

Original Research

Barriers and facilitators to implementing pharmacist-led services in community and primary care settings: A CFIR-Informed qualitative study

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Abstract

Objectives: The expansion of pharmacists' roles in community and primary healthcare settings is supported by national policies. However, implementation in Indonesia remains inconsistent due to persistent structural and contextual barriers. This study aims to examine barriers and facilitators influencing the implementation of pharmaceutical care services provided by pharmacists in community pharmacies and primary healthcare centers in Indonesia, guided by the Consolidated Framework for Implementation Research (CFIR). **Methods:** A qualitative study was conducted using semistructured in-depth interviews with pharmacists practicing in community pharmacies and primary healthcare facilities. The interview guide was informed by CFIR domains and constructs. Interviews were audio recorded, transcribed verbatim, and independently coded by two researchers. A thematic analysis was performed using a hybrid deductive-inductive approach, with identified themes mapped to CFIR domains. Data collection continued until thematic saturation was achieved. Ethical approval was obtained prior to study commencement. **Results:** Data saturation was achieved after 30 interviews. Barriers and facilitators were identified across all CFIR domains. Key facilitators included pharmacists' professional motivation, the perceived value of pharmacist-led services, and management and governmental support for maintaining service quality. Major barriers were primarily related to the outer and inner factors, including limited public understanding of pharmacists' roles, patient-related challenges, restricted access to external training, inadequate workforce capacity, suboptimal interprofessional collaboration, and infrastructure constraints. **Conclusion:** Implementation of pharmacist-led services in the Indonesian community and primary care settings is shaped by interactions among multilevel determinants across CFIR domains, highlighting the need for strengthened management and governmental support to address constraints within the outer and inner settings.

Keywords: pharmacists, community, primary care, barriers, facilitators

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INTRODUCTION

Pharmacist-led services in community and primary care settings are increasingly recognized as integral components of multidisciplinary healthcare delivery¹⁻³. Globally, expanded pharmacist roles, particularly in comprehensive medication management, medication review, patient education, and interprofessional collaboration, have been associated with improved clinical outcomes, medication safety, and greater

healthcare efficiency when implemented with adequate training, infrastructure, and organizational support⁴⁻⁷. However, despite robust evidence of clinical effectiveness, the implementation and institutionalization of pharmacist-led services remain highly variable across settings.

Emerging literature suggests that such variability is not solely attributable to individual clinical competence, but rather reflects the influence of multilevel determinants spanning policy environments, organizational capacity, professional norms, and patient expectations^{8,9}. While descriptive studies have documented barriers and facilitators to pharmacist-led services, there remains limited empirical, theory-informed implementation research that systematically examines how these determinants interact across levels to shape service delivery in community and primary care settings, particularly in low and middle-income countries (LMICs)¹⁰⁻¹². The absence of theoretically grounded analyses limits the capacity to generate transferable insights and to inform the development of scalable and context-sensitive implementation strategies. Moreover, insufficient attention has been given to examining how determinants across outer, inner, and individual levels interact dynamically to influence implementation trajectories in LMIC primary care systems.

Indonesia presents a particularly complex context for the implementation of expanded pharmacy services. As a geographically diverse country with a large population and a decentralized healthcare system, Indonesia relies heavily



on primary healthcare centers (Puskesmas) and community pharmacies (apotek) as the frontline of healthcare delivery¹³⁻¹⁵. Puskesmas function as government-operated primary care facilities mandated to provide integrated preventive, promotive, curative, and rehabilitative services through interprofessional teams, including physicians, nurses, midwives, and pharmacists. In contrast, community pharmacies are predominantly privately owned and serve as the main access point for medicines, self-care advice, and, increasingly, pharmaceutical services for the general population¹⁶⁻¹⁷.

Evidence from Indonesian studies suggests that pharmacists demonstrate strong professional motivation and a readiness to expand their roles. For example, a national survey of community pharmacists showed high levels of knowledge, positive perceptions, and readiness to implement telepharmacy services as an expanded mode of pharmaceutical care¹⁸. Nevertheless, implementation occurs within a complex landscape of health system transformation. Multiple barriers persist in Indonesia, including limited digital infrastructure, uneven distribution of the health workforce, rigid financing mechanisms, weak coordination across levels of care, and low digital literacy^{13,19}. At the same time, facilitators such as supportive leadership, structured capacity-building, interprofessional collaboration, and enabling policy environments have been shown to enhance implementation success²⁰⁻²². These determinants align closely with the domains of the Consolidated Framework for Implementation Research (CFIR), which offers a comprehensive, theory-informed lens to examine how innovation, inner and outer settings, individual attributes, and implementation processes interact to shape implementation outcomes. Published pharmacy implementation studies have applied CFIR to systematically characterize barriers and facilitators of community and primary care pharmacy services, including readiness for implementation, leadership engagement, interprofessional networks, and policy environments, thereby demonstrating its utility in informing targeted, scalable implementation strategies^{23,24}.

CFIR was selected over behaviour-focused frameworks such as the Theoretical Domains Framework because it more explicitly captures organizational and process-level determinants of implementation through its domain structure. Previous comparative studies have shown that CFIR is better suited to classify contextual and relational factors, such as organizational processes and clinician-patient interactions, that are less readily mapped within the TDF, particularly in complex healthcare interventions²⁵. By identifying key CFIR-informed barriers and facilitators, implementation research can generate actionable insights to guide the development of tailored strategies, strengthen institutional readiness, and inform evidence-based policy reforms²⁶⁻²⁸. Despite its relevance, the application of CFIR in studying pharmacy practice implementation in LMICs, including Indonesia, remains limited.

Unlike previous CFIR-based studies that have predominantly focused on high-income healthcare systems, this study provides

empirical evidence from a large and geographically diverse LMIC setting. By capturing perspectives from pharmacists working across community pharmacies and primary healthcare centers in multiple Indonesian provinces, this study highlights how regulatory environments, infrastructural disparities, and community-level perceptions interact to shape the implementation of pharmacist-led services. This extends the application of CFIR to a complex LMIC context and identifies context-specific determinants that may inform scalable and context-sensitive implementation strategies.

Therefore, this study aims to explore barriers and facilitators to the implementation of pharmacist-led services in community and primary care settings in Indonesia using the CFIR framework. Understanding these contextual influences is essential to support the integration and sustainability of expanded pharmacy services and improve medication use, patient safety, and primary care performance^{29,30}.

METHODS

Study design

A descriptive qualitative study was conducted using semi-structured in-depth interviews to explore the barriers and facilitators influencing the implementation of pharmacy-led services in community pharmacies and primary healthcare centers (Puskesmas). A qualitative methodology was employed to elicit context-bound understanding and the authentic experiences of pharmacists involved in service provision³¹. The study was conducted in accordance with the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines (Supplementary 1)³¹, and the findings are reported accordingly.

Study setting

The study was conducted in two primary healthcare delivery settings within the Indonesian health system:

1. Community pharmacies, which operate predominantly in the private sector and represent the most accessible point of contact for the public seeking medicines and pharmaceutical advice¹⁶
2. Primary healthcare centers (Puskesmas), government-funded clinics responsible for comprehensive primary care, including promotive, preventive, curative, and rehabilitative services¹⁷.

These settings were chosen to reflect the diversity of pharmacist roles and the contextual differences between private-sector community pharmacies and public-sector primary care institutions.

Sampling Strategy

Participants were recruited using a purposive sampling strategy, facilitated through professional associations and academic



networks accessible to the research team. These networks served as convenience recruitment channels, allowing access to pharmacists across multiple regions of Indonesia in the absence of a comprehensive national registry of practicing community pharmacists.

To ensure a maximum variation sample, participants were purposively selected to capture diversity in facility type (community pharmacies and primary healthcare centers (Puskesmas)), geographic characteristics (urban, semi-urban, and rural areas), and years of professional experience. This approach was intended to elicit a broad range of perspectives relevant to the implementation contexts explored within the CFIR.

Pharmacists were eligible if they were currently practicing in community pharmacies or puskesmas, had at least one year of professional experience, and provided informed consent. Pharmacists who were inactive, on leave, or working outside primary care settings were excluded.

Initial invitations were disseminated through professional and academic networks, and interested participants were contacted to schedule interviews at mutually convenient times. All interviews were conducted online. Sampling continued until thematic saturation was achieved, defined as the point at which no substantially new themes relevant to the CFIR domains emerged from successive interviews. A total of 31 pharmacists were approached, 30 agreed to participate, and 1 declined or did not respond. Participants were recruited from 26 provinces across Indonesia, reflecting broad geographic representation.

Sample Size

The sample size was determined based on the principle of data saturation, specifically theoretical saturation, defined as the point at which no new insights emerge to further elaborate the properties or relationships of the analytic categories. Consistent with qualitative studies informed by the CFIR and established recommendations for ensuring data adequacy in thematic analysis, 30 participants were recruited. This sample size enabled sufficient representation of variation across stakeholder groups and practice settings. Data collection continued until thematic saturation was reached, indicated by no emergence of new codes or themes during iterative data collection and analysis³³.

Ethics approval and consent to participate

This study was approved and authorized by the Ethics Committee of Padjajaran University, Protocol No. 180/UN6. KEP/EC/2025, Dated on 03-03-2025). Prior to each interview, participants were provided with detailed information about the study objectives and procedures, and subsequently gave written informed consent, including consent for audio recording. Interviews were conducted in Indonesian according to participant preference. To minimize potential

power imbalances and social desirability bias, participants were assured that there were no right or wrong answers, that all responses would be kept confidential, and that their participation would not influence their professional standing. All identifiable information was anonymized to protect privacy. Participants received a token of appreciation after completing the interview.

Theoretical Framework

In examining the multilevel factors that influence the implementation of healthcare services, several implementation science frameworks may be applied. Among these, the CFIR was selected as the guiding framework for this study. CFIR offers a comprehensive structure for identifying and organizing determinants that shape the adoption, delivery, and sustainability of interventions across diverse healthcare settings³⁴.

CFIR consists of five major domains: Innovation, Outer Setting, Inner Setting, Individuals, and Process of Implementation (Table 1), each encompassing multiple constructs that explain how contextual, organizational, and individual factors interact to influence implementation outcomes³⁴. This framework has been widely applied in studies examining the integration of new clinical services, workforce roles, policy changes, and quality improvement initiatives across primary care and community-based settings.

In this study, CFIR was used to:

1. Inform the development of research questions,
2. Guide the construction of the semi-structured interview guide, and
3. Support the analytic process by providing a structured lens to identify barriers and facilitators related to the implementation of pharmaceutical services in community pharmacies and primary healthcare centers.

Given its ability to systematically capture the complexity of implementation across multiple levels, CFIR was deemed highly suitable for exploring the contextual, organizational, and behavioral factors that shape pharmacists' roles and service delivery practices in the Indonesian primary care context.

Study Instrument development

A semi-structured interview guide (Supplementary 2) and interview protocol were developed based on the five domains of the CFIR. The guide was designed to explore multilevel determinants of the delivery of pharmacist-led services in community pharmacies and primary healthcare centers (Puskesmas). A demographic form was also used to collect participants' background characteristics. The interview guide underwent expert review for content validity by eight



senior pharmacists from community pharmacies and primary healthcare centers (Puskesmas). The experts assessed the relevance, clarity, and comprehensiveness of the questions in relation to the CFIR domains. Feedback from this review informed revisions to refine language and flow and to incorporate additional probes addressing context-specific barriers, including training-related constraints.

Data Collection

Data were collected through semi-structured interviews that were conducted online via secure video conferencing platforms to accommodate participants across diverse geographic regions in Indonesia. All interviews were conducted by the primary researcher. No prior personal or supervisory relationship existed between the interviewer and participants. Interviews lasted approximately 30–60 minutes. Field notes were taken to capture contextual information, emerging insights, and potential follow-up probes. No repeat interviews were conducted. Audio recordings were transcribed verbatim and anonymized. Transcripts were cross-checked against the audio files to ensure accuracy. When required for reporting, transcripts were translated into English using a meaning-preserving approach to maintain conceptual integrity.

Data Analysis

Qualitative data were analyzed using a hybrid deductive–inductive thematic analysis approach guided by the CFIR. The analytic process included the following steps³⁶:

1. Familiarization: All audio recordings and Indonesian-language transcripts were read and reread by the research team to achieve immersion in the data. Initial analytic notes and reflexive memos were documented to capture early impressions and contextual insights.
2. Initial coding: Two researchers independently conducted line-by-line coding of the transcripts to identify meaningful data segments. Coding decisions, definitions, and revisions were systematically documented in a coding log to maintain an audit trail. Discrepancies between coders were resolved through iterative discussion and consensus, with reference to the original transcripts to ensure interpretive accuracy. When consensus could not be reached, a third senior researcher was consulted.
3. Searching for themes (deductive and inductive): Initial codes were organized into potential themes by mapping them deductively onto the five CFIR domains. Concurrently, inductive coding identified context-specific themes not fully captured by CFIR, particularly those reflecting the Indonesian primary care context.
4. Reviewing themes: Candidate themes were reviewed

for internal coherence and distinctiveness by comparing coded extracts against the full dataset. Themes were refined through merging, splitting, or reclassification to ensure analytic clarity and alignment with the research objectives.

5. Defining and naming themes: Final themes were clearly defined and named to reflect their core meaning and relevance to barriers and facilitators of pharmacist-led service implementation. Analytic narratives were developed to articulate how each theme related to CFIR constructs and the broader implementation context.
6. Writing up and verification: Findings were synthesised into a coherent narrative supported by illustrative quotations. Credibility was enhanced through member checking with six participants, who reviewed summaries of preliminary themes for accuracy and relevance. Feedback-informed refinement of theme definitions and interpretations. Peer debriefing within the research team further strengthened analytic rigor. All data were managed and coded using NVivo (version 15) to support systematic organization and retrieval.

RESULTS

A total of 30 pharmacists were included in the interviews (Supplementary 3). As summarized in Table 2, the majority of participants were female, with a mean age of 36.57 years and a mean professional experience of 8.13 years. Provinces were grouped into major island regions in Indonesia to reflect Indonesia's geographic diversity and facilitate interpretation for international readers. Respondents were relatively evenly split between community pharmacy and primary healthcare settings, and most reported educational attainment beyond the professional pharmacist qualification, at least at the bachelor's degree level. Table 3 summarizes implementation themes identified as facilitators or barriers across CFIR domains and constructs.

Themes aligned to the CFIR domain and constructs

1. CFIR Domain: Innovation

Construct: Innovation Complexity

Implementation was hindered by overlapping roles requiring pharmacists to simultaneously manage clinical services, administrative responsibilities, and pharmaceutical supply functions. In practice, duties often extended beyond pharmaceutical care to include the management of medical devices, exceeding regulatory expectations and substantially increasing workload. This role multiplicity reduced time for direct patient care and limited consistent service implementation, particularly in settings with limited staffing.

Construct: Innovation Relative Advantage

Pharmacist-led initiatives demonstrated a clear relative advantage over usual dispensing-focused practice, characterized by limited patient engagement. In community settings, proactive outreach activities such as public exercise programs and health education in collaboration with local organizations enhanced professional visibility and strengthened the perceived societal value of pharmacists. In primary healthcare, innovations including a digital antibiotic reminder application and a traffic light system for monitoring near-expired medicines improved medication adherence, supported rational antibiotic use, enhanced inventory control, and reduced wastage. Collectively, these initiatives were perceived to improve patient understanding, optimize workflow efficiency, and contribute to safer and more coordinated pharmaceutical care across practice settings.

Construct: Innovation Adaptability

Role adaptability emerged as a key facilitator of implementation across practice settings. Pharmacists described flexibly adjusting service priorities and assuming expanded clinical responsibilities in response to workforce shortages and fluctuating patient demand. In both community and primary care settings, this adaptive approach enabled pharmacists to maintain essential pharmaceutical services despite limited staffing and operational constraints, while allowing for planned role expansion as service capacity and human resources increase.

2. CFIR Domain: Outer Setting

Construct: Local Attitudes

Participants described varying levels of community understanding of pharmacists' professional roles in primary care. Participants described limited patient awareness and persistent misconceptions regarding pharmacists' professional roles in primary healthcare as key barriers to service delivery. Many patients continued to view pharmacies primarily as points of medicine supply, resulting in low engagement with counseling and suboptimal adherence, particularly among individuals with chronic conditions. Pharmacists frequently reported the need to re-educate patients to ensure safe and appropriate medicine use. Conversely, pharmacists who were actively involved in community activities and home care services were more likely to be recognized as trusted healthcare professionals, which facilitated counseling and follow-up. These findings indicate that patients' understanding of pharmacists' roles can both facilitate and hinder effective implementation of pharmaceutical care.

Construct: Policies and Laws

Participants identified regulatory mandates as central facilitators shaping the implementation of pharmacist-led services in primary care. National regulations clearly define

responsibilities in pharmaceutical supply management and clinical pharmacy activities, including procurement, prescription screening, counseling, home care, and therapeutic monitoring, thereby strengthening professional accountability and standardizing practice. Recent ownership reforms further reinforce the pharmacist's role as the responsible professional, supporting service quality and patient safety. However, implementation varied across contexts. While the regulatory framework provides a clear mandate for pharmacist involvement in patient care, restrictive district-level policies, procurement limitations, budget constraints, and operational challenges were reported to hinder flexible decision-making and reduce efficiency. These contextual barriers limited the optimal translation of evidence-based practices into routine service delivery, particularly in resource-constrained settings.

Construct: Local Conditions

Unequal economic and digital infrastructure emerged as a key contextual barrier to implementation. Participants reported that limited and unstable internet connectivity, particularly in district and remote settings, constrained engagement with digital health systems, routine reporting, and online professional activities that increasingly rely on application-based platforms. In primary care facilities lacking institutional internet access, reliance on personal connectivity further restricted participation in online training and digital service initiatives, disproportionately affecting pharmacists in under-resourced and geographically remote areas.

3. CFIR domain: Inner Setting

Construct: Structural characteristics

Implementation capacity was strongly shaped by workforce structure within healthcare facilities. Participants reported insufficient numbers of pharmacists and pharmacy technicians, with staff often holding multiple roles, leading pharmacists to assume concurrent managerial and clinical responsibilities. Limited financial capacity and low remuneration further constrained the recruitment and retention of pharmacy personnel, restricting effective task delegation and increasing individual workload. These structural limitations narrowed the scope of services that could be delivered and posed challenges to the sustainability of pharmaceutical care across both primary care and community pharmacy settings.

Construct: Communication

Communication patterns within the facility varied, encompassing both challenges and productive exchanges. Participants noted that physicians were sometimes difficult to reach, leading to delays in resolving prescription-related issues. Unstructured communication pathways weakened pharmacists' participation in interdisciplinary decision-making, particularly in clinical contexts. In contrast, settings with established interprofessional communication and routine collaborative



Table 1. CFIR Domains and Core Constructs³⁵	
CFIR Domain	CFIR Core Constructs
Innovation	Innovation source; Evidence strength and quality; Relative advantage; Adaptability; Trialability; Complexity; Design quality and packaging; Cost
Outer Setting	Patient needs and resources; Local attitudes; Local conditions; Partnerships and connections; Policies and laws; Financing; External pressure
Inner Setting	Structural characteristics; Relational connections; Communications; Culture; Tension for change; Compatibility; Relative priority; Incentive systems; Mission alignment; Available resources; Access to knowledge and information
Individuals	Roles (leaders, facilitators, deliverers, recipients); Need; Capability; Opportunity; Motivation
Implementation Process	Teaming; Assessing needs; Assessing context; Planning; Tailoring strategies; Engaging; Doing; Reflecting and evaluating; Adapting

Table 2. Demographic Characteristics of Respondents (n=30)			
Variables	Categories	Frequency	Percentage (%)
Age (years)	18-30	7	23.33
	31-45	20	66.67
	46-60	3	10
Gender	Male	11	36.67
	Female	19	63.33
Years of practice	1-3 years	6	20
	>3-6 years	10	33.33
	>6-10 years	6	20
	>10 years	8	26.67
Type of healthcare facility	Community pharmacy	14	46.67
	Primary health center (PUSKESMAS)	16	53.33
Island Regions	Sumatra	8	26.67
	Java	10	33.33
	Bali and Nusa Tenggara	3	10
	Kalimantan	2	6.67
	Sulawesi	4	13.33
	Maluku & Papua	3	10
Highest Educational Attainment	Bachelor's Degree	18	60
	Master's Degree	11	36.67
	Doctoral Degree	1	3.33

practices enabled more integrated pharmaceutical care and enhanced acceptance of pharmacists' clinical contributions, including involvement in prescribing-related discussions. These experiences underscored the importance of mutual respect and open communication between pharmacists and other healthcare professionals, with participants emphasising that collaboration should not be influenced by hierarchical perceptions of professional knowledge.

Construct: Available Resources

Limitations in physical infrastructure, facility conditions, and medicine distribution systems restricted the delivery of comprehensive pharmacy services. In geographically remote areas, access to licensed pharmaceutical distributors remained centralized in major cities, requiring additional logistical arrangements and constraining timely access to medicine. Within facilities, older buildings without adequate counseling spaces limited privacy and comfort, forcing pharmacists to prioritize high-risk patients. Budget-related constraints, including inadequate temperature control, further raised concerns about the stability and quality of stored medicines, collectively challenging the operational capacity and safety of pharmacy services.

Construct: Access to Knowledge and Information

Limited access to clinically oriented training and decision support resources constrained pharmacists' competency development and implementation capacity. In several regions, continuing professional development (CPD) opportunities were infrequent compared with other healthcare professionals, and access to webinars remained limited, often requiring travel to major cities to obtain clinical training. Participants emphasized that government and regulator-led programs predominantly focused on administrative compliance, with minimal emphasis on clinical pharmacy and complex therapeutic issues such as off-label medicine use. Although digital platforms have expanded access to webinars and educational materials in some areas, disparities in access and training focus reduced their overall impact, thereby limiting pharmacists' clinical confidence and the scope of services delivered in practice.

4. CFIR Domain: Characteristics of Individuals

Construct: Self-efficacy and Capability

Effective implementation was strongly influenced by pharmacists' self-efficacy, shaped by context-specific competency demands across practice settings. In primary care, participants emphasized the need to strengthen therapeutic knowledge, clinical pharmacy skills, and interpersonal communication to support confident clinical decision making, collaborative engagement with other healthcare professionals, and the ability to provide evidence-based recommendations. Disaster preparedness was also identified as an essential competency to ensure the availability of medicine and a

coordinated response during emergencies. In community pharmacy settings, while clinical foundations among newly qualified pharmacists were perceived as adequate, confidence in practice was closely linked to business and managerial capability. Limited structured exposure to financial planning, operational management, and emerging digital market models constrained pharmacists' readiness to sustain services and compete in a market-driven environment. Participants highlighted that more systematic integration of business and entrepreneurship training would strengthen professional confidence and enable more effective application of clinical expertise in practice.

Construct: Individual Identification with Organization (Innovation Deliverers)

Pharmacists demonstrated growing awareness of their potential contributions to preventive and promotive care within primary healthcare. Participants recognised the increasing emphasis on health promotion and rational medicine use as integral to contemporary pharmaceutical practice. However, despite this self-awareness, the routine implementation of expanded roles remained constrained by the scope of Indonesia's existing institutional and regulatory frameworks. In particular, promotive and preventive pharmaceutical activities have not yet been explicitly incorporated into current regulations, resulting in inconsistent, non-routine integration into primary care services.

5. CFIR Domain: Process of Implementation

Construct: Planning

Limited strategic planning and oversight constrained the scalability and consistency of pharmacists' expanded roles within primary healthcare. Participants highlighted the need for stronger policy direction, professional guidance, and structured implementation frameworks to support sustainable role integration. Recommendations focused on embedding public health competencies within pharmacy education and professional practice, enabling pharmacists to engage more systematically in community-based health promotion beyond dispensing and clinical tasks. However, in the absence of formal guidelines, structured training programmes, and explicit regulatory recognition, these activities remain largely dependent on self-directed efforts. Participants expressed expectations that future regulations and professional oversight mechanisms would formally incorporate pharmacists' public health responsibilities and provide guidance comparable to that available for existing health promotion units.

Construct: Reflecting and Evaluating

Monitoring and evaluation mechanisms, including regulatory frameworks and accreditation processes, were perceived as important enablers of quality improvement and reflection on the implementation of pharmacists' roles. Participants



acknowledged that existing regulations and accreditation requirements have strengthened accountability and encouraged assessment of practice performance. However, as pharmacists' responsibilities continue to expand, particularly in relation to digital integration and online medicine distribution, ongoing evaluation and clearer regulatory oversight were considered necessary. Uneven adoption of electronic pharmaceutical service collaborations and the absence of explicit, standardised regulations were viewed as posing challenges for legal compliance, pricing consistency, and fair competition. Participants emphasised the need for harmonised monitoring and regulatory frameworks to ensure that digital pharmaceutical services remain safe, equitable, and aligned with service capacity as digital health continues to evolve.

DISCUSSION

This study demonstrates that the implementation of pharmacists' roles in Indonesian primary care is shaped by multilevel determinants across CFIR domains. Moving beyond the identification of discrete barriers and facilitators, the findings elucidate structured patterns of interaction among outer-setting governance arrangements, inner-setting organizational capacity, and individual professional capability. Implementation outcomes were therefore not determined solely by professional motivation or perceived innovation attributes, but by the extent of structural and functional alignment across policy, organizational, and workforce domains. These findings underscore the importance of examining cross-level dynamics to understand how implementation processes unfold in resource-constrained health systems.

A consistent cross-domain pattern emerged in which outer-setting determinants structured the operational space within which inner-setting processes unfolded. Regulatory emphasis on pharmaceutical supply management, combined with limited explicit recognition of preventive pharmaceutical services, prioritised dispensing and inventory control over clinical expansion. These policy orientations interacted with workforce shortages and infrastructural limitations at the facility level, amplifying the complexity of innovation and constraining the routinisation of expanded services. Individual adaptability served as a compensatory mechanism, providing minimal continuity of care while masking systemic fragilities.

In contrast to CFIR-based studies conducted predominantly in high-income healthcare settings, where inner-setting factors dominate³⁷⁻³⁹, this study demonstrates that in LMIC primary care systems, outer-setting governance and infrastructural determinants exert primary influence on implementation trajectories. These findings suggest a need to recalibrate implementation frameworks to more explicitly account for macro-level structural constraints in resource-constrained health systems.

Despite strong professional motivation and recognition of the relative advantage of expanded roles, implementation

was constrained by structural and operational barriers, including heavy workloads, understaffing, limited counselling infrastructure, and uneven access to clinically oriented training and decision-support tools. These constraints reflect broader systemic challenges related to policy environments, clarity of scope of practice, clinical autonomy, resource adequacy, time availability, and interprofessional collaboration, all of which shape pharmacists' integration into primary care settings⁴⁰⁻⁴². Innovation adaptability enabled pharmacists to sustain essential services, yet this flexibility served as a compensatory response to systemic limitations rather than evidence of robust implementation. Without protected staffing norms, structured continuing professional development, and sustained investment in district-level digital infrastructure, expanded roles are likely to remain episodic and individually driven rather than institutionally embedded⁴³⁻⁴⁶.

Patient and community-level determinants interacted dynamically with organizational capacity to shape implementation. Limited public awareness of pharmacists' clinical and public health roles reinforced dispensing-oriented expectations, particularly in facilities constrained by time pressures, workforce shortages, and inadequate counseling infrastructure. In contrast, proactive outreach and enhanced professional visibility contributed to a gradual reframing of patient perceptions, supporting broader acceptance of pharmacists' expanded roles⁴⁷, suggesting that public engagement strategies can function as system-level enablers when aligned with organizational support. In this study, organizational dynamics further shaped these processes, as supportive leadership, clear communication channels, and routine interprofessional collaboration enhanced pharmacists' involvement in clinical decision-making and acceptance of their recommendations, whereas fragmented communication and hierarchical cultures reinforced role ambiguity and constrained collaborative practice. Regulatory frameworks were perceived as a critical foundation for professional accountability and service standardisation. Existing global regulations defining pharmacists' responsibilities supported patient safety and quality assurance⁴⁸. However, the absence of explicit incorporation of preventive pharmaceutical services limited institutionalization of expanded roles. This regulatory gap contributed to variability across districts and underscored the need for clearer policy integration^{49,50}. Several strategies emerged to support more sustainable implementation. Participants emphasised the need for clearer operational guidance, structured, clinically-oriented training programmes, and stronger integration of public health competencies within pharmacy education and professional development. Improved infrastructure, including dedicated counselling spaces and reliable digital systems, was considered essential to enable consistent service delivery. Additionally, formal mechanisms for monitoring and evaluation were considered necessary to support quality improvement, ensure regulatory compliance, and guide the responsible expansion of digital pharmaceutical services. These facilitators align with international evidence



Table 3. Mapping of Facilitators and Barriers to CFIR Domains and Constructs

CFIR Domain	CFIR Construct	Barrier Themes	Facilitator Themes	Illustrative Quotes
Innovation	Innovation Complexity	Multiple and overlapping pharmacist roles, high workload, and the need for coordination across clinical, administrative, and supply functions		Service delivery has not been fully optimized due to overlapping responsibilities across multiple practice settings. Balancing clinical services, administrative duties, and supply management limits the time available for direct patient care and constrains consistent implementation in the field. (P23, Community pharmacist, Central Kalimantan)
				"I often manage multiple roles simultaneously, including clinical services and administrative responsibilities such as financial management. When staffing was limited, this double workload increased service complexity and reduced my capacity to deliver pharmacy services optimally." (P7, Primary care pharmacist, Jambi)
				"In practice, our responsibilities extend beyond pharmaceutical care to include the management of medical devices, resulting in a scope of work that exceeds regulatory expectations. This expansion of duties creates overlapping roles across clinical, administrative, and supply management functions, substantially increasing workload and operational complexity. Such role multiplicity highlights the challenges pharmacists face in maintaining optimal service quality amid competing responsibilities." (P9, Primary care pharmacist, DKI Jakarta)

				<p>Beyond routine dispensing, I believe community pharmacists should be directly involved in community activities. At our pharmacy, we consistently seek to launch programs that actively engage the local community. For example, during the Independence Day celebration last month, we collaborated with the local youth organization to organize group exercise sessions and health education activities. From my experience, few pharmacies are proactive in educating the community. Greater collective involvement would make the role of community pharmacists more visible and meaningful within society. (P13, Community pharmacist, West Java)</p>
	Innovation Relative Advantage		Pharmacist-led initiatives that provide tangible benefits for patients and the health system	<p>We have an innovation in pharmacy related to antibiotic use. One of our pharmacy team members developed an application, a reminder tool for antibiotic use. Patients who take antibiotics can download an app to help them remember their doses. But it is still limited to short-course antibiotics, not yet for tuberculosis (TB) treatment. (P8, Primary care pharmacist, Bangka Belitung)</p>

	Innovation Adaptability		Flexibility in role implementation across settings, including pharmacists undertaking expanded clinical responsibilities in contexts with limited human resources	<p>"We have implemented a traffic light system to strengthen the control of near-expired and expired medicines, enabling early identification and prioritization of stock based on expiry status. This pharmacist-led initiative enhances inventory monitoring, reduces the risk of dispensing expired products, and minimizes financial losses from waste. Compared with conventional manual checks, the system provides a practical and visible advantage in improving medication safety and supply efficiency within the primary healthcare setting." (P24, Primacy Care Pharmacist, Central Sulawesi)</p> <p>"At present, I independently manage pharmacy services by strategically adjusting my responsibilities to meet evolving service demands. As patient volume and operational capacity increase, I intend to involve an additional pharmacist to ensure the sustainability and expansion of clinical care delivery." (P6, Community pharmacist, Lampung)</p> <p>"In a high-volume primary healthcare setting with limited staffing, I continuously recalibrate my role by prioritizing services according to patient needs, thereby ensuring the continuity of essential pharmaceutical care despite workforce constraints". (P3, Primary care pharmacist, West Sumatra)</p>
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Outer Setting	Local Attitudes	Patient-related barriers, such as adherence and awareness of rational medicine use	Public perceptions and understanding of pharmacists' roles, functions, and responsibilities in primary healthcare	<p>"There remains a need to strengthen patients' understanding of pharmacists' professional roles, as many continue to perceive pharmacies primarily as sites for purchasing medicines rather than as providers of clinical counseling. Consequently, pharmacists frequently need to re-educate patients regarding the importance of medication-related information, particularly in the management of chronic conditions, where inappropriate use is often identified during follow-up. Although patients generally recognize that pharmacists are distinct from physicians due to the physical and organizational separation of services, this distinction may inadvertently contribute to the under-recognition of pharmacists' clinical responsibilities." (P4, Primary care Pharmacist, Riau)</p> <p>"Because we are actively engaged in community outreach and home care services, people in the neighborhood perceive us as accessible healthcare professionals for consultation, rather than solely as medicine sellers. This broader understanding facilitates the provision of counseling and follow-up care." (P12, Community pharmacist, West Java)</p>
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				<p>“Pharmaceutical services are implemented in accordance with regulatory standards, including prescription screening with clinical review, which is delegated during peak service hours, with any discrepancies referred to the pharmacist for verification. Drug information services and patient counseling remain routine components of care, supported by an available counseling room and ongoing patient monitoring, particularly for patients enrolled in referral-back programs. Home care services are provided upon request and encompass medication delivery, patient education, and periodic follow-up. Therapeutic drug monitoring is selectively prioritized for high-risk conditions, such as patients with diabetes mellitus and cardiovascular diseases, which require laboratory evaluation.” (P22, Community pharmacist, South Kalimantan)</p>
	Policies & Laws		<p>Implementation of pharmacists’ roles in pharmaceutical supply management, medical consumables, and clinical pharmacy services as mandated by national and global regulations</p>	<p>“Pharmaceutical supply management is conducted through a structured procurement and verification process involving coordination with distributors. This includes confirming stock availability, reconciling invoices, verifying expiry dates, and documenting discrepancies upon receipt. The receipt, storage, and disposal of expired medicines are undertaken collaboratively with another pharmacist to ensure regulatory compliance.” (P29, Community pharmacist, Central Papua)</p>

				<p>"Clinical pharmacy and medication management activities are implemented in accordance with national regulations, encompassing drug procurement, inpatient visits, prescription screening, and selective patient counseling. The regulatory framework provides a clear mandate for pharmacists to engage directly in patient care within the facility." (P19, Primary care Pharmacist, Bali)</p>
		Regulatory limitations that constrain pharmacists' authority in primary care practice	Management and governmental support to maintain the quality of pharmacy services	<p>"Although existing evidence supports flexible medicine procurement to ensure service continuity, district-level regulations prohibit primary care facilities from sourcing medicines from private pharmacies, even under Regional Public Service Agency status. This regulatory restriction constrains pharmacists' authority and contributes to operational inefficiencies, including concerns regarding suboptimal budget utilization." (P20, Primary care pharmacist, West Nusa Tenggara)</p> <p>"Recent regulatory reforms have reinforced professional accountability within pharmacy practice. The requirement that individually owned pharmacies be owned by pharmacists, and that non-pharmacist ownership comply with formal corporate licensing mechanisms, ensures that the practising pharmacist retains professional responsibility, thereby strengthening service quality and patient safety." (P13, Community Pharmacist, West Java)</p>

	Local Conditions	Unequal economic and digital infrastructure limit the implementation of expanded pharmacy services	<p>"Limited and unstable internet infrastructure at the district level substantially constrains the implementation of digital health systems. Given that most professional activities and reporting processes are conducted through online applications, these technological limitations hinder consistent engagement by pharmacists." (P26, Community Pharmacist, Southeast Sulawesi)</p> <p>"The absence of institutional Wi-Fi necessitates reliance on personal internet resources, creating substantial barriers to participation in online training and digital service initiatives, particularly in remote primary care setting (P21, Primary care Pharmacist, East Nusa Tenggara/NTT)</p>
Inner Setting	Structural Characteristics	Inadequate staffing and time resources for sustainable pharmaceutical service delivery	<p>"To work optimally, it is not feasible to manage all responsibilities independently. The pharmacy concurrently assumes additional administrative roles, requiring me to undertake both managerial and clinical pharmacy tasks. Ideally, at least two pharmacy technicians should be dedicated to managerial and clinical pharmacy services, given that pharmaceutical services must be delivered by pharmacy personnel. However, the technician's availability is inconsistent due to concurrent responsibilities as treasurer. In the absence of honorary staff, temporary personnel have been formally appointed and provided internal training to support delegated tasks." (P5, Primary care Pharmacist, South Sumatra)</p>

				<p>"Although additional pharmacists are clearly needed, financial constraints significantly limit workforce expansion. Pharmacist remuneration remains relatively low, with pharmacy technicians receiving even lower wages, thereby hindering recruitment and retention. Ideally, at least two pharmacists should be available to ensure adequate service provision. However, current compensation structures do not make this feasible." (P10, Community Pharmacist, DKI Jakarta)</p>
	<p>Communications</p>	<p>Lack of structured communication pathways is weakening pharmacists' role in interdisciplinary decision-making</p>	<p>Effective interprofessional communication and collaborative workflows supporting integrated pharmaceutical care</p>	<p>"Several challenges were encountered in interprofessional collaboration. At times, the physician was difficult to reach, leading to prescriptions being returned to patients. In one pediatric dosing case, the physician initially rejected the proposed dosage adjustment. However, after the pharmacist provided justification supported by relevant scientific articles, the discussion became more constructive, and the recommendation was ultimately accepted. Effective collaboration requires pharmacists to communicate with physicians in a manner that reflects mutual professional respect, rather than assumptions of disciplinary superiority." (P2, Community Pharmacist, North Sumatra)</p>

				<p>“Regular communication between the physician and pharmacist facilitated constructive clinical discussions, particularly in relation to antibiotic prescribing. Through routine meetings and sustained professional interaction, pharmacists provided input on prescribing practices, which was gradually accepted and associated with a reduction in irrational antibiotic use.” (P30, Primary care Pharmacist, West Papua)</p>
	<p>Available Resources</p>	<p>Limitations in facilities, infrastructure, and physical space to support pharmacy services</p>		<p>“Although the procurement process complies with regulatory requirements, access to licensed pharmaceutical distributors remains geographically centralized in major urban areas. Limited distribution infrastructure in remote areas necessitates additional logistical arrangements, thereby constraining timely access to medicines and challenging the operational capacity of pharmacy services.” (P23, Community Pharmacist, Central Kalimantan)</p> <p>“Temperature control within the pharmacy cannot be consistently maintained due to the absence of air conditioning, primarily attributable to budgetary constraints. This condition raises concerns regarding the stability and quality of stored medicines, particularly those requiring controlled storage conditions.” (P1, Community Pharmacist, Nanggroe Aceh Darussalam)</p>

				<p>"Counselling services are substantially limited due to the use of an old facility/building, which has become a major obstacle. Consequently, we have to prioritize patients with the most urgent needs, such as those undergoing long-term tuberculosis treatment, where adherence is critical, and interruption risks are high. Ideally, patients with other chronic conditions should also receive counseling, as their treatments last for months or even a lifetime." (P15, Primary Care Pharmacist, Yogyakarta)</p>
	<p>Access to Knowledge & Information (training, guidelines, decision support)</p>	<p>Limited external training and support for strengthening pharmacists' competencies and clinical services</p>	<p>The degree to which individuals within an organization have access to information, training, and tools necessary to understand and implement an intervention effectively</p>	<p>"We upgrade our knowledge less frequently than general practitioners (GPs), who typically update their knowledge every three to four months, whereas pharmacists often do so only annually. In Maluku, access to webinars remains limited. Consequently, to enhance our skills, we often need to travel outside the region, at least to Surabaya. We particularly hope for more training in clinical pharmacy and the use of off-label medicines. Current programs provided by the government and the National Agency of Drug and Food Control (BPOM) predominantly emphasize administrative topics, with comparatively limited support for clinical skill development." (P28, Community pharmacist Maluku)</p>

				Access to professional training has expanded through digital platforms, making webinars and educational resources more readily available and easier to access than previously, thereby supporting continuous learning and facilitating the implementation of pharmacy services.” (P20, Primary Care Pharmacist, West Nusa Tenggara/NTB)
Individuals		Capability	Competencies required for pharmacists to perform optimally in primary healthcare settings	“While clinical competencies among newly qualified pharmacists are generally well developed, preparedness in business and managerial aspects remains limited. Formal education has tended to emphasize basic administrative management, with comparatively less structured exposure to comprehensive business strategies, including financial planning, operational management, and adaptation to emerging market models such as digital and marketplace-based services. Although these skills may be acquired independently, their systematic integration into the curriculum would provide a more coherent foundation, enabling pharmacists to compete more effectively within an evolving and increasingly market-driven practice environment.” (P14, Community Pharmacist, Central Java)

				<p>“One of the important aspects is therapeutic knowledge, which still needs improvement, along with clinical pharmacy skills. Enhanced expertise enables more effective collaboration with physicians, including providing recommendations on therapy selection or discontinuation and working collaboratively with nursing staff. Interpersonal communication is equally essential so that physicians do not feel dictated to. Early-career pharmacists may hesitate when uncertain about medication-related problems; therefore, ongoing professional development and a culture of open discussion are critical. When knowledge gaps arise, acknowledging uncertainty and engaging in joint problem-solving supports constructive interprofessional practice.” (P18, Primary Care Pharmacist, Banten)</p>
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				<p>“Disaster preparedness and response should be further integrated into pharmacists’ core competencies within primary healthcare. Beyond routine clinical and supply management roles, pharmacists are expected to ensure the availability of medicines, provide urgent medication counseling, and coordinate logistics during emergencies. Strengthening disaster management competencies would enhance pharmacists’ capacity to respond effectively in crisis situations.” (P13, Primary Care Pharmacist, West Java)</p>
	Innovation Deliverers		Expansion of pharmacists’ roles in primary care and self-awareness of their contributions	<p>“Primary healthcare is increasingly recognized as emphasizing preventive and promotive functions over curative care, underscoring the need to expand pharmaceutical contributions in health promotion and rational use of medicines.” (P16, Community Pharmacist, East Java)</p>
				<p>“Although pharmacists’ roles are formally well-defined, their implementation remains misaligned in practice due to multiple barriers. Promotive and preventive roles should be strengthened because pharmacy services in primary health care should not be focused solely on curative care. Currently, outreach activities are typically led by the health promotion teams and focus predominantly on healthy lifestyles education, while rational medicine use campaigns remain limited. Because these activities are not explicitly mandated within existing regulations, we don’t do them regularly.” (P17, Primary Care Pharmacist, East Java)</p>

Process of Implementation	Planning		Recommended policy and structural changes to strengthen pharmacists' roles in primary healthcare	<p>"Stronger strategic planning and oversight by professional organizations are needed to ensure equitable and accountable pharmacy practice. Improved monitoring mechanisms would facilitate better alignment between workforce distribution and local health needs, and protect the sustainability of pharmacists' roles within primary healthcare systems." (P25, Community Pharmacist, South Sulawesi)</p> <p>"I consistently emphasize to internship students that pharmacy practice should incorporate public health activities. Direct community engagement and health education are integral components of our professional roles. However, these activities currently depend largely on individual initiative, and formal recognition through regulations, structured training programmes, and official guidelines would better support their sustainable implementation." (P27, Primary Care Pharmacist, Gorontalo)</p>
	Reflecting & Evaluating		Monitoring and evaluation of pharmacists' roles as part of quality improvement in pharmacy services	<p>"Online medicine sales are currently facilitated through collaboration with electronic pharmacy service providers. However, adoption remains uneven across pharmacies. As digital integration expands, clearer regulatory oversight is required to standardize practices, ensure legal compliance, and mitigate price variability associated with unregulated vendors." (P13, Community Pharmacist, West Java)</p>

				Existing regulations have provided a comprehensive framework for pharmacy practice, and subsequent accreditation processes have introduced additional activities that encourage reflection on the role implementation. Continuous evaluation of these requirements is necessary to ensure that expanding responsibilities remain feasible and aligned with service capacity.” (P15, Primary Care Pharmacist, Yogyakarta)
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and map to the majority of the CFIR domains. Despite strong professional motivation, the sustainable integration of pharmacist-led services ultimately depends on structured capacity building, embedded public health competencies, and organizational and policy environments that enable consistent, high-quality practice⁵¹. These findings carry clear practical and policy implications. At the facility level, sustainable implementation requires not only regulatory clarity but also operational supports such as protected time for patient counselling, protected pharmacist-to-population workforce ratios, nationally standardized clinical CPD requirements, and adequate physical and digital infrastructure to enable confidential, consistent, and data-informed service delivery^{52,53}. At the system level, explicit regulatory inclusion of preventive and promotive pharmaceutical services within national health policy frameworks is essential to formalize pharmacists’ public health contributions and reduce role ambiguity, while sustained investment in district-level digital infrastructure is necessary to ensure equitable access to training, reporting systems, and decision-support tools across urban and remote settings^{54,55}. At the community levels, public-facing strategies, including pharmacist role awareness initiatives and medicine literacy campaigns, may help recalibrate patient expectations and strengthen engagement with pharmacist-led services^{56,57}. Embedding routine monitoring and evaluation mechanisms within daily practice is also critical, aligning with implementation science approaches that emphasise iterative learning, accountability, and continuous quality improvement in primary care settings⁵⁸.

This study benefits from the systematic application of the CFIR, which enabled a structured examination of multilevel implementation determinants across diverse primary care settings in Indonesia. However, several limitations warrant consideration. First, the recruitment strategy may have introduced selection bias, as pharmacists who were more engaged or motivated to expand their roles were more likely to participate. Second, the findings reflect pharmacists’

perspectives only and may not fully capture the views of other key stakeholders or the heterogeneity of experiences nationwide. Additionally, as interviews were conducted and analysed across languages, there is potential for interpretive bias in the translation of quotes. To mitigate this, transcripts were cross-checked and dual-coded, and translations were conducted with attention to preserving contextual and conceptual meaning. Future research should incorporate multi-stakeholder perspectives, including patients and other primary care professionals, to better elucidate system-level dynamics and the acceptability of expanded pharmacist roles.

CONCLUSIONS

Implementation of pharmacist-led services in the Indonesian community and primary care settings is shaped by interactions among multilevel determinants across CFIR domains. Outer-setting governance arrangements, inner-setting resource capacity, and individual competencies operate in dynamic interdependence, collectively influencing whether expanded roles become institutionally embedded or remain episodic and individually driven. Efforts focused solely on strengthening clinical competencies are unlikely to achieve sustainable impact without concurrent reforms in workforce policy, regulatory scope, and district-level digital infrastructure. These findings underscore the need for coordinated, system-level strategies that align policy, organisational readiness, and professional capability to ensure that the recognised value of pharmacist-led services translates into durable and equitable integration within primary care systems in low- and middle-income countries.

AUTHORS CONTRIBUTION

Irianti Bahana Maulida Reyaan: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft, Writing – Review and Editing.Tjokorde

Istri Armina Padmasawitri: Methodology, Formal Analysis, Validation, Writing – Review and Editing.



Sherly Meilianti: Methodology, Formal Analysis, Validation, Writing – Review and Editing.

I Ketut Adnyana: Supervision, Validation, Writing – Review and Editing.

Lia Amalia: Conceptualization, Methodology, Supervision, Validation, Writing – Review and Editing.

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CONFLICT OF INTEREST

The author(s) declare that there are no conflicts of interest.

Supplementary 1. COREQ (Consolidated Criteria for Reporting Qualitative Research) Checklist			
Topic	Item No.	Guide Questions / Description	Reported on Page No.
Domain 1: Research Team and Reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author(s) conducted the interviews or focus groups?	All interviews were conducted by the primary researcher (IBMR).
Credentials	2	What were the researchers' credentials (e.g. PhD, MSc, MD)?	The research team consisted of four lecturers (PhD) and one doctoral candidate (PhD student).
Occupation	3	What was their occupation at the time of the study?	University lecturers, students, and researchers
Gender	4	Was the researcher male or female?	Both male and female
Experience and training	5	What experience or training did the researchers have in qualitative research?	The interviewer have established experiences in qualitative research, including conducting semi-structured interviews and thematic analysis.
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	No prior relationship was established with participants before recruitment.
Participant knowledge of the interviewer	7	What did participants know about the researcher (e.g. goals, reasons for the research)?	Participants were informed about the study objectives, the interviewer's role as a researcher, and the purpose of the research before providing consent.
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator (e.g. bias, assumptions, interests)?	Who the interviewer/facilitator is, the interviewer's professional background, role in the study, interest in primary care pharmacy practice, and interview procedures
Domain 2: Study Design			
Theoretical framework			
Methodological orientation and theory	9	What methodological orientation underpinned the study (e.g. content analysis, phenomenology, grounded theory)?	Descriptive qualitative study using semi-structured interviews and hybrid deductive-inductive thematic analysis guided by the Consolidated Framework for Implementation Research (CFIR).
Participant selection			
Sampling	10	How were participants selected (e.g. purposive, convenience, snowball)?	Purposive sampling with maximum variation based on healthcare setting, geographic location, and years of professional experience.
Method of approach	11	How were participants approached (e.g. face-to-face, telephone, email)?	Participants were approached through professional associations and academic networks and contacted online.
Sample size	12	How many participants were included in the study?	Thirty pharmacists participated in the study.

Non-participation	13	How many people refused or dropped out? Reasons?	Thirty-one pharmacists were approached; 30 agreed to participate, and 1 declined or did not respond.
Setting			
Setting of data collection	14	Where was the data collected (e.g. clinic, workplace, online)?	Online interviews conducted via secure video conferencing platforms.
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	No individuals other than the participant and interviewer were present during the interviews.
Description of sample	16	What were the key characteristics of the sample (e.g. demographics, professional background)?	Participants were pharmacists working in community pharmacies and public primary healthcare centers (Puskesmas) in Indonesia, representing diverse geographic regions, professional experience, and educational backgrounds.
Data collection			
Interview guide	17	Were interview guides or prompts provided? Were they pilot-tested?	A semi-structured interview guide based on the five CFIR domains was developed and underwent expert review by eight senior pharmacists. Details in Supplementary 2
Repeat interviews	18	Were repeat interviews conducted? If yes, how many?	No repeat interviews were conducted.
Audio/visual recording	19	Were audio or visual recordings used to collect data?	Interviews were audio-recorded with participants' consent.
Field notes	20	Were field notes made during and/or after interviews?	Field notes were taken during and after interviews to capture contextual information and emerging insights
Duration	21	What was the duration of the interviews or focus groups?	Interviews lasted approximately 30–60 minutes.
Data saturation	22	Was data saturation discussed?	Data collection continued until thematic saturation was achieved, defined as the absence of substantially new themes across successive interviews.
Transcripts returned	23	Were transcripts returned to participants for comment or correction?	No
Domain 3: Analysis and Findings			
Data analysis			
Number of data coders	24	How many researchers coded the data?	Two researchers independently coded the transcripts.
Description of the coding tree	25	Was a description of the coding framework or coding tree provided?	A coding framework based on CFIR domains and emergent inductive themes was developed and refined iteratively during analysis.

Derivation of themes	26	Were themes identified in advance or derived inductively from the data?	Themes were derived using both deductive coding informed by CFIR and inductive coding from the data.
Software	27	What software was used to manage and analyse the data (if applicable)?	NVivo version 15.
Participant checking	28	Did participants provide feedback on the findings?	N/A
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate themes, and were they identified?	Yes. Illustrative quotations are presented and identified using anonymized participant codes
Data and findings consistent	30	Was there consistency between the data presented and the findings?	Yes. Findings are supported by participant quotations and aligned with the data.
Clarity of major themes	31	Were major themes clearly presented?	Yes. Major themes are presented according to CFIR domains and constructs.
Clarity of minor themes	32	Were minor themes or divergent cases described and discussed?	Yes. Context-specific themes and divergent perspectives are described where relevant

Supplementary 2. Interview Guide for Pharmacists

A qualitative study exploring the implementation, barriers, and facilitators of pharmacist-led services in community and primary healthcare settings in Indonesia

Part I

Focus: Implementation of Pharmacists' Roles in Primary Healthcare

1. What roles do pharmacists currently perform in your workplace?
2. How are clinical pharmacy services and pharmaceutical supply management implemented in your setting?
3. Approximately how is your workload distributed between clinical pharmacy services and pharmaceutical supply management (including medical consumables and devices)?
4. Can you describe any pharmacist-led activities or programs that you consider beneficial to patients or the healthcare system?

Part II

Focus: Perceived Barriers and Challenges in Practice

1. What challenges do you face in performing your role as a pharmacist in your current workplace?
2. How adequate is the availability of pharmacists and pharmacy support staff in your facility?
3. How do communication and collaboration occur between you and other healthcare professionals (e.g., physicians, nurses)?
4. Have you experienced difficulties in interprofessional collaboration? If yes, what were the main causes?

Part III

Focus: Policy, Training, and Public Perception-Related Barriers

1. Are there any existing regulations or health policies that you perceive as limiting pharmacists' roles in primary healthcare settings?
2. Do you feel that your education and professional training have adequately prepared you to deliver clinical and patient-centred services?
3. Are there specific gaps in training or continuing professional development that affect your ability to expand or optimise your role?
4. How do patients and the community generally perceive the role of pharmacists in primary healthcare?
5. Are there common misconceptions regarding pharmacists' responsibilities, and how do these perceptions affect service delivery?

Part IV

Focus: Facilitators and Opportunities for Role Expansion

1. What factors or supports have facilitated the implementation of pharmacist-led services in your workplace?
2. Do you see opportunities for pharmacists to expand their roles in primary healthcare?
3. In which areas or services do you see the greatest potential for role expansion?

Conclusion / Recommendations

1. What strategies or changes would you recommend to strengthen the role of pharmacists in primary healthcare settings?
2. In your opinion, who should be responsible for implementing these changes (e.g., policymakers, professional organisations, facility management)?
3. Would you like to provide any additional comments or suggestions related to pharmacist-led services in primary healthcare in Indonesia.



Supplementary 3. Pharmacists Characteristics						
Participant No	Age (years)	Gender	Years of practice	Type of healthcare facility	Regions (Provinces)	Highest Educational Attainment
1	35	Female	9	Community pharmacy	Nanggroe Aceh Darussalam	Bachelor's Degree
2	60	Female	20	Community pharmacy	North Sumatra	Master's Degree
3	46	Female	10	Primary health care (puskesmas)	West Sumatra	Master's Degree
4	31	Female	4	Primary health care (puskesmas)	Riau	Bachelor's Degree
5	27	Female	3	Primary health care (puskesmas)	South Sumatra	Master's Degree
6	26	Male	1	Community pharmacy	Lampung	Bachelor's Degree
7	42	Male	3	Primary health care (puskesmas)	Jambi	Bachelor's Degree
8	30	Female	6	Primary health care (puskesmas)	Bangka Belitung	Bachelor's Degree
9	35	Male	6	Primary health care (puskesmas)	DKI Jakarta	Master's Degree
10	47	Female	23	Community pharmacy	DKI Jakarta	Master's Degree
11	36	Female	6	Primary health care (puskesmas)	West Java	Bachelor's Degree
12	36	Male	10	Community pharmacy	West Java	Bachelor's Degree
13	30	Female	7	Community pharmacy	West Java	Master's Degree
14	45	Female	15	Community pharmacy	Central Java	Master's Degree
15	34	Male	6	Primary health care (puskesmas)	Yogyakarta	Bachelor's Degree
16	30	Male	7	Community pharmacy	East Java	Bachelor's Degree
17	43	Female	15	Primary health care (puskesmas)	East Java	Master's Degree
18	38	Male	12	Primary health care (puskesmas)	Banten	Bachelor's Degree
19	35	Male	6	Primary health care (puskesmas)	Bali	Bachelor's Degree
20	31	Female	6	Primary health care (puskesmas)	West Nusa Tenggara	Bachelor's Degree
21	31	Female	3	Primary health care (puskesmas)	East Nusa Tenggara	Bachelor's Degree
22	36	Female	1	Community pharmacy	South Kalimantan	Doctoral Degree
23	30	Male	5	Community pharmacy	Central Kalimantan	Bachelor's Degree
24	44	Female	11	Primary health care (puskesmas)	Central Sulawesi	Bachelor's Degree

25	44	Male	16	Community pharmacy	South Sulawesi	Master's Degree
26	45	Female	5	Community pharmacy	Southeast Sulawesi	Master's Degree
27	36	Female	10	Primary health care (puskesmas)	Gorontalo	Bachelor's Degree
28	37	Male	11	Community pharmacy	Maluku	Master's Degree
29	25	Female	2	Community pharmacy	Central Papua	Bachelor's Degree
30	32	Female	5	Primary health care (puskesmas)	West Papua	Bachelor's Degree

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