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Community pharmacists' perspectives towards automated pharmacy systems and extended community pharmacy services: An online cross-sectional study

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ABSTRACT

Background: Private sector partnerships through community pharmacies are essential for effective healthcare integration to achieve the United Nations 2030 Agenda for Sustainable Development Goals. This partnership can provide significant clinical outcomes and reduce health system expenditures by delivering services focused on patient-centred care, such as public health screening and medication therapy management.

Objectives: To assess the understanding of the proposed strategic and health system reform in Saudi Arabia by exploring community pharmacists' perspectives towards the capacity and readiness of community pharmacies to use automated pharmacy systems, provide extended community pharmacy services, and identify perceived barriers.

Materials and methods: This multicentre, cross-sectional, web-based survey was conducted in Saudi Arabia (October–December 2021). Graphical and numerical statistics were used to describe key dimensions by the background and characteristics of the respondents, and multiple ordinal logistic regression analyses were sought to assess their associations.

Results: Of the 403 consenting and participating community pharmacists, most were male (94%), belonged to chain pharmacies (77%), and worked >48 h per week (72%). Automated pharmacy systems, such as electronic prescriptions, were never utilised (50%), and health screening services, such as blood glucose (76%) and blood pressure measurement (74%), were never provided. Services for medication therapy management were somewhat limited. Age groups ≤40 years, chain pharmacies, >10 years of experience and ≥ 3 pharmacists in place with <100 daily medication prescriptions and Jazan province were significantly more likely to provide all medication therapy management services than others. Operational factors were the barriers most significantly associated with the independent variables.

Conclusion: The results showed that most services and automated pharmacy systems remained limited and well-needed. When attempting to implement these services to drive change, community pharmacies face numerous challenges, and urgent efforts by private and government sectors are essential to improve pharmaceutical care in community pharmacy settings.

Abbreviations: CPs, Community pharmacies; ECPSs, Extended community pharmacy services; APSs, Automated pharmacy systems; MOH, Ministry of Health; SA, Saudi Arabia; MTM, Medication therapy management.

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1. Introduction

Community pharmacies (CPs) provide many benefits as venues for promoting public health and wellness.[1] Additionally, community pharmacists are essential in optimising adequate medication use, reducing unnecessary costs, and utilising healthcare services. Collectively, these efforts improve the overall health outcomes and quality of life in the population.[2]

Beyond dispensing medications, CPs offer a comprehensive suite of resources to address patient needs. One such innovative approach is extended community pharmacy services (ECPSs), which encompass health assessments, referral to hospitals,[3] chronic disease management,[4] health screenings such as blood pressure monitoring, and vaccination services.[5] It also extends to health programs such as obesity management[6] and managing smoking cessation.[7]

For top-notch ECPSs, it is crucial to establish proper infrastructure and facilities. This entails a reservation system for appointments, discreet counselling spaces, and comfortable waiting areas, all supported by attentive personnel, which are essential for providing exceptional services.[8] Automated pharmacy systems (APSs), such as computerised medication prescriptions and specialised computer software, are vital in reducing medication errors and streamlining operations.[9]

Although the provision of ECPSs in CPs settings is crucial, CPs may encounter several potential obstacles. According to a sub-national Saudi study, the lack of public awareness of ECPSs, inadequate physician-pharmacist collaboration,[10] and inadequate salary structures were common challenges.[11] Other studies have identified barriers related to inadequate pharmacist training, staff shortages, and service costs.[12] Furthermore, the lack of supportive legalisation of ECPSs[13] and incentives for pharmacists have been highlighted.[14]

In June 2016, the Saudi government unveiled its ambitious 2030 vision plan.[15] One key area of focus was healthcare transformation to enhance public health through disease prevention, raise awareness, and ensure equitable access to healthcare services. The plan underscored the importance of leveraging comprehensive e-health solutions and digital innovations to modernise the healthcare system and meet the evolving needs of a digital society.[16] This has placed CPs in the spotlight, challenging them to innovate and upgrade their facilities to keep pace with time.

According to the Saudi Ministry of Health (MOH), there are 20,900 licenced community pharmacists operating in 11,597 CPs as reported in a statistical book from 2021.[17] However, the concept of ECPSs in the country is still in its infancy and requires further evaluation.[18] To address this, the study aimed to explore community pharmacists' perspectives on the capacity and readiness of CPs for the proposed strategic and health system reform in Saudi Arabia (SA), focusing on a) the extent of APSs and ECPSs currently provided, b) community pharmacists' perceptions towards ECPSs, and c) perceived barriers to ECPSs.

2. Materials and methods

This multicentre cross-sectional study was conducted in SA from October to December 2021. The study used an online self-administered questionnaire.

2.1. Ethical approval

This study was approved by the Ethical Research Committee of the Saudi MOH, Riyadh (Central IRB log No:21-56E, June 2021). To ensure anonymity and confidentiality, all participants provided written consent before submitting their responses (Page 1 in Appendix A).

2.2. Survey instrument

A literature search was conducted to find validated survey items aligned with the research study's objectives.[13,19–23] Three field experts created and reviewed a modified questionnaire to ensure the survey was appropriate for the Saudi context. Prior to distribution, the survey was pilot tested with a group of 30 community pharmacists who were not involved in the study's primary participants. This allowed for any necessary revisions to be made before the final release of the survey. Internal consistency was measured and resulted in a reliability coefficient of 0.90 (non-standardised alpha). The survey included a brief introduction to the aims of the study. It comprised the following domains: a) background and characteristics of participants, b) use of APSs and provision of ECPSs, c) perceptions of current practice and willingness to provide ECPSs, and d) perceived barriers to the implementation of ECPSs (Appendix A).

2.3. Sample recruiting and study setting

A list of 702 CPs with location and contact channels was obtained from health affairs in Al Baha ($n = 86$), Najran ($n = 156$), and Jazan ($n = 460$) provinces. The selection of these three provinces based on the authors' systematic review of Saudi CP services indicates that no survey data are available for these provinces (unpublished results). Hayes and Bennett's method was used to estimate the sample size.[24] Sample size was calculated using a cluster-simple random sampling design for categorical outcomes within a 95% confidence interval. The CPs define clusters in this recruitment process. An intra-cluster correlation of 1.6% was assumed with a power of 80% anticipated to detect a difference of 33.4% of the dichotomised measure (i.e., agree/disagree categories), with $\alpha = 0.05$. Hence, a total of 101 CP clusters was estimated for a proportionate number of clusters in each province: a) Al Baha =13, b) Jazan =66, and c) Najran =22.

It was assumed that each pharmacy had at least three pharmacists, resulting in a required total of 303 pharmacists in 101 clusters. According to other studies, the nonresponse rate was estimated to be 45%; therefore, 136 participants were factored in, bringing the total number of targeted pharmacists to 439. An electronic link to the SurveyMonkey platform was distributed to the targeted CPs via the WhatsApp messenger application and email, with a regular reminder. All community pharmacists who gave consent were included in this study (Appendix A). The survey was structured to allow only one response per participant, thereby ensuring precision in the collected data.

2.4. Data management and statistical analysis

All collected data were cleaned, coded, and analysed using Stata, version 17.

2.4.1. Characteristics of participants

The frequencies (n) and percentages (%) of participant characteristics, including the regions and form of operations, were used for all variables. Study outcomes are presented in tables and graphs.

2.4.2. Using APSs and providing ECPSs

A 5-point Likert scale was used to measure outcomes and then converted to a 3-point Likert scale for clarity in describing ordinal outcome factors. As a result, the utilised APSs and provided ECPSs were grouped and rescaled. Code 2 was assigned to 'always/mostly', meaning 'moderate/large'; code 1 was assigned to 'sometimes/occasionally', meaning 'limited'; and code 0 was assigned to 'never'. It was considered 'limited' if services were provided <3 times/week, while 'moderate/large' was any number above this.[23]

2.4.3. Perceptions towards ECPSs and perceived barriers to implementing ECPSs

In contrast, a 5-point Likert scale for perceptions and service barriers was collapsed into a 3-point Likert scale. This involved merging 'strongly agree/agree' into 'agree' and was coded as 2. 'Neutral' was coded as 1,

while 'strongly disagree/disagree' was combined into 'disagree' and coded as 0. The 20 identified barriers were then sorted into four dimensions based on their nature: personal, contextual, operational, and healthcare-system factors. To simplify the assessment, the five corresponding factors for each dimension with scores ranging from 0 to 10 were combined into one variable using the 25th, 50th, and 75th percentiles of the scale.

Using ordinal logistic regression, crude and adjusted odds ratios and 95% confidence intervals were generated for the medication therapy management (MTM) and barrier outcome dimensions. Potential confounders or modifiers were initially defined based on information from the literature and further inputs from expertise opinions. The likelihood ratio test of a forward-wise model-building approach was used, and the significant association of outcomes was reported at the ≤5% level. Only factors with significant contribution to the model or showing confounding effect were retained in the final model.[25]

3. Results

In this study, a total of 403 registered community pharmacists have given their consent and participated.

3.1. Characteristics of participants

The findings revealed that most pharmacists operating within the surveyed areas were male (94%), non-Saudi (69%), and employed as chain CPs (77%). Nearly half of them belonged to the younger age group (< 30 years), and 80% had obtained a bachelor's degree in pharmacy. Approximately 46% had less than five years of practical experience. The pharmacists were distributed almost equally between Najran and Jazan provinces, with approximately 25% working in Al Baha province. Most pharmacists (91%) worked full-time, with 72% working >48 h weekly. Additionally, 49% worked alone or with one other pharmacist (Table 1).

Table 1
Characteristics of participants in Saudi CPs ($N = 403$).

Variables	n (%)
Gender	
Females	25 (6.20)
Males	378 (93.80)
Age groups	
23–30	191 (47.39)
31–40	155 (38.46)
≥ 41*	57 (14.14)
Nationality	
Saudi	125 (31.02)
Non-Saudi	278 (68.98)
Pharmacy type	
Independent pharmacy	93 (23.08)
Chain pharmacy	310 (76.92)
Educational level	
Bachelor of Pharmacy (BSc)	323 (80.15)
Doctor of Pharmacy (PharmD)	65 (16.13)
Postgraduate (MSc, PhD) *	15 (3.72)
Pharmacy location	
Al Baha province	99 (24.57)
Jazan province	154 (38.21)
Najran province	150 (37.22)
Years of experience	
≤ 5 *	186 (46.15)
6–10	117 (29.03)
>10	100 (24.81)
Work status	
Full-time	368 (91.32)
Part-time	35 (8.68)
Number of pharmacists in pharmacy	
1	58 (14.39)
2	141 (34.99)
3	83 (20.60)
> 3	121 (30.02)
Working hours per week	
> 48 h	292 (72.46)
≤ 48 h *	111 (27.54)
Daily dispensing prescriptions	
≥ 100 *	90 (22.33)
< 100	313 (77.67)

MSc, Master of Science; PhD, Doctor of Philosophy.
* Groups were collapsed.

3.2. Using APSs and providing ECPSs

Of the 403 community pharmacists, 341 reported using APSs and providing ECPSs weekly.

3.2.1. Using APSs

Approximately 80% had yet to utilise any form of robotic pharmacist in their medication dispensing processes, while 50% had never utilised electronic prescription systems like the national 'Wasfaty' system. Additionally, approximately 39% had yet to use printed labels on medication containers to provide clear instructions to patients on how to use their medication safely and effectively.

3.2.2. Providing ECPSs

3.2.2.1. Health screening service. Most pharmacists declared that they had never measured blood glucose (76%), blood pressure (74%), blood lipids (79%), peak flow level in asthma (87%), or conducted osteoporosis screening (88%). In addition, the public health programs pharmacies offered were lacking. Nutrition and body weight management, smoking cessation, and travel health programs were not offered by most pharmacists (66%, 81%, and 69%, respectively).

3.2.2.2. Vaccination service. Seasonal flu vaccinations for COVID-19 and COVID-19 testing were typically not offered (79% and 86%, respectively).

3.2.2.3. MTM. Half of the surveyed pharmacists did not assess patients' health status or formulate medication treatment plans (52%), while 37% never monitored medication adherence. Furthermore, approximately 51% of pharmacists never informed the physician about the patient's progress or systematically documented all stated MTM services (42%). Results obtained from the ordinal logistic regression revealed a consistent association between all MTM services and some participant characteristics. Overall, the ≤40 age groups, chain CPs with ≥3 pharmacists in place, pharmacists with >10 years of experience, and those with <100 daily medication prescriptions and working in Jazan province were significantly more likely to provide MTM than their counterparts. More details are presented in Fig. 1 and Table 2.

3.3. Perceptions towards ECPSs

Among the pharmacists surveyed, 335 (83%) provided inputs on implementing ECPSs. Of those, 68% felt that their duties were restricted to dispensing medication but expressed a keen interest in participating in ECPSs (87%). Pharmacists generally viewed ECPSs as excellent opportunities to apply their clinical expertise and enhance public health (91%). Additionally, 71% of pharmacists anticipated that the public would be amenable to receiving ECPSs. However, 85% of the respondents felt they required further training to deliver these services. Further details are presented in Table 3.

3.4. Perceived barriers to implementing ECPSs

Three hundred and twelve (77%) pharmacists rated their level of agreement with 20 factors that may affect their practice of delivering ECPSs.

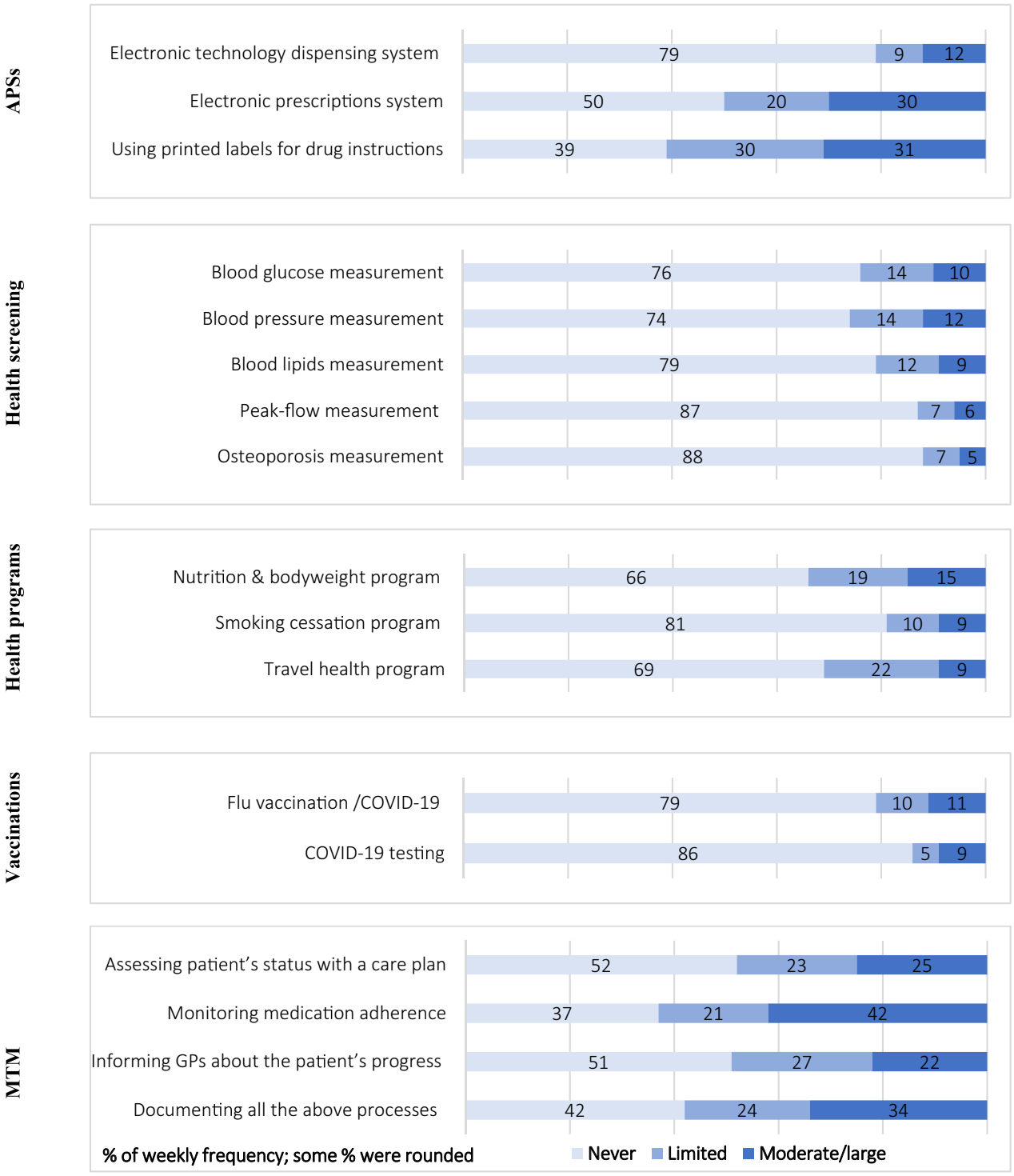

Fig. 1. Weekly frequency of using APSs and providing ECPSs in Saudi CPs (n = 341).

3.4.1. *Personal factors*

The most common factor was inadequate pharmaceutical care training (62%). Over half (58%) of the respondents reported that a lack of practical communication skills with patients or physicians was a barrier. Additionally, lack of therapeutic knowledge and skills to solve clinical problems and insufficient understanding of the pharmaceutical care concept were identified as obstacles by 46% and 42% of the respondents, respectively. Self-confidence in providing ECPSs was the least commonly cited person-related factor, with only 19% of respondents reporting it as a barrier. Regression analysis showed that age and years of experience were significantly associated. The 23–30-year-old age group was less likely to consider personal factors as barriers, while pharmacists with >10 years of experience were more likely to consider them barriers.

3.4.2. *Contextual factors*

Most (75%) pharmacists cited a lack of collaboration with physicians as a major factor. Additionally, 59% believed that physicians should be better informed about ECPSs. Economic status was also a concern, with 56% of pharmacists worried that customers' financial situations could

Table 2
The association between characteristics of community pharmacists and delivering MTM in Saudi CPs (n = 341).

Variables; *reference*	Assessing patients' health status		Monitoring medication adherence		Informing physicians about patients' health status		Documenting all MTM process	
	COR (95% CI)	AOR (95% CI)	COR (95% CI)	AOR (95% CI)	COR (95% CI)	AOR (95% CI)	COR (95% CI)	AOR (95% CI)
Gender; *females*								
Males	0.75 (0.32—1.73)	0.97 (0.41—2.30) [a]	0.84 (0.38—1.87)	1.14 (0.50—2.60) [a]	0.84 (0.38—1.87)	1.08 (0.48—2.45) [a]	0.93 (0.44—1.98)	1.28 (0.60—2.79 [a]
Age groups; ≥ *41* *								
23—30	**4.64 (2.20—9.80)**	**4.59 (2.16—9.75)** [b]	**5.24 (2.66—10.33)**	**5.22 (2.63—10.37)** [b]	**4.13 (2.00—8.52)**	**4.11 (1.98—8.56)** [b]	**4.83 (2.41—9.67)**	**4.93 (2.45—9.95)** [b]
31—40	**4.50 (2.10—9.65)**	**4.50 (2.10—9.63)** [b]	**7.05 (3.52—14.15)**	**7.05 (3.51—14.14)** [b]	**4.68 (2.24—9.80)**	**4.68 (2.24—9.80)** [b]	**4.74 (2.34—9.60)**	**4.75 (2.34—9.64)** [b]
Citizenship; *Saudi*								
Non-Saudi	0.92 (0.60—1.41)	0.84 (0.54—1.31) [c]	**1.92 (1.26—2.94)**	**2.88 (1.77—4.71)** [g]	**1.74 (1.11—2.72)**	**2.34 (1.44—3.78)** [a]	1.34 (0.88—2.05)	**1.84 (1.17—2.91)** [a]
Pharmacy type; *Independent*								
Chain	**3.57 (2.05—6.20)**	**4.24 (2.40—7.50)** [d]	**3.73 (2.27—6.15)**	**2.63 (1.56—4.43)** [e]	**3.71 (2.15—6.40)**	**2.94 (1.66—5.18)** [e]	**4.82 (2.82—8.23)**	**3.78 (2.17—6.57)** [e]
Educational level; *MSc, PhD**								
BSc	1.13 (0.39—3.26)	0.73 (0.25—2.16) [a]	1.71 (0.64—4.55)	1.05 (0.38—2.87) [a]	0.96 (0.34—2.68)	0.60 (0.21—1.73) [a]	**4.14 (1.29—13.34)**	**3.71 (1.13—12.18)** [e]
Pharm D	0.87 (0.27—2.78)	0.38 (0.11—1.32) [a]	0.81 (0.27—2.39)	0.31 (0.10—1.00) [a]	0.43 (0.13—1.38)	**0.18 (0.05—0.62)** [a]	1.75 (0.49—6.20)	1.32 (0.36—4.81) [e]
Pharmacy location; *Al Baha*								
Jazan	**4.17 (2.37—7.36)**	**5.09 (2.84—9.13)** [c]	**2.46 (1.47—4.12)**	**2.87 (1.68—4.90)** [c]	**1.81 (1.08—3.03)**	**2.07 (1.22—3.52)** [c]	**3.13 (1.85—5.29)**	**3.73 (2.16—6.45)** [c]
Najran	**2.53 (1.44—4.43)**	**3.31 (1.85—5.91)** [c]	1.31 (0.79—2.17)	1.63 (0.97—2.75) [c]	1.50 (0.90—2.51)	**1.93 (1.13—3.30)** [c]	**2.28 (1.36—3.80)**	**3.22 (1.87—5.55)** [c]
Years of experience; ≤ *5* *								
6—10	1.06 (0.67—1.70)	1.00 (0.62—1.61) [c]	**1.83 (1.13—2.95)**	**1.78 (1.10—2.88)** [f]	1.49 (0.93—2.39)	1.02 (0.60—1.75) [h]	1.55 (0.97—2.47)	1.19 (0.70—2.04) [h]
>10	**0.42 (0.25—0.72)**	**0.52 (0.30—0.90)** [c]	**0.51 (0.32—0.84)**	**0.50 (0.30—0.82)** [f]	**0.52 (0.31—0.87)**	**0.37 (0.21—0.66)** [h]	**0.31 (0.18—0.53)**	**0.25 (0.14—0.44)** [h]
Work status; *full-time*								
Part-time	0.64 (0.31—1.32)	0.67 (0.32—1.39) [e]	**0.46 (0.23—0.91)**	**0.46 (0.22—0.93)** [e]	0.67 (0.33—1.37)	0.68 (0.33—1.40) [e]	0.66 (0.32—1.36)	0.71 (0.34—1.47) [e]
Number of pharmacists; *1*								
2	1.50 (0.75—2.94)	1.70 (0.86—3.39) [f]	**2.39 (1.26—4.55)**	**2.78 (1.44—5.36)** [h]	1.86 (0.93—3.69)	**2.04 (1.02—4.09)** [h]	1.55 (0.82—2.95)	1.67 (0.87—3.20) [h]
3	**2.62 (1.26—5.43)**	**3.10 (1.48—6.48)** [f]	**4.47 (2.20—9.06)**	**5.67 (2.74—11.70)** [h]	**3.49 (1.68—7.27)**	**3.95 (1.88—8.30)** [h]	**3.70 (1.84—7.45)**	**4.12 (2.03—8.36)** [h]
> 3	**3.60 (1.81—7.11)**	**4.62 (2.29—9.35)** [f]	**7.32 (3.71—14.47)**	**10.65 (5.18—21.90)** [h]	**3.89 (1.93—7.83)**	**4.93 (2.40—10.14)** [h]	**4.08 (2.12—7.88)**	**4.84 (2.46—9.53)** [h]
Weekly working hours; > *48*								
≤ 48 h *	0.98 (0.63—1.54)	0.83 (0.53—1.32) [e]	0.71 (0.45—1.10)	**0.55 (0.34—0.87)** [e]	0.96 (0.61—1.51)	0.82 (0.51—1.30) [e]	0.90 (0.58—1.40)	0.72 (0.46—1.14) [e]
Daily prescriptions; ≥ *100* *								
<100	**1.94 (1.16—3.24)**	**2.58 (1.50—4.44)** [d]	**1.80 (1.11—2.91)**	**2.69 (1.60—4.52)** [e]	1.57 (0.96—2.58)	**2.06 (1.22—3.46)** [e]	**1.73 (1.06—2.80)**	**2.39 (1.43—3.98)** [e]

Bold indicates significance at 0.05.
* Groups were collapsed.
[a] Adjusted to age groups (standard background variable).
[b] Adjusted to gender (standard background variable).
[c] Adjusted to pharmacy type.
[d] Adjusted to pharmacy location.
[e] Adjusted to the number of pharmacists.
[f] Adjusted to daily prescriptions.
[g] Adjusted to years of experience.
[h] Adjusted to citizenship.

hinder their ability to access ECPSs. Negative perceptions of pharmacists' roles also pose a problem, with 44% reporting this as an issue and 29% being concerned that their customers may not accept ECPSs. The regression analysis showed that sex and pharmacy type were significantly associated. Male pharmacists considered contextual factors as barriers less often than female pharmacists. In contrast, pharmacists working in chain CPs were more likely to consider these factors as barriers than pharmacists working in independent CPs.

Table 3
Community pharmacists' perceptions towards ECPSs ($n = 335$).

Statements	Agree [a] *n* (%)	Neutral *n* (%)	Disagree [b] *n* (%)
Community pharmacists' role is still, to a large extent, product-oriented	228 (68.06)	50 (14.93)	57 (17.01)
It is time for community pharmacists to engage in ECPSs	291 (86.87)	30 (8.96)	14 (4.18)
ECPSs are an opportunity for pharmacists to improve public health	305 (91.04)	23 (6.87)	7 (2.09)
ECPSs are an opportunity for pharmacists to use their skills/knowledge	305 (91.04)	21 (6.27)	9 (2.69)
Pharmacists require additional training to provide ECPSs	286 (85.37)	33 (9.85)	16 (4.78)
People are willing to receive ECPSs	239 (71.34)	66 (19.70)	30 (8.96)

5-point Likert scales were collapsed into 3-point Likert scales:
[a] (strongly agree/agree), neutral.
[b] (strongly disagree/disagree).

3.4.3. Operational factors

Pharmacists reported several operational challenges hindering their work. The lack of a pharmacy clinic for private counselling and regular follow-ups were the most significant issues reported by 75% of participants. In addition, inappropriate pharmacy management systems, including staff and cashier shortages, were reported by 71% of participants. A lack of drug information resources, such as computer equipment and software to support medication assessment, was reported by 46% of participants. Pharmacists also noted that a lack of motivation and support from CP owners were barriers, with 71% and 38% of participants citing these issues, respectively. According to ordinal logistic models, non-Saudi pharmacists, who worked in chain CPs, with three pharmacists in place, and who dispensed <100 prescriptions daily were significantly less likely to view operational factors as barriers. Conversely, pharmacists in Jazan and Najran provinces were more likely to experience operational barriers than those in Al Baha province.

3.4.4. Healthcare system factors

The primary barriers identified were a lack of access to patients' medical records (74%) and the absence of government remuneration for these services (72%). Other cited barriers included the absence of data on the value of delivering ECPSs or role models of CPs who provided such services in SA (67% and 53%, respectively). Legislative issues, such as regulatory resolution and ECPS guidelines, were also reported as barriers (58%). Findings from the ordinal logistic model revealed that years of experience, the number of staff pharmacists, and daily prescriptions were significantly associated with this dimension. Moreover, pharmacists with >10 years of experience were more likely to consider health system factors as barriers, while ≥3 pharmacists in place or pharmacists who dispense <100 prescriptions daily were less likely to consider them barriers. Further details are presented in Fig. 2 and Table 4.

4. Discussion

ECPSs and associated tools, such as APSs, are emerging applications worldwide that can potentially improve health management and reduce avoidable medical complications.[12] Despite their added value, the transition to ECPSs is limited or unequal worldwide and particularly slow in SA. Thus, this study investigated the capacity and readiness of CPs for Saudi national strategic and health system reforms towards APS and ECPS applications.

Recent research has revealed that only 6% of pharmacists are female. However, a Saudi report showed that 11% of pharmacists working in all Saudi CPs were female.[17] Although the government advocates that more female pharmacists join CPs, factors such as long working hours (with 72% of pharmacists working over 48 h per week) and contextual challenges identified in the study have led many female pharmacists to prefer working in the government sector for greater personal and household stability.[26]

Global studies have confirmed that applying APSs reduces dispensing errors.[27,28] However, this study showed that most CPs had never used electronic dispensing systems. The lack of training in this advanced technology, inadequate space inside CPs, and economic costs are possible explanations. Other studies have demonstrated that these systems can reduce the risk of medication errors and adverse drug events.[29] In 2018, the electronic prescription system '***Wasfaty***' was implemented in SA. Still, one-half of CPs do not use it and can only use it if they meet the necessary contractual criteria established by the Saudi Ministry of Health.[30] Additionally, nearly 39% of pharmacists in CPs still rely on handwritten instructions instead of printed labels for medication instructions, which is alarming because studies have shown that unclear instructions lead to a high incidence of patient misunderstanding, resulting in drug misuse or adverse effects.[31–33]

Many international efforts have been made to equip community pharmacists with the key responsibilities of managing chronic diseases and providing ECPSs. In Australia, Canada, England, the Netherlands, Scotland, and the United States, CPs engage in chronic disease management and health-screening services. Additionally, community pharmacists can provide public health programs such as smoking cessation and weight management as part of their essential practice. However, this study showed that most CPs did not provide routine health-screening services, such as measurement of blood glucose, blood pressure, blood lipids, asthma management, or osteoporosis screening. One potential explanation for the low rate of providing these services is the high hygiene standards set by the Saudi MOH for infection control, which minimise the dissemination of infections in CPs. In addition, public health programs such as nutrition and body weight management, smoking cessation, and travel health programs still need to be introduced. The findings of this study also highlight significant shortages in vaccination services and rapid COVID-19 tests. Compared to a recent local study involving 193 pharmacists conducted in Asir province,[35] this study found that health screening and health program services in Al Baha, Jazan and Najran provinces were provided less often than in Asir province. This contrast could suggest sociodemographic differences.

MTM services are widely recognised as the cornerstone of pharmaceutical care. These pharmacist-provided services[36] are aimed at enhancing targeted therapeutic results and minimising the unwanted effects of medications.[37] Through this practice, pharmacists first assess patients' health status, formulate medication treatment plans, monitor medication adherence, and contact physicians as needed; therefore, MTM has fostered new collaboration channels between community pharmacists and physicians, resulting in cost-effective interventions for chronic diseases.[38] Although this study's findings showed that MTM services in SA were inadequate, a study involving 25 European countries found only six countries (24%) provided comprehensive MTM services similar to those in the United States.[39] In low- and middle-income countries, MTM is limited by the paucity of effective policies.[38] The current study demonstrated that more experience, increased workforce, and lower daily prescription volumes were predictors of successful MTM services. These predictors should be considered when implementing effective MTM services.

Community pharmacists in this study reported positive perceptions towards ECPSs. They recognised the potential of ECPSs to improve public health and allowed them to utilise their clinical expertise. This aligns with a previous scoping review that found that pharmacists have positive attitudes towards new patient-centred services and role extensions.[40] However, many still believe that their primary role is traditional practice (product-oriented), and further training is needed for successful engagement in providing ECPSs. This practice was also highlighted in a previous study by the authors in SA, where the public expressed a desire for change in implementing ECPSs.[10] As we finish 2023, the midpoint of

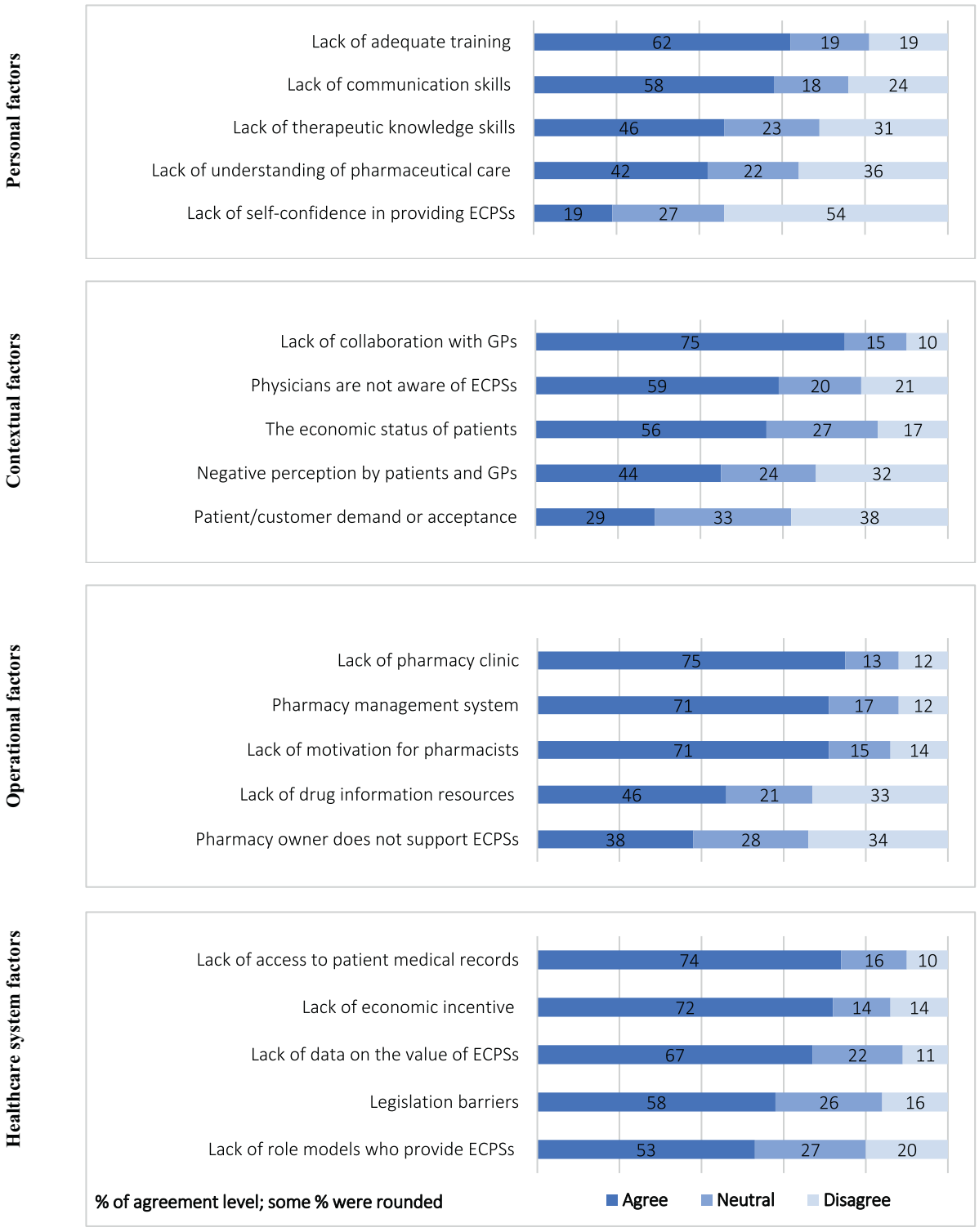

Fig. 2. Barriers facing community pharmacists to deliver extended community pharmacy services in Saudi CPs (n = 312).

the 15-years set by the United Nations to achieve the Sustainable Development Goals, it is crucial for the ***concerned authorities in SA*** to track their performance indices and ensure the promotion of healthy lives and well-being.

In 2016, The Saudi government launched a strategic plan called Saudi Vision 2030 that included a national transformation plan. As a result of the proposed changes, most outpatient pharmacy services in the government sector will be provided by CPs.[41,42] According to this study, the implementation of ECPSs is influenced by the following four main dimensions:

The first dimension emphasises personal factors, with inadequate pharmaceutical care training being a major issue. The study found that pharmacists' therapeutic knowledge skills for solving clinical problems and understanding pharmaceutical care remain insufficient. Additionally, over half of the surveyed pharmacists felt they needed more practical communication skills with patients and physicians. This barrier has

Table 4
The association between characteristics of community pharmacists and barriers to extended community pharmacy services in Saudi CPs (n = 312).

Variables; *reference*	Personal factors		Contextual factors		Operational factors		Healthcare System factors	
	COR (95% CI)	AOR (95% CI)	COR (95% CI)	AOR (95% CI)	COR (95% CI)	AOR (95% CI)	COR (95% CI)	AOR (95% CI)
Gender; *females*								
Males	1.36 (0.59—3.16)	1.04 (0.44—2.46) [a]	0.44 (0.20—1.00)	**0.40 (0.17—0.92)** [a]	0.50 (0.22—1.14)	0.50 (0.21—1.17) [a]	0.61 (0.27—1.39)	0.52 (0.22—1.20) [a]
Age groups; ≥ *41* *								
23—30	**0.41 (0.22—0.77)**	**0.41 (0.22—0.77)** [b]	0.76 (0.40—1.41)	0.67 (0.36—1.27) [b]	0.88 (0.47—1.64)	0.81 (0.43—1.53) [b]	0.60 (0.32—1.12)	0.56 (0.30—1.05) [b]
31—40	0.75 (0.40—1.44)	0.75 (0.39—1.44) [b]	0.72 (0.37—1.37)	0.70 (0.37—1.35) [b]	0.58 (0.31—1.11)	0.58 (0.30—1.10) [b]	0.68 (0.36—1.29)	0.67 (0.35—1.27) [b]
Citizenship; *Saudi*								
Non-Saudi	1.12 (0.73—1.73)	0.78 (0.48—1.26) [g]	0.71 (0.46—1.10)	0.66 (0.43—1.03) [c]	**0.43 (0.27—0.67)**	**0.48 (0.30—0.75)** [f]	0.84 (0.55—1.31)	1.03 (0.65—1.61) [f]
Pharmacy type; *Independent*								
Chain	1.00 (0.62—1.61)	1.22 (0.74—2.00) [a]	**2.13 (1.30—3.50)**	**2.23 (1.35—3.68)** [h]	**0.52 (0.32—0.84)**	**0.54 (0.33—0.90)** [h]	0.70 (0.43—1.14)	0.74 (0.45—1.21) [f]
Educational level; *MSc, PhD**								
BSc	0.97 (0.33—2.86)	1.48 (0.49—4.48) [a]	1.98 (0.71—5.53)	1.58 (0.56—4.49) [c]	0.47 (0.17—1.33)	0.41 (0.14—1.18) [d]	0.55 (0.19—1.62)	0.63 (0.21—1.88) [f]
Pharm D	0.78 (0.24—2.54)	1.67 (0.47—5.90) [a]	2.58 (0.84—7.96)	2.09 (0.67—6.53) [c]	1.86 (0.59—5.85)	1.61 (0.50—5.16) [d]	1.46 (0.45—4.74)	1.31 (0.40—4.30) [f]
Pharmacy location; *Al Baha*								
Jazan	0.71 (0.41—1.22)	0.78 (0.45—1.34) [g]	1.13 (0.67—1.90)	1.24 (0.73—2.10) [c]	**1.97 (1.15—3.40)**	**1.96 (1.13—3.38)** [i]	0.86 (0.51—1.46)	0.77 (0.45—1.31) [f]
Najran	1.06 (0.63—1.78)	1.30 (0.76—2.21) [g]	1.29 (0.78—2.13)	1.51 (0.90—2.54) [c]	**2.41 (1.43—4.08)**	**2.55 (1.50—4.34)** [i]	1.59 (0.96—2.62)	1.24 (0.73—2.10) [f]
Years of experience; ≤ *5**								
6—10	1.56 (0.95—2.55)	1.63 (1.00—2.68) [f]	1.04 (0.64—1.69)	0.98 (0.60—1.61) [c]	**0.60 (0.37—0.98)**	0.73 (0.44—1.20) [i]	1.23 (0.76—2.00)	1.41 (0.86—2.31) [f]
>10	**2.35 (1.40—3.95)**	**2.41 (1.43—4.04)** [f]	0.86 (0.52—1.45)	1.01 (0.60—1.71) [c]	0.98 (0.59—1.64)	1.02 (0.60—1.73) [i]	1.88 (1.12—3.14)	**2.06 (1.22—3.48)** [f]
Work status; *full-time*								
Part-time	0.97 (0.47—2.00)	0.78 (0.37—1.64) [a]	0.64 (0.31—1.31)	0.78 (0.37—1.63) [c]	0.77 (0.36—1.67)	0.51 (0.23—1.15) [i]	0.92 (0.43—1.79)	0.91 (0.42—1.97) [f]
Number of pharmacists; *1*								
2	1.14 (0.61—2.13)	1.33 (0.70—2.53) [g]	1.31 (0.70—2.48)	1.24 (0.65—2.34) [c]	0.77 (0.41—1.45)	0.64 (0.33—1.20) [i]	0.66 (0.35—1.24)	0.53 (0.28—1.01) [f]
3	0.62 (0.31—1.23)	0.78 (0.38—1.57) [g]	1.60 (0.81—3.17)	1.32 (0.66—2.66) [c]	0.52 (0.26—1.06)	**0.44 (0.22—0.91)** [i]	**0.39 (0.19—0.77)**	**0.31 (0.15—0.62)** [f]
>3	0.84 (0.45—1.60)	1.14 (0.58—2.24) [g]	1.45 (0.76—2.78)	1.15 (0.59—2.26) [c]	0.61 (0.32—1.15)	0.53 (0.28—1.02) [i]	**0.49 (0.26—0.94)**	**0.36 (0.18—0.70)** [f]
Weekly working hours; > *48*								
≤ 48 h *	0.98 (0.63—1.53)	1.08 (0.70—1.70) [g]	1.10 (0.69—1.73)	1.24 (0.78—1.98) [c]	1.26 (0.80—1.98)	1.11 (0.70—1.76) [i]	1.19 (0.76—1.87)	0.93 (0.58—1.49) [f]
Daily prescriptions; ≥ *100* *								
<100	0.75 (0.46—1.22)	0.70 (0.43—1.15) [g]	0.81 (0.49—1.34)	0.77 (0.47—1.28) [c]	**0.42 (0.25—0.68)**	**0.47 (0.29—0.79)** [h]	**0.35 (0.20—0.59)**	**0.30 (0.17—0.50)** [e]

Bold indicates significance at 0.05.
* Groups were collapsed.
[a] adjusted to age groups (standard background variable).
[b] Adjusted to gender (standard background variable).
[c] Adjusted to pharmacy type.
[d] Adjusted to pharmacy location.
[e] Adjusted to the number of pharmacists.
[f] Adjusted to daily prescription.
[g] Adjusted to years of experience.
[h] Adjusted to citizenship.
[i] Adjusted to educational level.

been reflected in several studies.[43,44] Addressing these issues requires the involvement of pharmacy administration and the authorities responsible for granting professional licenses. Training courses and continuing education should be mandatory to support community pharmacists in providing excellent patient care.

The implementation of ECPSs is influenced by contextual factors, which comprise the second dimension. Studies have shown that one of the most common barriers is the need for more collaboration with physicians to reduce adverse reactions and improve health outcomes among patients.[45,46] Lack of collaboration with physicians and limited knowledge of ECPSs dominate this dimension, as revealed in this study. Therefore, it is necessary to develop policies to encourage physicians to

collaborate with community pharmacists.[47] Approximately one-third of the respondents believed that the public would accept these services, and economic status remained a barrier from the pharmacists' perspectives. Recent research on Saudi public perspectives of ECPSs supports this finding.[10] Therefore, it is crucial to consider economic barriers in settings without universal health insurance coverage or reimbursement for ECPSs.

The third dimension of barriers is operational factors. Private counselling areas are essential for ensuring comfortable care and confidentiality. The results showed that this major barrier was common in several studies.[1] Most participants reported a lack of motivation. To boost community pharmacists' satisfaction, CP owners must increase their motivation and competence levels.[48] Additionally, staff shortages are a significant concern, with pharmacists often taking on managerial or cashier duties. Logistic regression analysis showed that the more pharmacists working at a CP, the more MTM services it provides. Accessing drug information resources is critical for pharmacists, patients, and healthcare providers.[49] The need for drug information resources was also observed in this study. In a local study, Alrabiah et al. (2019) called for electronic systems to help CPs detect drug-drug interactions easily.[50] However, approximately half of the pharmacists surveyed were concerned about the lack of such resources. A poorly managed pharmacy system can disrupt the pharmaceutical care process; therefore, it is essential to have a well-established infrastructure with high functional standards. The responsibility of owners and managers to create an environment that prioritises quality care is crucial.

The fourth barrier dimension was healthcare-system factors. Accessing medical history records is key to enhancing ECPSs, particularly MTM services.[51,52] Although the new national digitised 'Wasfaty' system has the potential to facilitate communication between physicians and pharmacists, it serves only as an electronic prescription system, without providing patients' medical histories. The lack of access to patient data is due to concerns about public confidentiality and may be revised by the government in upcoming years. In addition, the lack of incentives to deliver ECPSs was a major concern for respondents. This finding is consistent with global studies.[4,53] Compensation or financial support from the government can create a competitive environment in which CPs provide these services. Even though ECPSs have been explicitly legalised on the Saudi Ministry of Health's website (Annexes 4 and 5),[54] most pharmacists must be made aware of the new regulations, as more than half of the respondents claimed that guidelines and regulations are not easily accessible.

5. Limitations

This study had some limitations that should be considered. Owing to COVID-19 restrictions, the data were collected through a self-administered web-based survey, which could have created bias. Additionally, there was a low participation rate among female pharmacists, independent pharmacies, and Saudi community pharmacists, which may have led to unrepresentative data. Moreover, this study focused only on three regions of SA. Future studies should explore these services throughout the country.

6. Conclusion

This study sought to address gaps in evidence-based decision-making by evaluating CPs for practice change towards Saudi Vision 2030. However, numerous challenges in implementing essential services to drive change were found. The findings revealed a shortage of female pharmacists in CPs. Ensuring women are empowered to work in CPs is crucial to keeping up with the evolving landscape. In addition, CPs must prioritise the implementation of better facilities to improve public health services and promote good pharmacy practices. To achieve this goal, there are several key measures that can be taken, including the use of printed labels for medication instructions, availability of drug information resources, communication channels for booking appointments, and offering private counselling areas for customers. Furthermore, offering continuous training to community pharmacists to provide essential care pharmacy services is critical, particularly as many community pharmacists come from diverse educational backgrounds. Policies should also be developed to encourage physicians to collaborate with community pharmacists.

The study suggests that the 'Wasfaty' program should be accessible to all CPs, and regular assessments should be conducted to ensure its effectiveness. Pharmacy colleges should also update their curricula to provide students with comprehensive internships alongside CPs to improve their understanding of pharmaceutical care before joining the CPs workforce. Finally, both private and government sectors must take swift action to bolster pharmaceutical care in SA.

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CRediT authorship contribution statement

Khalid S. Alghamdi: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Visualization, Writing – review & editing. **Max Petzold:** Conceptualization, Methodology, Formal analysis, Data curation, Writing – review & editing, Supervision. **Mahdi H. Alsugoor:** Investigation, Writing – original draft, Writing – review & editing. **Hafiz A. Makeen:** Validation, Investigation, Writing – review & editing. **Kudaisi H. Al Monif:** Investigation, Writing – review & editing. **Laith Hussain-Alkhateeb:** Conceptualization, Methodology, Validation, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rcsop.2023.100363.

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