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Saudi Pharmaceutical Journal

journal homepage: www.sciencedirect.com

Original article

Knowledge, attitude, and perception of community pharmacists towards antimicrobial stewardship in Saudi Arabia: A descriptive cross-sectional study

Abdul Haseeb^{a,*}, Mahmoud Essam Elrggal^a, Mohammed Saeed Bawazir^m, Mohammed Omar Bawazir^b, Inayat Ur Rehman^c, Hani Saleh Faidah^d, Saleh Alghamdi^e, Ahmad J. Mahrous^a, Alaa Mutlaq^f, Muhammad Shahid Iqbal^g, Safa S. Almarzoky Abuhussain^a, Manal Algethamy^h, Sattam Saad Alshuail^h, Abdullmoin AlQarniⁱ, Asim A. Khogeer^{j,k}, Nayyira Fatani^l, Zikria Saleemⁿ

^a Department of Clinical Pharmacy, College of Pharmacy, Umm Al-Qura University, Makkah, Saudi Arabia

^b Biopharmaceutical Department, Amgen Pharmaceuticals, Saudi Arabia

^c Department of pharmacy, Abdul Wali Khan University Mardan, Pakistan

^d Department of Microbiology, Faculty of Medicine, Umm Al-Qura University, Makkah, Saudi Arabia

^e Department of Clinical Pharmacy, Faculty of Clinical Pharmacy, Al Baha University, Al Baha 57911, Saudi Arabia

^f General Department of Pharmaceutical care, Ministry of Health, Riyadh, Saudi Arabia

^g Department of Clinical Pharmacy, College of Pharmacy, Prince Sattam bin Abdul Aziz University, 11942, Alkharj, Saudi Arabia

^h Alnoor Specialist Hospital Makkah, Department of Infection prevention & Control Program, Makkah, Saudi Arabia

ⁱ Alnoor Specialist Hospital Makkah, Infectious diseases department, Makkah, Saudi Arabia

^j Plan and Research Department, General Directorate of Health Affairs of Makkah Region, Ministry of Health (MOH), Saudi Arabia

^k Medical Genetics Unit, Maternity & Children hospital, Makkah Healthcare Cluster, Ministry of Health, Saudi Arabia

^l Department of Pharmacy Practice, College of Pharmacy, King Abdulaziz University, Jeddah, Saudi Arabia

^m Amman Pharmaceutical Industries, Jeddah, Saudi Arabia

ⁿ Department of Pharmacy Practice, Faculty of Pharmacy, Bahauddin Zakaria University, Multan, Pakistan

ARTICLE INFO

Article history:

Received 16 February 2022

Accepted 11 September 2022

Available online 16 September 2022

Keywords:

Antimicrobial Stewardship
Resistance
Infection
Community
Treatment
Pharmacy
Protocol

ABSTRACT

Background: Antimicrobial resistance is of paramount concern globally. Community pharmacists (CPs) play a vital role in supporting judicious antimicrobial use in the community as they are the key health-care providers at a public level. This study aimed to assess the knowledge, attitude, and perception of CPs towards antimicrobial stewardship at the community level in Saudi Arabia.

Methods: A self-administered questionnaire was distributed to all community pharmacies in four major cities of Saudi Arabia. A simple random sampling approach was used to select pharmacies in each chain.

Results: A total of 520 CPs responded to the survey with a response rate of 98.6%. Most of the pharmacists (n = 479, 92.1%) accepted that antimicrobial stewardship programs are essential tools to limit injudicious usage of antimicrobials at the community level. Interestingly, very few (n = 105, 21%) agreed to recommend antibiotics for common illnesses, including upper respiratory tract infections, cold, and flu without a valid prescription. Further, we found a significant role of Saudi health authorities, e.g., Saudi food & drug authorities and the Ministry of Health, in restricting antimicrobials sale in community pharmacies without a valid prescription.

Conclusion: Our study findings revealed that CPs had good knowledge about antimicrobial stewardship in Saudi Arabia. The CPs play an active role in the optimization of antimicrobial therapy and infections caused by different microbes. Strict policies by the Saudi health care authority regarding the restricted

* Corresponding author at: Department of Clinical Pharmacy, College of Pharmacy, Umm Al-Qura University, Makkah, Saudi Arabia.

E-mail addresses: amhaseeb@uqu.edu.sa (A. Haseeb), merggal@uqu.edu.sa (M. Essam Elrggal), akhogeer@moh.gov.sa (A.A. Khogeer).

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

dispensing of antimicrobials are welcomed by the CPs and thus may contribute toward lowering of antimicrobial resistance burden on the patients and Saudi health care authorities.

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1. Introduction

The increasing trend in antimicrobial resistance (AMR) is a global public health problem that demands urgent action (Sarwar et al., 2018). The AMR resulted in serious illness, prolonged hospitalization, treatment failures, and increases in healthcare expenditures (Dadgostar and Resistance 2019). Irrational use of antimicrobials is directly associated with AMR, which is resulted from misuse and abuse of antimicrobials as well as resulting from self-medication for the treatment of viral infections (Franco et al., 2009, Saleem et al., 2016). It has been reported many patients receive antimicrobials for respiratory tract infections (RTIs) such as the common cold (Kotwani et al., 2014, Saleem et al., 2016). The irrational utilization of antimicrobials for viral infections leads to the escalation of antimicrobial-resistant pathogens. Being among RTIs, Coronavirus Disease 2019 (COVID-19) increases the emergence of AMR due to over-prescribing, irrational use, and self-medication of antimicrobials (Mudenda et al., 2020; Phiri et al., 2020). Nowadays, the misuse of antimicrobials is a common issue around the globe, including, in Saudi Arabia due to the persistent use of antimicrobials (Hsu 2020, Phiri et al., 2020).

The CPs can help to cope with AMR by developing and executing antimicrobial stewardship (AMS) in a community setup (Saleem et al., 2019). In 2013, the General Administration of Pharmaceutical Care at the Ministry of Health started the AMS in Saudi Arabia (Alomi 2017). The chief goal of this intervention was to promote the judicious use of antimicrobials. Initiation and implementation of AMS have been successfully carried out in secondary as well as tertiary healthcare settings (Amer et al., 2013, Al-Omari et al., 2020). However, community settings are deprived of such practices. In May 2018, laws and regulations alongside heavy fines were imposed by the Ministry of Health for dispensing antimicrobials without prescriptions (Alrasheedy et al., 2020). But, the injudicious sale of antimicrobials is still common in Saudi Arabia like in other countries (Saleem et al., 2020). In Riyadh, Saudi Arabia the rate of antimicrobial dispensing without a prescription happened to be 77.6 % before the enforcement of the antimicrobial restriction law (Abdulhak et al., 2011). Moreover, this regulation has a negative impact on the sales profits of community pharmacies, resulting in non-compliance by some community pharmacies (Hadi et al., 2016, AlRukban et al., 2020).

Important approaches for initiation and implementation of AMS in community setup must consist of, awareness programs concerning AMR among community staff members, enhancing knowledge regarding updated treatment protocols, and restricting and managing the inventory of antimicrobials (Sarwar et al., 2018). CPs must ensure the judicious use of antimicrobials even in times of global health pandemic to reduce the emergence of AMR (Organization 2014). Before incorporating CPs in the initiation and execution of AMS programs, it is important to know their knowledge, attitude, and current practices about the AMS program. No study has been carried out to assess the view of CPs toward AMS programs in Saudi Arabia. Therefore, this study aimed to assess the knowledge, attitude, and perception (KAP) of CPs regarding AMS programs in community pharmacies in four cities of Saudi Arabia. The findings of this study will highlight the loopholes if any in the irrational or self-medication of antimicrobials for common viral infections if and also highlight the role of CPs to restrict the use of antimicrobials to assist in reducing the burden of antimicrobial resistance

which is a big threat to mankind. Also, assessing the knowledge of CPs will assist to revise courses and regular continuous medical education (CMEs) for them to keep them updated about the antimicrobials up to date research.

2. Method

2.1. Study design and settings

A descriptive cross-sectional study was performed to evaluate the KAP of CPs regarding AMS programs in community-pharmacy settings in Saudi Arabia. Licensed pharmacists working at community pharmacies from different regions of Saudi Arabia were included in this study. According to a study, a total of 25,119 pharmacists are registered, of which, 57 % of pharmacists are working in community settings (Almaghaslah et al., 2019). The CPs working in community pharmacies were approached in person for nearby locations and for those who are far away the questionnaire were sent to them through emails and social media to get their responses.

2.2. Data collection tool

A validated questionnaire after reviewing published articles (Sarwar et al., 2018, Feng et al., 2020, Mudenda et al., 2020) was used in this study, which is comprised of 24 items. These items were divided into three sections. The first section is comprised of five statements on the demographic history of respondents such as age, gender, city, educational level, and experience (years). The second section had eight statements on the knowledge of respondents regarding AMS. A 5-point Likert scale was employed to scale the responses of the respondents. On this scale, scoring 1 was for 'strongly disagree,' 2 for 'disagree,' 3 for 'neutral,' 4 for 'agree,' and 5 for 'strongly agree.' The third section had eleven statements on the practices of respondents concerning AMS. A semantic differential scale was employed to record the responses. The responses were recorded as 'never', 'rarely', 'occasionally', 'often', and 'always'.

2.3. Statistical analysis

Data were entered into a Microsoft Excel spreadsheet before being exported to SPSS version 21.0 (IBM, Armonk, NY, USA). Descriptive statistics in terms of frequencies and percentages were utilized while the Kruskal-Wallis test was used along with all items were ranked based on the important relative index (RII) values shown in the equation below. Those factors were ranked as the main factors in the knowledge and practice of pharmacists toward AMS, of whom RII-value was closest to one. A p-value of < 0.05 was considered statistically significant.

$$RII = \frac{\sum W}{A \times N} \quad (0 \leq RII \leq 1)$$

In Equation, "W is the weight given to each item by the respondents on a scale from 1 to 5, (where '1' = strongly disagree and '5' = strongly agree) for the knowledge of pharmacists toward AMS, while 1 = never, 2 = rare, 3 = Occasionally, 4 = often, and 5 = Always, for the practice of pharmacists toward AMS, A is the highest weight (i.e., 5 in this case), and N is the total number of respondents".

3. Results

3.1. Demographic characteristics of participants

A total of 527 questionnaires were distributed among CPs, of whom, seven were incomplete and excluded from the final analysis. A total of 520 CPs participated in this survey, with a response rate of 98.6 %. The majority of the respondents were males (N = 506, 97.3 %), while (N = 457, 87.9 %) of the respondents were holding a bachelor's degree in pharmacy. The majority of the respondents were among the age group of 31–40 years (N = 225, 43.2 %), followed by 20–30 years (N = 159, 30.6 %). Regarding the work experience (N = 240, 46.2 %) were having work experience of more than 10 years, followed by (N = 155, 29.8 %) who were having 5–9 years of experience (Details shown in [Table 1](#)).

3.2. Knowledge about antimicrobials

All 520 participants responded to eight questions regarding knowledge about antimicrobials. Respondents had good knowledge of antimicrobials (as shown in [Table 2](#)). A total of N = 485 (93.2 %) participants strongly agreed/agreed that “AMS programs improve patient care” and are statistically significant (p = 0.008). About N = 476 (90.3 %) respondents agreed/strongly agreed that “AMS should be incorporated at the community pharmacy level” (p = 0.132); while N = 479 (90.8 %) responded that “AMS programs reduce the problem of antimicrobial resistance” and is statistically significant having (p = 0.001). Most of the CPs N = 450 (86.5 %), agreed/strongly disagreed that adequate training should be provided to CPs on antimicrobial use having (p = 0.045) and is statistically significant. Variation in responses by the respondents made it impossible to rank the main statements regarding the knowledge of AMS, therefore, the important relative index (RII) was used to estimate the relative importance of the identified statements. The RII analysis revealed that the top five statements with regard to knowledge of pharmacist knowledge toward “AMS were AMS programs improve patient care”, RII = 0.87; “AMS programs reduce the problem of antimicrobial resistance”, RII = 0.86; “AMS should be incorporated at community pharmacy level”, RII = 0.85; “Adequate training should be provided to community pharmacists on antimicrobial use”, RII = 0.84 and “Pharmacists have a responsibility to take

prominent role in antimicrobial stewardship and infection control programs in health system” having RII = 0.82 respectively (as shown in [Table 2](#)).

3.3. Practices of community pharmacists regarding AMS programs

All participants gave responses to all eleven statements regarding their practices in AMS (Shown in [Table 3](#)). A large number of respondents N = 445(85.6 %) dispense antimicrobials on prescription with complete clinical information with (p = 0.701). N = 501 (96.3 %) never “dispense antimicrobials without a prescription” (p = 0.228); while N = 183 (35.5 %) CPs often collaborate with other healthcare professionals for infection control and AMS (p = 0.398); while N = 228 (44.2 %) of the CPs “sought additional clinical information (E.g. drug interaction, ADRs, allergy, etc.) before deciding to dispense the antibiotic prescribed” (p = 0.457) shown in [Table 3](#). The RII analysis revealed the top five ranked practices by community pharmacists in toward AMS “I dispense antimicrobial on prescription with complete clinical information”, RII = 0.94; “I screen the antimicrobial prescription in accordance with local guidelines before dispensing”, RII = 0.89; “I educate patients on the use of antimicrobials, and resistance-related issues”, RII = 0.82; “I make efforts to prevent or reduce the transmission of infections within the community”, RII = 0.81 and “I sought additional clinical information (E.g. drug interaction, ADRs, allergy, etc.) before deciding to dispense the antibiotic prescribed”, RII = 0.81 as shown in [Table 3](#).

4. Discussion

We evaluated the KAP of CPs regarding antimicrobial stewardship. Currently, there is limited information about the knowledge, attitude, and practices of CPs on AMR and AMS in Saudi Arabia. The CPs play an integral role in AMS and infection prevention and control programs in the healthcare system ([Khan et al., 2021](#)). Therefore, it is important to understand the perspectives of CPs regarding AMS so that proper strategies can be designed and implemented to address this issue. We are well aware that published articles have evaluated the attitudes of CPs toward inappropriate antimicrobial dispensing and antimicrobial resistance ([Hadi et al., 2016](#), [Alrasheedy et al., 2020](#), [AlRukban et al., 2020](#)). However, we believe that this is the first study in Saudi Arabia to comprehensively assess the knowledge, attitude, and perception of CPs towards AMS programs, which may help the healthcare authorities and other stakeholders to implement the AMS program in a community setup.

The current study showed a positive response of CPs toward AMS programs. The majority of CPs agreed that implementation of AMS can improve patient safety, comparing favorably with another study conducted in Aden-Yemen ([Alshakka et al., 2019](#)). Implementation of effective AMS in the healthcare setting not only minimizes the irrational use of antimicrobials but also reduces prolonged hospital stay and healthcare costs and improves patient care and clinical outcomes ([Palmer et al., 2011](#), [Kapadia et al., 2018](#)). The majority of CPs were in the agreement that AMS programs can reduce the problems of AMR. AMS programs assist to control AMR by optimizing antimicrobial usage ([Majumder et al., 2020](#)). Our findings reported that 86.53 % of CPs agreed that adequate training regarding the rational use of antimicrobials and AMR is required. Similar findings were documented in other studies conducted in Malaysia and Pakistan ([Khan et al., 2016](#), [Rehman et al., 2018](#)). However, the percentage was comparatively lower in a study conducted in Ethiopia (60.4 %) ([Erku 2016](#)). Education and training on AMS programs are effective in minimizing irrational use of antimicrobials and help to control AMR ([Saha et al., 2020](#)). Therefore, CPs should be encouraged to take part in training ses-

Table 1
Demographic characteristics of study participants.

Variables	Frequency (%)
Gender	
Male	506 (97.3)
Female	14 (2.7)
City	
Makkah	150 (28.8)
Jeddah	200 (38.5)
Riyadh	100 (19.2)
Dammam	70 (13.5)
Age	
20 – 30 years	159 (30.6)
31 – 40 years	225 (43.2)
41 – 50 years	107 (20.6)
51 – 60 years	29 (5.6)
Highest Education Degree	
Bachelor's Degree in Pharmacy	457 (87.9)
Master's Degree in Pharmacy	51 (9.8)
Doctorate Degree in Pharmacy	11 (2.1)
Other	1 (0.2)
Experience in years	
< 1 year	9 (1.7)
1 – 4 years	116 (22.3)
5 – 9 years	155 (29.8)
≥ 10 years	240 (46.2)

Table 2
Knowledge of community pharmacists regarding AMS programs.

Statements	Strongly Disagree N (%)	Disagree N (%)	Neutral N (%)	Agree N (%)	Strongly Agree N (%)	RI	Rank	P-Value
AMS programs improve patient care.	7 (1.3)	0 (0)	28 (5.4)	237 (45.6)	248 (47.7)	0.87	1	0.008*
AMS should be incorporated at community pharmacy level	5 (1)	10 (1.9)	29 (5.6)	283 (54.5)	193 (37.2)	0.85	3	0.132
AMS programs reduce problem of antimicrobial resistance	4 (0.8)	10 (1.9)	27 (5.2)	264 (51.3)	215 (41.7)	0.86	2	0.001*
Adequate training should be provided to community pharmacists on antimicrobial use.	7 (1.3)	12 (2.3)	51 (9.8)	242 (46.6)	208 (40.1)	0.84	4	0.045*
Relevant conferences, workshops and other educational activities are required to be attended by community pharmacist to enhance understanding of antimicrobial stewardship.	6 (1.2)	15 (3.5)	90 (17.4)	247 (47.8)	159 (30.8)	0.80	6	0.179
Individual efforts at antimicrobial stewardship have minimal impact antimicrobial resistance problem.	9 (1.7)	25 (4.8)	124 (23.9)	234 (45.1)	128 (24.7)	0.77	7	0.478
I think that the prescribing physicians are the only professionals who need to understand antimicrobial stewardship	29 (5.6)	194 (37.3)	154 (29.6)	95 (18.3)	48 (9.2)	0.57	8	0.045*
Pharmacists have a responsibility to take prominent role in antimicrobial stewardship and infection control programs in health system	7 (1.35)	8 (1.5)	79 (15.2)	234 (45)	192 (36.9)	0.82	5	0.134

Kruskal-Wallis test was applied, AMS = antimicrobial stewardship, RI = relative index, * p-value < 0.05 was considered statistically significant, Grouping variable job sector.

Table 3
Practices of community pharmacist regarding AMS.

Statements	Never N (%)	Rarely N (%)	Occasionally N (%)	Often N (%)	Always N (%)	RI	Rank	P-Value
I dispense antimicrobial on prescription with complete clinical information	9 (1.7)	11 (2.1)	15 (2.9)	40 (7.7)	445 (85.6)	0.94	1	0.701
I dispense antimicrobials without a prescription	501 (96.3)	10 (1.9)	5 (1)	2 (0.4)	2 (0.4)	0.21	11	0.228
I dispense antimicrobial for durations more than prescribed by the physician on patient's request	451 (87.2)	18 (3.5)	12 (2.3)	5 (1)	15 (2.9)	0.24	10	0.430
I screen the antimicrobial prescription in accordance with local guidelines before dispensing	24 (4.6)	10 (1.9)	22 (4.2)	105 (20.2)	359 (69.3)	0.89	2	0.459
I collaborate with other health professionals for infection control and antimicrobial stewardship.	12 (2.3)	26 (5)	142 (27.6)	183 (35.5)	157 (30.5)	0.77	8	0.398
I communicate with prescribers if I am unsure about the appropriateness of an antibiotic prescription.	10 (1.9)	25 (4.8)	146 (28.4)	177 (34.4)	162 (31.5)	0.77	7	0.897
I sought additional clinical information (E.g. drug interaction, ADRs, allergy, etc.) before deciding to dispense the antibiotic prescribed.	6 (1.2)	10 (1.92)	104 (20.2)	228 (44.2)	172 (33.3)	0.81	5	0.457
I take part in antimicrobial awareness campaigns to promote the optimal use of antimicrobials	14 (2.7)	46 (8.85)	155 (30.3)	184 (36)	121 (23.7)	0.73	9	0.410
I educate patients on the use of antimicrobials, and resistance-related issues.	5 (1)	11 (2.11)	120 (23.3)	175 (33.9)	209 (40.5)	0.82	3	0.657
I make efforts to prevent or reduce the transmission of infections within the community.	2 (0.4)	12 (2.31)	133 (25.7)	167 (32.3)	206 (39.8)	0.81	4	0.391
I ask the patients about their knowledge of prescribed antimicrobial and its usage	6 (1.15)	32 (6.2)	147 (28.4)	145 (28)	190 (63)	0.78	6	0.223

Kruskal-Wallis test was applied, AMS = antimicrobial stewardship, ADRs = adverse drug reactions, RI = relative index, * p-value < 0.05 was considered statistically significant, Grouping variable job sector.

sions regarding the rational use of antimicrobial and appropriate dispensing. This can be done by introducing the training on the AMS program in pharmacy schools and continuing with other additional activities using electronic media (Saleem et al., 2019).

Encouragingly, 96.3 % of CPs do not dispense antimicrobials without prescription. Our findings are similar to Hoxha et al. who also documented the perception of pharmacists regarding inappropriate dispensing of antimicrobial (Hoxha et al., 2018). Considering the good pharmacy practice to execute a pharmaceutical plan, the main concern of CPs should be the promotion of appropriate and economic prescribing and dispensing, and adequate utilization of drugs (Hanafi et al., 2013). It is therefore essential that CPs play a significant role as antimicrobial stewards to foster the appropriate use of antimicrobials. A high percentage of CPs (85.6 %) stated that they always dispense antimicrobials on

prescriptions after reviewing the full clinical information. However, in similar studies reported in Malaysia (28.7 %) and Ethiopia (37.73 %) antimicrobials were dispensed occasionally on prescription after reviewing clinical data of the patient (Erku 2016, Khan et al., 2016). CPs should ensure the dispensing of antimicrobials with complete clinical knowledge (e.g. indication, dose, frequency, and route of administration) and guide the patients on how to administer antimicrobials (Dameh et al., 2012). Lack of providing complete clinical knowledge and counseling patients on antimicrobial use may cause the spread and emergence of AMR (Mudenda et al., 2020). Antimicrobials should not be dispensed for a prolonged period because this practice can lead to misuse and abuse, which could result in the escalation of AMR (Nasrin et al., 2002).

The majority of the CPs in our study collaborated with other healthcare professionals in AMS programs and infection preven-

tion and control practices. Multisite studies also documented that collaboration with healthcare professionals may promote the rational use and prescribing of antimicrobials (Erku 2016, Sarwar et al., 2018, Hayat et al., 2019). The collaboration between healthcare professionals and pharmacists helps to minimize AMR by pointing out the inappropriately prescribed antimicrobials (Klepser et al., 2015, Tegagn et al., 2017, Saha et al., 2019). Also, pharmacists in different settings must unite in the fight against AMR (Howard et al., 2020). CPs must take part in ASM programs to promote the rational prescribing and dispensing of antimicrobials. The majority of CPs stated that they always (40.5 %) and often (33.9 %) counsel patients regarding the appropriate use of antimicrobials and resistance-related problems and they always (63.0 %) asked patients about their knowledge of prescribed antimicrobials and their use. In Saudi Arabia, there is no proper AMS program implemented in community pharmacies. By knowing the perspectives of CPs on their role as antimicrobial stewards, the Ministry of Health, Saudi Arabia, and other stakeholders should provide a plan on how they could make a mark as AMS proponents.

The generalisability of these results is subject to certain limitations. For instance, this study is carried out in four cities in Saudi Arabia, and the results cannot be generalizable to all CPs in Saudi Arabia. Second, data collected via a self-administered questionnaire is biased because differences may occur in respondents' accuracy and completeness of the questionnaire and under- and over-reporting of KAP regarding AMS programs. Despite the above limitations, our findings provide an updated insight into CPs toward community-based AMS programs.

5. Conclusion

CPs in Saudi Arabia had good knowledge and attitude regarding antimicrobial use and AMS programs. We discovered antimicrobials restriction without prescription at the community level was a positive antimicrobial stewardship initiative by Saudi health care authorities and warmly welcomed by the CPs as an ASP strategy to promote judicious antimicrobial usage. Therefore, initiation and implementation of AMS programs are required which leads to the improved practice of CPs regarding antimicrobial use, AMR, and AMS. CPs must be recognized as essential players in infection prevention and control among community staff members. Therefore, educational training sessions regarding antimicrobial use, AMR, and AMS should be focused on community settings.

Institutional Review Board Statement.

This study was approved by the Institutional Review Board of the College of Pharmacy with the number UQU-COP-EA # 143916. The ethics committee waived the requirement for informed consent. The personal details of survey respondents and their institutions were kept anonymous, and each community pharmacy was assigned a specific code for data analysis purposes.

Funding

The authors would like to thank the Deanship of Scientific Research at the Umm Al-Qura University for supporting this work by grant code: 22UQU4290073DSR03.

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CRediT authorship contribution statement

Abdul Haseeb: Conceptualization, Resources, Writing – original draft, Funding acquisition. **Mahmoud Essam Elrggal:** Methodology, Resources. **Mohammed Saeed Bawazir:** Methodology. **Mohammed Omer Bawazir:** . **Inayat Ur Rehman:** Writing – original draft, Writing – review & editing. **Hani Saleh Faidah:** . **Saleh Alghamdi:** Conceptualization, Writing – original draft, Writing – review & editing. **Ahmad Jamal Mahrous:** Writing – review & editing. **Alaa Mutlaq:** . **Muhamad Shahid Iqbal:** Supervision. **Safa S. Almarzoky Abuhussain:** Supervision. **Manal Algethamy:** Writing – review & editing, Supervision. **Sattam Saad Alshuail:** Writing – review & editing, Supervision. **Abdullmoin AlQarni:** Writing – original draft, Supervision. **Asim A. Khogeer:** . **Nayyira Fatani:** . **Zikria Saleem:** Conceptualization, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

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

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