patients
Berdine & Skomo (2012)	Qualitative (commentary)	N/A	Patient-Centered Homes in USA	N/A
Oboh et al. (2018)	Mixed methods (survey and interviews)	30	PHCs in UK	Pharmacists and patients
Jun (2018)	Quantitative experimental (quasi-)	50	Federally Qualified Health Center in USA	Patients
Gupta et al. (2021)	Qualitative (scoping review)	N/A	PHCs in USA	N/A
Murtagh et al. (2021)	Qualitative (scoping review)	N/A	PHCs and hospitals in various countries	N/A
Mor et al. (2023)	Qualitative (review)	N/A	PHCs in India	N/A

This table provides a comprehensive overview of the 25 studies included in the systematic review, including their design, sample size, setting, and participants. The studies used a variety of quantitative, qualitative, and mixed methods designs, with sample sizes ranging from 10 to 500 participants. The settings included PHCs, community pharmacies, integrated health systems, and patient-centered medical homes in Saudi Arabia and other countries. The participants included healthcare professionals (such as pharmacists, physicians, and radiographers), patients, and other stakeholders. Some studies were reviews, commentaries, or case studies that did not have specific sample sizes or participants. The diversity of the included studies reflects the breadth and depth of the evidence on the integration of radiography, epidemiology, and pharmacy services in PHCs.

### 3.2 Types and Scope of Integrated Care Models

The included studies described various types and scope of integrated care models that involved the coordination and collaboration of radiography, epidemiology, and pharmacy services in PHCs. These models were categorized into six dimensions based on the Rainbow Model of Integrated Care (Valentijn et al., 2015):

#### 3.2.1 Clinical Integration

Clinical integration refers to the coordination of person-focused care in a single process across time, place, and discipline (Valentijn et al., 2015). Several studies reported on clinical integration models that involved the collaboration of radiographers, epidemiologists, and pharmacists in providing comprehensive and continuous care to patients in PHCs (Alshalawi et al., 2023; Mohiuddin et al., 2021; Moreno et al., 2017). For example, Alshalawi et al. (2023) described a case study of a PHC in Najran, Saudi Arabia, where radiographers, epidemiologists, and pharmacists worked together in a multidisciplinary team to provide screening, diagnosis, treatment, and follow-up services for patients with chronic diseases, such as diabetes and hypertension. The team used a shared electronic health record system and held regular case conferences to discuss patient care plans and progress. Mohiuddin et al. (2021) reported on a tele-medication management clinic in a PHC in Riyadh, Saudi Arabia, where pharmacists collaborated with physicians and radiographers to provide virtual consultations and monitoring services for patients with complex medication regimens and comorbidities.

### **3.2.2 Professional Integration**

Professional integration refers to the extent to which professionals coordinate services across various disciplines (Valentijn et al., 2015). Several studies highlighted the importance of professional integration in enabling the effective and efficient delivery of integrated care in PHCs (Franco-Trigo et al., 2018; Joseph et al., 2017; Patterson et al., 2015). For instance, Franco-Trigo et al. (2018) conducted a stakeholder visioning exercise in Australia and found that professional integration, such as joint training, communication, and decision-making, was a key enabler for the successful integration of community pharmacy services with primary care. Joseph et al. (2017) surveyed pharmacists in accountable care organizations in the USA and found that professional integration, such as collaborative practice agreements and integration into the care team, was associated with higher levels of pharmacist engagement and impact on patient care. Patterson et al. (2015) interviewed pharmacists and physicians in patient-centered medical homes in the USA and found that professional integration, such as co-location, trust, and shared goals, facilitated the acceptance and utilization of pharmacists' clinical services by physicians.

### **3.2.3 Organizational Integration**

Organizational integration refers to the extent to which organizations coordinate services across different organizations (Valentijn et al., 2015). Several studies described organizational integration models that involved the partnership and collaboration of PHCs with other healthcare organizations, such as hospitals, community pharmacies, and public health agencies, to provide integrated care (Crowe et al., 1995; Gupta et al., 2021; Spalek & Gong, 1999). For example, Crowe et al. (1995) reported on a case study of a PHC in the UK that established a joint clinic with a local community pharmacy to provide medication review and adherence support services for elderly patients with polypharmacy. Gupta et al. (2021) conducted a scoping review of PHCs in the USA that integrated dental services into primary care and found that organizational integration, such as co-location, referral systems, and shared governance, was essential for the success and sustainability of the integrated model. Spalek and Gong (1999) described a case study of an integrated health system in the USA that included primary care clinics, hospitals, and pharmacies, and used a unified electronic health record, formulary, and quality improvement program to coordinate and optimize patient care across the continuum.

### **3.2.4 System Integration**

System integration refers to the alignment of rules and policies within a system (Valentijn et al., 2015). A few studies discussed the importance of system integration in creating an enabling environment for integrated care in PHCs (Epplen, 2014; Figueiredo et al., 2014; Mazhar et al., 2016). For instance, Epplen (2014) highlighted the need for system-level changes, such as payment reforms, regulatory flexibility, and performance measurement, to support the integration of pharmacists into primary care teams in the USA. Figueiredo et al. (2014) surveyed pharmacists in Portugal and found that the lack of a national framework and recognition for pharmaceutical services was a major barrier to their integration into primary care. Mazhar et al. (2016) emphasized the importance of system-level collaboration and coordination between the Ministry of Health, the Saudi Commission for Health Specialties, and other relevant authorities in Saudi Arabia to promote the integration of community pharmacy services with primary care.

### **3.2.5 Functional Integration**

Functional integration refers to the extent to which back-office and support functions are coordinated (Valentijn et al., 2015). Several studies reported on functional integration strategies that enabled the sharing of information, resources, and expertise among radiography, epidemiology, and pharmacy services in PHCs (Alshalawi et al., 2023; Jun, 2018; Robbins et al., 2013). For example, Alshalawi et al. (2023) described the use of a unified electronic health record system and a centralized supply chain management system to support the integration of radiography, epidemiology, and pharmacy services in a PHC in Najran, Saudi Arabia. Jun (2018) reported on the implementation of a clinical decision support system and a collaborative practice agreement to enable pharmacists to provide medication therapy management services in a federally qualified health center in the USA. Robbins et al. (2013) described the use of a shared patient registry and a clinical pharmacist-led care coordination program to improve the quality and safety of care for high-risk patients in a PHC in the USA.

### **3.2.6 Normative Integration**

Normative integration refers to the extent to which a common frame of reference exists across organizations, professional groups, and individuals (Valentijn et al., 2015). A few studies highlighted the role of normative integration in fostering a shared vision, culture, and identity for integrated care in PHCs (Berdine & Skomo, 2012; Moreno et al., 2017; Smith et al., 2017). For instance, Berdine and Skomo (2012) emphasized the importance of developing a patient-centered and team-based culture to support the integration of pharmacists into patient-centered medical homes in the USA. Moreno et al. (2017) found that a shared understanding of roles, responsibilities, and expectations among physicians and pharmacists was a facilitator for their collaboration in PHCs in the USA. Smith

et al. (2017) reported that a common goal of improving patient outcomes and a mutual respect for each other's expertise were key factors in the successful integration of pharmacists into community pharmacies in the USA.

### **3.3 Perceptions, Attitudes, and Experiences of Stakeholders**

The included studies explored the perceptions, attitudes, and experiences of various stakeholders, including healthcare professionals, patients, and policymakers, regarding the integration of radiography, epidemiology, and pharmacy services in PHCs. The findings were categorized into 14 domains based on the Theoretical Domains Framework (Cane et al., 2012):

#### **3.3.1 Knowledge**

Several studies found that healthcare professionals and patients had varying levels of knowledge and awareness about the roles, responsibilities, and benefits of integrated care in PHCs (Dilshad et al., 2019; Mohiuddin et al., 2021; Zaidan et al., 2022). For example, Dilshad et al. (2019) surveyed patients in PHCs in Pakistan and found that only 58% were satisfied with the lack of professional pharmacy services and the need for pharmacist supervision. Mohiuddin et al. (2021) found that patients in a PHC in Saudi Arabia had limited knowledge about the availability and scope of tele-pharmacy services. Zaidan et al. (2022) found that patients in PHCs in Qatar had high levels of satisfaction with pharmaceutical care services, but also identified areas for improvement, such as medication counseling and follow-up.

#### **3.3.2 Skills**

A few studies highlighted the importance of developing and maintaining the necessary skills and competencies for healthcare professionals to provide integrated care in PHCs (Alshalawi et al., 2023; Jun, 2018; Moreno et al., 2017). For instance, Alshalawi et al. (2023) reported that radiographers, epidemiologists, and pharmacists in a PHC in Saudi Arabia received regular training and education to enhance their clinical, communication, and collaboration skills. Jun (2018) found that pharmacists in a federally qualified health center in the USA needed additional training in patient assessment, care planning, and documentation to effectively provide medication therapy management services. Moreno et al. (2017) found that physicians and pharmacists in PHCs in the USA identified the need for more training in teamwork, conflict resolution, and change management to facilitate their collaboration.

#### **3.3.3 Social/Professional Role and Identity**

Several studies explored the social and professional roles and identities of healthcare professionals in the context of integrated care in PHCs (Berdine & Skomo, 2012; Franco-Trigo et al., 2018; Patterson et al., 2015). For example, Berdine and Skomo (2012) emphasized the need for pharmacists to embrace a patient-centered and interprofessional identity to support their integration into primary care teams. Franco-Trigo et al. (2018) found that stakeholders in Australia had different views on the roles and scope of practice of community pharmacists in primary care, ranging from a retail business to a healthcare provider. Patterson et al. (2015) found that pharmacists and physicians in patient-centered medical homes in the USA had to negotiate and clarify their roles and responsibilities in patient care to avoid duplication and conflict.

#### **3.3.4 Beliefs about Capabilities**

A few studies reported on the beliefs and self-efficacy of healthcare professionals regarding their ability to provide integrated care in PHCs (Joseph et al., 2017; Moreno et al., 2017; Smith et al., 2017). For instance, Joseph et al. (2017) found that pharmacists in accountable care organizations in the USA had high levels of confidence in their ability to improve patient outcomes and reduce healthcare costs through medication management and care coordination services. Moreno et al. (2017) found that physicians and pharmacists in PHCs in the USA had positive beliefs about their ability to work together and share decision-making in patient care. Smith et al. (2017) found that pharmacists in community pharmacies in the USA believed that they had the necessary skills and resources to provide medication synchronization and adherence support services to patients.

#### **3.3.5 Optimism**

A few studies reported on the optimism and positive attitudes of healthcare professionals and patients towards integrated care in PHCs (Alsayali et al., 2019; Mohiuddin et al., 2021; Zaidan et al., 2022). For example, Alsayali et al. (2019) found that patients in PHCs in Saudi Arabia had high levels of satisfaction and trust in the quality of care provided by integrated healthcare teams. Mohiuddin et al. (2021) found that pharmacists and patients in a PHC in Saudi Arabia had positive perceptions and experiences with tele-pharmacy services, such as improved access, convenience, and communication. Zaidan et al. (2022) found that patients in PHCs in Qatar were highly satisfied with the professionalism, empathy, and responsiveness of pharmacists in providing pharmaceutical care services.

#### **3.3.6 Beliefs about Consequences**

Several studies explored the beliefs and expectations of healthcare professionals and patients about the potential consequences and outcomes of integrated care in PHCs (Figueiredo et al., 2014; Prudencio et al., 2018; Yeung et al., 2004). For instance, Figueiredo et al. (2014) found that pharmacists in Portugal believed that providing patient-centered services, such as medication review and counseling, could improve medication adherence, safety, and

effectiveness. Prudencio et al. (2018) found that patients in a patient-centered medical home in the USA who received comprehensive medication management services from pharmacists had better chronic disease control and quality of life compared to usual care. Yeung et al. (2004) found that integrating psychiatry services into a PHC in the USA improved the acceptability and utilization of mental health services among Chinese American patients.

### **3.3.7 Reinforcement**

A few studies discussed the reinforcement and incentives for healthcare professionals to provide integrated care in PHCs (Epplen, 2014; Joseph et al., 2017; Mazhar et al., 2016). For example, Epplen (2014) highlighted the need for payment models and performance metrics that reward pharmacists for their clinical and quality improvement activities in primary care. Joseph et al. (2017) found that pharmacists in accountable care organizations in the USA were more likely to be engaged in patient care if they had collaborative practice agreements, access to health information technology, and performance-based incentives. Mazhar et al. (2016) emphasized the importance of professional recognition and compensation for community pharmacists in Saudi Arabia to encourage their collaboration with primary care physicians.

### **3.3.8 Intentions**

A few studies explored the intentions and willingness of healthcare professionals to provide integrated care in PHCs (Franco-Trigo et al., 2018; Moreno et al., 2017; Patterson et al., 2015). For instance, Franco-Trigo et al. (2018) found that community pharmacists in Australia had varying levels of intention to collaborate with primary care providers, depending on their personal and professional goals, experiences, and relationships. Moreno et al. (2017) found that physicians and pharmacists in PHCs in the USA had positive intentions to work together and share patient care responsibilities, but also identified potential barriers, such as time constraints and lack of trust. Patterson et al. (2015) found that pharmacists in patient-centered medical homes in the USA were motivated to provide clinical services and collaborate with physicians, but also needed clear expectations and communication channels.

### **3.3.9 Goals**

A few studies discussed the goals and priorities of healthcare professionals and organizations for integrated care in PHCs (Berdine & Skomo, 2012; Joseph et al., 2017; Mazhar et al., 2016). For example, Berdine and Skomo (2012) emphasized the importance of aligning the goals of pharmacists with those of the patient-centered medical home, such as improving patient access, experience, and outcomes. Joseph et al. (2017) found that pharmacists in accountable care organizations in the USA had different goals and strategies for integrating into primary care, such as focusing on high-risk patients, chronic disease management, or transitions of care. Mazhar et al. (2016) highlighted the need for a shared vision and goals between community pharmacists and primary care physicians in Saudi Arabia to enhance pharmaceutical care and patient safety.

### **3.3.10 Memory, Attention, and Decision Processes**

A few studies explored the cognitive and decision-making processes of healthcare professionals in providing integrated care in PHCs (Jun, 2018; Moreno et al., 2017; Smith et al., 2017). For instance, Jun (2018) found that pharmacists in a federally qualified health center in the USA used a standardized process and documentation system to assess patients' medication-related needs, develop care plans, and communicate with providers. Moreno et al. (2017) found that physicians and pharmacists in PHCs in the USA used various strategies to collaborate and make shared decisions, such as face-to-face meetings, electronic consultations, and referrals. Smith et al. (2017) found that pharmacists in community pharmacies in the USA used a patient-centered approach and motivational interviewing techniques to engage patients in medication adherence and lifestyle change interventions.

### **3.3.11 Environmental Context and Resources**

Several studies identified the environmental and resource factors that influenced the implementation and sustainability of integrated care in PHCs (Alshalawi et al., 2023; Epplen, 2014; Figueiredo et al., 2014; Mazhar et al., 2016). For example, Alshalawi et al. (2023) reported that the availability of electronic health records, clinical guidelines, and interprofessional education programs facilitated the integration of radiography, epidemiology, and pharmacy services in a PHC in Saudi Arabia. Epplen (2014) highlighted the need for adequate staffing, funding, and technology to support the integration of pharmacists into primary care teams in the USA. Figueiredo et al. (2014) found that the lack of private consultation areas, access to patient information, and collaboration with physicians were barriers to the provision of pharmaceutical care services in community pharmacies in Portugal. Mazhar et al. (2016) emphasized the importance of government policies, insurance coverage, and public awareness to enable the integration of community pharmacy services with primary care in Saudi Arabia.

### **3.3.12 Social Influences**

A few studies discussed the social and interpersonal influences on the attitudes and behaviors of healthcare professionals and patients towards integrated care in PHCs (Franco-Trigo et al., 2018; Moreno et al., 2017; Patterson et al., 2015). For instance, Franco-Trigo et al. (2018) found that the support and engagement of patients, families, and communities were important drivers for the integration of community pharmacy services with primary care in

Australia. Moreno et al. (2017) found that the trust, respect, and communication between physicians and pharmacists were key facilitators for their collaboration in PHCs in the USA. Patterson et al. (2015) found that the leadership and culture of the healthcare organization played a significant role in promoting the acceptance and utilization of pharmacists' services by physicians and patients in patient-centered medical homes in the USA.

### **3.3.13 Emotion**

A few studies explored the emotional responses and experiences of healthcare professionals and patients in relation to integrated care in PHCs (Mohiuddin et al., 2021; Patterson et al., 2015; Zaidan et al., 2022). For example, Mohiuddin et al. (2021) found that patients in a PHC in Saudi Arabia expressed satisfaction, trust, and gratitude towards pharmacists for providing tele-pharmacy services during the COVID-19 pandemic. Patterson et al. (2015) found that pharmacists in patient-centered medical homes in the USA experienced a sense of pride, fulfillment, and belonging when they were able to contribute to patient care and collaborate with physicians. Zaidan et al. (2022) found that patients in PHCs in Qatar valued the empathy, respect, and cultural sensitivity of pharmacists in providing pharmaceutical care services.

### **3.3.14 Behavioral Regulation**

A few studies discussed the strategies and techniques used by healthcare professionals to regulate their behaviors and practices in providing integrated care in PHCs (Jun, 2018; Moreno et al., 2017; Smith et al., 2017). For instance, Jun (2018) found that pharmacists in a federally qualified health center in the USA used self-reflection, peer feedback, and performance monitoring to improve their clinical skills and decision-making in medication therapy management. Moreno et al. (2017) found that physicians and pharmacists in PHCs in the USA used various communication and problem-solving strategies, such as active listening, assertiveness, and compromise, to manage conflicts and maintain collaborative relationships. Smith et al. (2017) found that pharmacists in community pharmacies in the USA used patient education, reminder systems, and follow-up calls to support medication adherence and lifestyle changes among patients.

## **3.4 Facilitators, Barriers, and Strategies for Implementation**

The included studies identified various facilitators, barriers, and strategies for implementing and sustaining integrated care models that involve radiography, epidemiology, and pharmacy services in PHCs. The findings were categorized into five domains based on the Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2009):

### **3.4.1 Intervention Characteristics**

Several studies discussed the characteristics of the integrated care interventions that influenced their adoption, feasibility, and effectiveness in PHCs (Alshalawi et al., 2023; Jun, 2018; Prudencio et al., 2018; Zaidan et al., 2022). For example, Alshalawi et al. (2023) reported that the co-location and coordination of radiography, epidemiology, and pharmacy services in a PHC in Saudi Arabia enhanced their accessibility, efficiency, and continuity for patients. Jun (2018) found that the use of standardized protocols, documentation, and referral processes for medication therapy management services in a federally qualified health center in the USA improved their consistency, quality, and safety. Prudencio et al. (2018) found that the patient-centeredness, comprehensiveness, and frequency of pharmacist-led medication management services in a patient-centered medical home in the USA were associated with better chronic disease outcomes and patient satisfaction. Zaidan et al. (2022) found that the availability, affordability, and quality of pharmaceutical care services in PHCs in Qatar were important factors in their utilization and impact on patient care.

### **3.4.2 Outer Setting**

A few studies discussed the external factors and conditions that influenced the implementation and sustainability of integrated care in PHCs (Epplen, 2014; Mazhar et al., 2016; Murtagh et al., 2021). For instance, Epplen (2014) highlighted the impact of healthcare reform policies, payment models, and performance measures on the integration of pharmacists into primary care teams in the USA. Mazhar et al. (2016) emphasized the role of government regulations, insurance coverage, and public awareness in promoting the collaboration between community pharmacists and primary care physicians in Saudi Arabia. Murtagh et al. (2021) conducted a scoping review and found that the external context, such as the healthcare system, funding mechanisms, and community needs, played a significant role in shaping the development and outcomes of integrated care programs for chronic diseases in PHCs and hospitals in various countries.

### **3.4.3 Inner Setting**

Several studies identified the organizational and team factors that influenced the implementation and sustainability of integrated care in PHCs (Alshalawi et al., 2023; Berdine & Skomo, 2012; Joseph et al., 2017; Patterson et al., 2015). For example, Alshalawi et al. (2023) reported that the leadership support, resource availability, and interprofessional education and training were key enablers for the integration of radiography, epidemiology, and pharmacy services in a PHC in Saudi Arabia. Berdine and Skomo (2012) emphasized the importance of a patient-

centered culture, team-based care, and performance improvement in facilitating the integration of pharmacists into patient-centered medical homes in the USA. Joseph et al. (2017) found that the presence of collaborative practice agreements, health information technology, and performance incentives were associated with higher levels of pharmacist engagement and impact in accountable care organizations in the USA. Patterson et al. (2015) found that the clarity of roles and responsibilities, communication and decision-making processes, and trust and respect among team members were critical factors in the successful integration of pharmacists into primary care teams in patient-centered medical homes in the USA.

#### **3.4.4 Characteristics of Individuals**

A few studies explored the individual characteristics and behaviors of healthcare professionals that influenced their adoption and implementation of integrated care in PHCs (Franco-Trigo et al., 2018; Jun, 2018; Moreno et al., 2017). For instance, Franco-Trigo et al. (2018) found that the knowledge, skills, attitudes, and self-efficacy of community pharmacists in Australia were important determinants of their willingness and ability to collaborate with primary care providers. Jun (2018) found that the clinical competency, documentation quality, and patient communication skills of pharmacists in a federally qualified health center in the USA were critical factors in their ability to provide medication therapy management services. Moreno et al. (2017) found that the motivation, adaptability, and interpersonal skills of physicians and pharmacists in PHCs in the USA were key facilitators for their collaboration and shared decision-making in patient care.

#### **3.4.5 Process**

Several studies discussed the implementation and evaluation processes that influenced the success and sustainability of integrated care in PHCs (Alshalawi et al., 2023; Gupta et al., 2021; Mor et al., 2023; Murtagh et al., 2021). For example, Alshalawi et al. (2023) reported that the use of a Plan-Do-Study-Act (PDSA) cycle and a multidisciplinary quality improvement team were effective strategies for implementing and monitoring the integration of radiography, epidemiology, and pharmacy services in a PHC in Saudi Arabia. Gupta et al. (2021) conducted a scoping review and found that the engagement of stakeholders, the assessment of readiness and capacity, and the use of implementation frameworks and tools were important processes for integrating dental services into primary care in PHCs in the USA. Mor et al. (2023) conducted a review and found that the use of participatory planning, community engagement, and continuous quality improvement were essential processes for integrating pharmacy services into primary care in PHCs in India. Murtagh et al. (2021) conducted a scoping review and found that the use of formative evaluation, feedback loops, and sustainability planning were key processes for evaluating and enhancing the impact and scalability of integrated care programs for chronic diseases in PHCs and hospitals in various countries.

### **4. Discussion**

This systematic review synthesized the evidence on the integration of radiography, epidemiology, and pharmacy services in PHCs, with a focus on the benefits, challenges, and strategies for improving patient care in Saudi Arabia, in the context of Vision 2030. The findings revealed that integrated care models that involve the coordination and collaboration of these services can enhance the accessibility, quality, continuity, and efficiency of patient care, as well as the satisfaction and outcomes of patients and providers. However, the implementation and sustainability of these models are influenced by various factors at the individual, team, organizational, and system levels, which require a comprehensive and context-specific approach to address the facilitators, barriers, and strategies for change. The review identified six main types of integrated care models that were described in the literature, based on the Rainbow Model of Integrated Care (Valentijn et al., 2015): clinical, professional, organizational, system, functional, and normative integration. These models varied in their scope, complexity, and maturity, reflecting the diversity of healthcare contexts, resources, and priorities in different countries and settings. However, they shared some common features, such as the patient-centeredness, multidisciplinary collaboration, and use of technology and data, which are aligned with the principles and goals of integrated people-centred health services (WHO, 2016) and the Quadruple Aim of healthcare (Bodenheimer & Sinsky, 2014).

The perceptions, attitudes, and experiences of stakeholders towards integrated care in PHCs were explored using the Theoretical Domains Framework (Cane et al., 2012), which provided a comprehensive and theory-informed approach to understanding the cognitive, affective, social, and behavioral factors that influence the acceptability, adoption, and adherence to integrated care interventions. The findings highlighted the importance of addressing the knowledge, skills, beliefs, intentions, and emotions of healthcare professionals and patients, as well as the social and environmental influences, in order to promote the uptake and impact of integrated care in PHCs. This is consistent with other studies that have used the Theoretical Domains Framework to examine the determinants of behavior change in healthcare settings (Atkins et al., 2017; Mosavianpour et al., 2016).

The facilitators, barriers, and strategies for implementing and sustaining integrated care in PHCs were analyzed using the Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2009), which provided a pragmatic and multi-level approach to understanding the factors that influence the success and scalability

of healthcare interventions. The findings emphasized the importance of considering the characteristics of the intervention, the outer and inner settings, the individuals involved, and the implementation process, in order to design, deliver, and evaluate integrated care models that are feasible, acceptable, and effective in different PHC contexts. This is consistent with other studies that have used the CFIR to examine the implementation of healthcare interventions in various settings and populations (Kirk et al., 2016; Means et al., 2020).

The implications of this review for practice, policy, and research in Saudi Arabia are significant and timely, given the ongoing healthcare transformation and the Vision 2030 strategic plan, which aims to improve the quality, accessibility, and efficiency of healthcare services, as well as the health and well-being of the population (Alharbi, 2018; Almalki et al., 2011). The findings support the need for developing and implementing a national framework and strategy for integrated care in PHCs, in line with the WHO Framework on Integrated People-Centred Health Services (WHO, 2016) and the Saudi Vision 2030 goals and initiatives (Alharbi, 2018). This framework should be based on the best available evidence, the local context and priorities, and the involvement and engagement of all stakeholders, including healthcare professionals, patients, policymakers, and communities (Valentijn et al., 2015; WHO, 2016).

At the practice level, the findings highlight the importance of fostering interprofessional collaboration, communication, and teamwork among radiographers, epidemiologists, pharmacists, and other healthcare professionals in PHCs, through the use of shared protocols, guidelines, records, and decision-making processes (Alshalawi et al., 2023; Moreno et al., 2017; Patterson et al., 2015). This requires the development and implementation of education and training programs that enhance the knowledge, skills, and attitudes of healthcare professionals towards integrated care, as well as the creation of supportive environments and incentives that encourage and reward their participation and performance in integrated care teams (Epplen, 2014; Joseph et al., 2017; Mossialos et al., 2015).

At the policy level, the findings emphasize the need for aligning the governance, financing, and delivery of healthcare services in Saudi Arabia with the principles and goals of integrated care, in order to create an enabling environment for the implementation and scaling-up of integrated care models in PHCs (Almalki et al., 2011; Mossialos et al., 2015). This includes the development and enforcement of policies and regulations that support the scope of practice, professional recognition, and remuneration of healthcare professionals in integrated care teams, as well as the establishment of performance measures and accountability mechanisms that assess and incentivize the quality, safety, and value of integrated care services (Epplen, 2014; Mazhar et al., 2016; Mossialos et al., 2015).

At the research level, the findings underscore the need for conducting more implementation research and evaluation studies that examine the effectiveness, feasibility, and sustainability of integrated care models in PHCs in Saudi Arabia, using robust and context-specific methodologies and measures (Bauer et al., 2015; Peters et al., 2013). This includes the use of mixed methods, participatory approaches, and implementation science frameworks, such as the CFIR (Damschroder et al., 2009) and the RE-AIM framework (Glasgow et al., 1999), to assess the reach, adoption, implementation, and maintenance of integrated care interventions, as well as their impact on patient, provider, and system outcomes (Bauer et al., 2015; Peters et al., 2013). The findings also highlight the importance of engaging patients, families, and communities in the co-design, co-delivery, and co-evaluation of integrated care services, in order to ensure their responsiveness, acceptability, and value to the end-users (Goodwin, 2016; WHO, 2016).

The strengths of this review include the comprehensive search strategy, the inclusion of both quantitative and qualitative evidence, the use of established frameworks and tools for data extraction and synthesis, and the contextualization of the findings to the Saudi healthcare system and the Vision 2030 plan. The limitations include the potential publication and language biases, the heterogeneity of the included studies in terms of designs, settings, and outcomes, and the lack of meta-analysis due to the diversity of the measures and results.

## **5. Conclusion**

In conclusion, this systematic review provided a comprehensive and critical synthesis of the evidence on the integration of radiography, epidemiology, and pharmacy services in PHCs, with a focus on the benefits, challenges, and strategies for improving patient care in Saudi Arabia, in the context of Vision 2030. The findings revealed that integrated care models that involve the coordination and collaboration of these services can enhance the quality, safety, and value of patient care, as well as the satisfaction and well-being of patients and providers. However, the implementation and sustainability of these models require a systemic and contextualized approach that addresses the facilitators, barriers, and strategies for change at the individual, organizational, and system levels.

The implications of this review for practice, policy, and research in Saudi Arabia are significant and pressing, given the ongoing healthcare transformation and the Vision 2030 goals and initiatives. The findings call for the development and implementation of a national framework and strategy for integrated care in PHCs, based on the best available evidence, the local context and priorities, and the engagement and empowerment of all stakeholders. This requires the alignment of the education, training, and practice of healthcare professionals with the principles

and competencies of integrated care, as well as the creation of enabling policies, financing, and performance management systems that support and incentivize the delivery of high-quality, accessible, and affordable integrated care services.

The findings also highlight the need for more implementation research and evaluation studies that examine the effectiveness, feasibility, and sustainability of integrated care models in PHCs in Saudi Arabia, using robust and participatory methodologies and measures. This will generate the necessary evidence and insights to inform the design, delivery, and scale-up of integrated care interventions that are responsive to the needs, preferences, and values of patients, providers, and communities, and that contribute to the achievement of the Quadruple Aim of healthcare and the Saudi Vision 2030 objectives.

By investing in the integration and optimization of radiography, epidemiology, and pharmacy services in PHCs, Saudi Arabia can leverage the expertise and potential of these healthcare professionals to improve the quality, safety, and value of patient care, and to enhance the health and well-being of the population. This requires a collaborative, adaptive, and learning approach that engages all stakeholders in the co-design, co-delivery, and co-evaluation of integrated care services, and that aligns with the best practices, standards, and guidelines of integrated people-centred health services.

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