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# Antimicrobial stewardship in community pharmacies in Jordan: assessing current status

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## Abstract

**Objectives** The aim of this study was to assess knowledge and perceptions of the Jordanian community pharmacists towards antimicrobial resistance and antimicrobial stewardship programmes (ASPs).

**Methods** A descriptive cross-sectional questionnaire-based study was conducted between August and September 2020. The validated questionnaire consisted of sections that measure participants' demographics, knowledge and perceptions towards ASPs, and assess antibiotic prescribing practice. Questionnaires were distributed via social media to be filled by community pharmacists in Jordan. For knowledge questions, participants gained one point for each correct answer and zero point for each incorrect answer. Then, a knowledge score was calculated out of 10.

**Key findings** During the study period, a convenience sample of 200 pharmacists were recruited and were asked to fill out the study questionnaire, with a majority claimed attending ASPs workshops previously ($n$ = 162, 81.0%). The main sources of knowledge about antimicrobial resistance were university courses and books. With a median knowledge score of 6/10, participants knew that antimicrobials are not always safe. Although only less than 25% knew that ASPs does not necessarily increase treatment duration, most of the pharmacists had positive perceptions towards ASPs. Barriers against application of ASPs were mainly lack of training and lack of physicians' cooperation (89.0% and 87.5%, respectively). It was agreed by 90.0% of the respondents that ASPs would boost public health confidence in community pharmacists, and 86.0% believed that ASPs would enhance their job satisfaction. Multivariate linear regression showed that female gender of pharmacist was significantly associated with higher knowledge score ($P$-value = 0.045).

**Conclusions** This study highlighted that community pharmacists have a good knowledge in antibiotics and a positive perception regarding ASPs. Despite not being highly familiar with ASPs concept, pharmacists showed great support for involvement in ASPs. They also encouraged incorporating ASPs within community pharmacy level which is considered crucial to control antimicrobial resistance throughout the world.

**Keywords:** antimicrobial stewardship; knowledge; perception; community pharmacists; Jordan

## Introduction

Recently, the world has observed an increase in the appearance of antimicrobial resistance, which is considered one of the most significant threats to public health.[1] Resistance seems to be the natural consequence of antibiotics use; the development of microbial resistance correlates with the excessive consumption of these drugs. According to the British medical journal, the community consumption of antibiotics was 80%; most of it was based on the inappropriate treatment of viral infections.[2]

The suitable choice of antimicrobial therapy is a difficult decision; it depends on the different aspects of knowledge and perception of infectious diseases.[3] The overuse of antibiotics causes the global spread of bacterial resistance as well as over-the-counter dispensing of antibiotics, which is considered the primary factor that would increase antimicrobial resistance worldwide.[4] It has been reported that more than 50% of the antibiotics were sold without a prescription by a community pharmacy in Sweden.[5, 6]

On the other hand, the underuse seems to be a contributing factor in microbial resistance as well, through reduction accessibility of antibiotics, incorrect dosing and failure to commit taking medications, all of these factors driving to increase the resistance of antibiotics.[7]

Resistance develops through inappropriate health care behaviours such as improper prescribing, the suitability of drug, dosing and treatment duration. The patient also contributes by nonadherence to treatment and using drugs not authorized by the ministry of health at a low cost. So, the control of the emergence of resistance could be achieved by using antimicrobial agents carefully and wisely, neither underuse nor overuse.[8]

In Jordan, pharmacies are considered one of the essential facilities in the health care sector. More than 2500 pharmacies have been registered in pharmacy syndicate.[9] The significant role of pharmacists in Jordan encompasses proper giving counselling to patients and dispensing medication, including antimicrobial drugs, despite those providing antibiotics without a doctor's prescription is considered illegal in many countries.[10]

The community pharmacy plays a crucial role in the development of antimicrobial resistance, so it is essential to educate the pharmacists to combat the increase of antimicrobial resistance.[11, 12] Several efforts are necessary to improve the knowledge of pharmacists against antimicrobial resistance, such as antimicrobial stewardship programmes (ASPs), which aim to treat and prevent infectious disease. Antimicrobial Stewardship as a term indicates that antimicrobial agents must be used wisely and responsibly, which includes developing actions that balance between appropriate patient therapy and sustained society access to achieve effective treatment.[13] The main goal of ASPs is to improve health care outcomes and achieve cost-effectiveness to health care sectors.[14] To accomplish ASPs in community pharmacies, several strategies must be included, such as the increase in knowledge of antimicrobial resistance, guidelines for the treatment of infectious disease and adjusting antibiotic inventory.[11, 12] ASPs ensure patient health and safety; furthermore, these programmes accomplish this interest while decrease cost on health care sectors.[15]

Before incorporating ASPs in community pharmacies, understanding the pharmacist's knowledge and perception regarding these programmes must be taken into consideration. At the time of this research project, few studies were done in Jordan to improve pharmacist's knowledge and perception regarding ASPs. Therefore, the aim of this study was to assess the knowledge and perception of the Jordanian community pharmacists towards antimicrobial resistance and ASPs.

## Methodology

### Study design, participants and settings

This study evaluates the community pharmacist's knowledge about antibiotics and their perception regarding the ASPs in Jordan. It is based on a descriptive cross-sectional study design that was conducted between August and September 2020. The survey was distributed electronically through social media platforms in Jordan, including Facebook and WhatsApp.

This study targeted community pharmacists working in a different area in Jordan. A convenience sample of community pharmacists were asked to fill out a questionnaire after being informed of the nature of the research and taking the approval to participate in the study on the electronic consent form. The inclusion criteria for community pharmacist's participation in this study were the following: community pharmacists who had registered license to practice pharmacy at the Jordan Pharmaceutical Association and willing to participate in the survey.

### Sample size calculation

The standard formula: $n = P \times (1 - P) \times z^2/d^2$ was used to calculate a minimal sample size where 96 pharmacists were considered a representative sample size for this study. In this calculation, the most conservative proportion of pharmacists with good awareness about ASPs ($P = 50\%$) was used. Also, 10% desired precision, and confidence levels of 95% were used.

### Ethical consideration

The approval on ethical consideration was obtained from the Institutional Review Board (IRB) at Applied Science Private University and the approval number (2020-PHA-20). The study followed the ethical standards outlined in the World Medical Association Declaration of Helsinki guideline.[16] Pharmacists were informed that their participation in the study is voluntary and that their responses will be kept classified and evaluated only as part of a cohort.

### Questionnaire development

A comprehensive literature review was performed on multiple databases such as Google Scholar and PubMed to identify all relevant literature regarding the evaluation of pharmacist's knowledge and perception regarding ASPs. A questionnaire was prepared based on the results of the reviewed literature and to evaluate the aim of this study.[1, 17–19]

The initial draft of the survey was content and face validated by a group of experts to improve and modify the study. Then, the final draft of the survey was tested by a group of pharmacists to assure the clarity and comprehensibility of the questions, and the response from these pharmacists was excluded from the final analysis.

Then, the questionnaire was uploaded on an electronic data collection platform (Google Forms). At the onset of the questionnaire, the participants were informed about the purpose of the study, the potential benefits of the study, data confidentiality protections and the voluntariness of participation. At this stage, the questionnaire would not open unless respondents agreed to take part in the study by ticking the approval box at the end of the consent form.

The questionnaire is divided into the following four parts: (1) demographic characteristics of respondents, which involve information about pharmacist's gender, age, educational level, experience and the type of pharmacy where they work. (2) Assessment of community pharmacy knowledge regarding antibiotics, which involves

questions to evaluate the general information about antibiotics use (for this section, the answer options were 'true', 'false' and 'do not know'). (3) Evaluation of the perception of community pharmacists towards ASPs, the responses on perception were on a Likert scale of 5 to 1 (5: strongly agree, 4: agree, 3: neutral, 2: disagree and 1: strongly disagree). And (4) Assessment of antimicrobial prescribing practice by a community pharmacist, the responses on practice questions were given as 5: always, 4: often, 3: sometimes, 2: rarely and 1: never.

For knowledge questions, participants gained one point for each correct answer and zero point for each incorrect answer. Then, the total knowledge score was calculated out of 10.

### Statistical analysis

Data were analysed using statistical package for social science (SPSS) version 22 (SPSS Inc., Chicago, IL, USA). The descriptive analysis was done using mean and standard deviation (SD) for continuous variables and percentages for qualitative variables.

Univariate and multivariate linear regression were used to screen for factors that affects participants' knowledge score towards antibiotics and ASPs. Variables that were found to be significant on a single predictor level ($P$-value < 0.25) using univariate linear regression analysis were entered into multiple linear regression analysis. Variable were selected after checking their independence, where person correlation coefficient ($r$) less than 0.9 indicate the absence of multicollinearity between the independent variables in regression analysis. In the multiple linear regression analysis, variables that were independently associated with hesitancy score were identified. Statistical significant was considered at $P$-value <0.05.

## Results

### Socio-demographic characteristics of community pharmacists

A total of 200 community pharmacists were recruited in this study. Among the respondents, more than 50% were females ($n$ = 129, 64.5%), with a median age of 30 [interquartile range (IQR)= 11], and most of the respondents had a BPharm level of education ($n$ = 130, 65.0%). The majority of the respondents were employees in the pharmacies ($n$ = 151, 72.5%) and working in counselling and dispensing ($n$ = 103, 51.5%). More than a half of them ($n$ = 110, 55.0%) reported the number of patients per day was less than 50, and 81.0% of the respondents ($n$ = 162) claimed that they attended a course/workshop regarding the ASP. The demographic characteristics of community pharmacy are given in Table 1.

Regarding pharmacists' source of knowledge about antibiotics and antimicrobial resistance (Figure 1), university courses was selected to be the most commonly used resource for knowledge about antibiotics and antimicrobial resistance ($n$ = 183, 91.5%), followed by books ($n$ = 168, 84%) and scientific articles ($n$ = 151, 75.5%), while lectures webinars and social media were not a significant resource for knowledge [($n$ = 89, 44.5%) and ($n$ = 102, 51%), respectively].

### Knowledge about antibiotics and antimicrobial stewardship programmes

Regarding pharmacists' knowledge about antibiotics and ASPs, 10 questions were used to assess knowledge. Community pharmacists had a median score of 6 out of 10 (IQR = 3). The majority of them ($n$ = 188, 94%) knew that antibiotics are not safe and they cause side effects. On the other hand, only 24.0% ($n$ = 48) of community pharmacists knew that ASPs does not increase the treatment duration to ensure therapeutic efficacy, and more than half ($n$ = 129, 64.5%) answered that stewardship is a process that involves a suitable route and dosing of antibiotics. For details, refer to Table 2.

**Table 1** Demographic characteristics of the study sample at baseline ($n$ = 200)

| Parameter | Median (IQR) | $n$ (%) |
|---|---|---|
| Age (years) | 30 (11) | |
| Gender | | |
| Female | | 129 (64.5%) |
| Male | | 71 (35.5%) |
| Educational level | | |
| Bpharm | | 130 (65.0%) |
| MS.C | | 33 (16.5%) |
| Pharm D | | 30 (15%) |
| PhD | | 7 (3.5%) |
| Job status | | |
| Owner | | 49 (24.5%) |
| Employee | | 151 (72.5%) |
| Community practice experience (years) | 5 (8) | |
| Site of work | | |
| Independent community pharmacy | | 153 (76.5%) |
| Chain community pharmacy | | 47 (23.5%) |
| Place of residence | | |
| Amman | | 144 (72.0%) |
| Other | | 56 (28.0%) |
| Number of patients you provide a service to them/day | | |
| <50 | | 110 (55.0%) |
| ≥50 | | 90 (45.0%) |
| Have you ever attended a course/workshop about Antimicrobial Stewardship programmes? | | |
| Yes | | 162 (81.0%) |
| No | | 38 (19.0%) |

### Perception of community pharmacy towards antimicrobial stewardship programmes

All of the 200 recruited pharmacists responded to 11 statements to express their perception towards the ASPs (Table 3). Pharmacists had a positive perception towards ASPs, where 87.0% of respondents agreed that ASPs should be applied to the community pharmacy level, and more than half of the respondents ($n$ = 130, 65%) agreed that the responsibility of ASPs relays on community pharmacists. Similarly, 92.5% of respondents ($n$ = 185) agreed that community pharmacists should have sufficient practice regarding ASPs.

Second part of perception section shows the importance of the ASPs. Results showed that 88.5% of the respondents ($n$ = 177) strongly agreed that ASPs would reduce the inappropriate use of antibiotics, as well as 85.5% of the respondents ($n$ = 171) agreed that ASPs would reduce antibiotics resistance. For more details, refer to Table 3.

Regarding the barriers against the application of ASPs (Figure 2), results illustrate that the most important barrier towards the application of ASPs was the lack of training in antimicrobial stewardship ($n$ = 178, 89.0%), followed by the lack of cooperation from physicians ($n$ = 175, 87.5%) and the lack of reimbursement for antimicrobial stewardship services ($n$ = 165, 82.5%). The least important barrier was the lack of time ($n$ = 136, 68.0%).

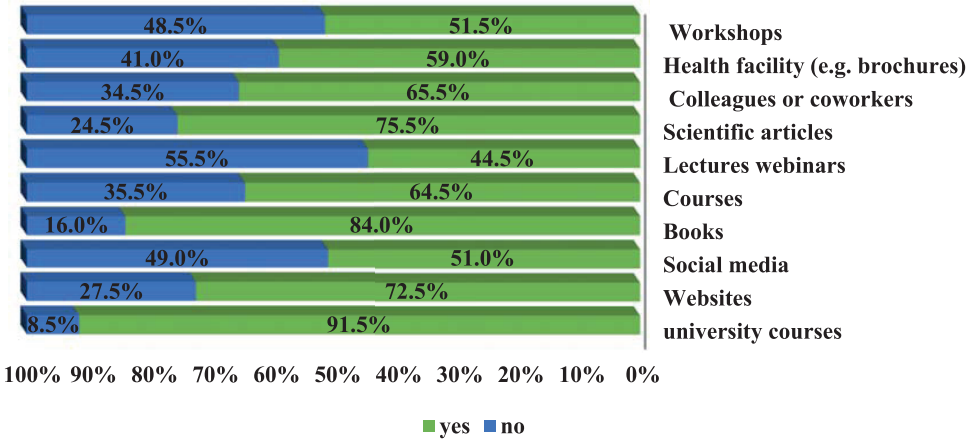


**Figure 1** Community pharmacist's main source of knowledge about antibiotics and antimicrobial resistance ($n$ = 200).

**Table 2** Assessment of community pharmacists' knowledge about antibiotics and antimicrobial stewardtship programmes ($n$ = 200)

| Statements | Correct answer $n$ (%) |
|---|---|
| Antibiotics can be used to treat all types of infections (both bacterial and viral)[1] | 178 (89.0%) |
| Antibiotics treat all kind of inflammations[1] | 156 (78.0%) |
| Antibiotics are safe and do not cause side effects[1] | 188 (94.0%) |
| If bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause[0] | 126 (63.0%) |
| Antibiotics always kill normal flora and make the treatment of infections more difficult[1] | 87 (43.5%) |
| Antibiotics always should be indicated for fever condition[1] | 170 (85.0%) |
| Antimicrobial stewardship is a programme that increase the treatment duration to ensure therapeutic efficacy[1] | 48 (24%) |
| Antimicrobial stewardship is process that involves a suitable antibiotics dosing and route of administration[0] | 129 (64.5%) |
| Antimicrobial stewardship is process that involves appropriate duration of antibiotics therapy[0] | 125 (62.5%) |
| The role of Antimicrobial stewardship is to encourage the OTC prescription of antibiotics agents[1] | 89 (44.5%) |
| Knowledge score (median (IQR) (out of 10) | 6 (3) |

0: True, 1: False.

**Table 3** Assessment of community pharmacists' perception towards antimicrobial stewardship programmes ($n$ = 200)

| Statements | Agree/Strongly agree n (%) | Neutral $n$ (%) | Disagree/Strongly disagree $n$ (%) |
|---|---|---|---|
| Perceived role of community pharmacists in Antimicrobial stewardship | | | |
| Antimicrobial stewardship should be applied at the community pharmacy level | 147 (87.0%) | 25 (12.5%) | 1 (0.5%) |
| Community pharmacists should have sufficient training and education on Antimicrobial stewardship | 185 (92.5%) | 14 (7.0%) | 1 (0.5%) |
| For better knowledge and practice regarding ASPs, community pharmacists should attend workshops and conferences | 179 (89.5%) | 19 (9.5%) | 2 (1.0%) |
| The only ones that should be involved in Antimicrobial stewardship are doctors and nurses | 53 (26.5%) | 62 (31.0%) | 85 (42.5%) |
| The responsibility of Antimicrobial stewardship relays on community pharmacists | 130 (65.0%) | 52 (26.0%) | 18 (9.0%) |
| Perceived importance of Antimicrobial stewardship | | | |
| Antimicrobial stewardship will reduce inappropriate use of antibiotics | 177 (88.5%) | 22 (11.0%) | 1 (0.5%) |
| Antimicrobial stewardship will improve patient's clinical outcomes | 169 (84.5%) | 29 (14.5%) | 2 (1.0%) |
| Antimicrobial stewardship will reduce healthcare cost | 160 (80.0%) | 38 (19.0%) | 2 (1.0%) |
| Antimicrobial stewardship will reduce antimicrobial resistance | 171 (85.5%) | 27 (13.5%) | 2 (1.0%) |
| Antimicrobial stewardship improves the cost-effectiveness of health care sectors | 168 (84.0%) | 30 (15.0%) | 2 (1.0%) |
| Antimicrobial stewardship improves the collaboration between healthcare providers | 175 (87.5%) | 24 (12.0%) | 1 (0.5%) |

On the other hand, Figure 3 illustrates the perceived motivation for community pharmacists to participate in Antimicrobial stewardship. Results showed that 90.0% of the respondents ($n$ = 180) agreed/strongly agreed that ASPs would boost public health confidence in community pharmacists, as well as 86.0% of the respondents ($n$ = 172) believed that ASPs would enhance the job satisfaction of pharmacists.

Linear regression analysis shows the relationship between community pharmacist's characteristics and knowledge scores (Table 4). The univariable analysis shows a significant relationship between gender and community practice with knowledge score. Still, after the multivariate analysis, only the gender remains significant, and it showed that being female is associated with a significantly higher knowledge score ($P$-value = 0.045).

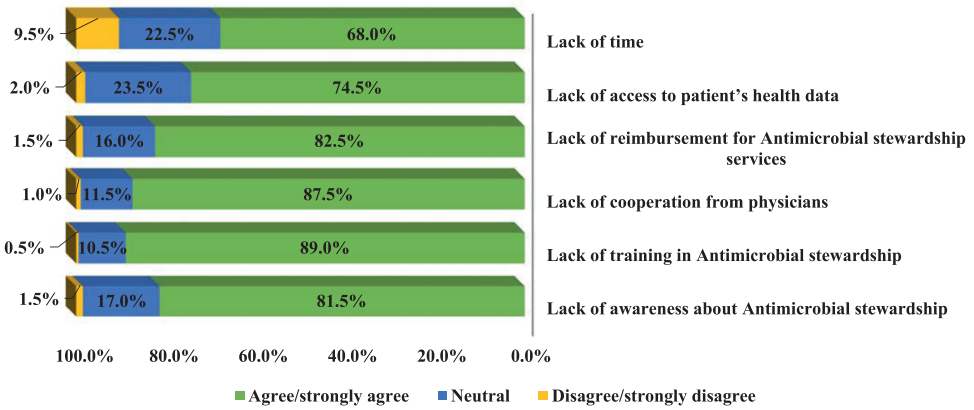


**Figure 2** Perceived barriers towards the application of antimicrobial stewardship programmes ($n$ = 200).

## Discussion

The misuse of antibiotics has become common in most of the world's nations, including Jordan, due to the easy accessibility for antibiotics. Such frequent use has led to increasing antimicrobial resistance.[20] Therefore, the responsibility of controlling the irrational use of antibiotics rests on the health care sectors, including pharmacists.[17] Pharmacist's plays a crucial role in reducing antimicrobial resistance through the implementation of ASPs.[17] Hence, evaluating community pharmacist's knowledge and perception in Jordan regarding ASPs is an important step to illustrate its potential. Up to our knowledge, there is no previous study investigated the knowledge and perception of community pharmacists regarding ASPs in Jordan. Therefore, this study was conducted to assess the knowledge and perception of community pharmacists towards antibiotics and ASPs.

Most participants in this study were female 64.5%, with a median age of 30 years old and community practice experience 5 years. Such finding shows that most of the participants were in middle age with qualified experience and qualifications. This study brought out that those community pharmacists had good knowledge of antibiotics and a positive perception regarding ASPs. The result of this study reinforces the previous studies indicating the crucial role of pharmacists in controlling the irrational use of antibiotics.[21, 22]

The majority of community pharmacists answered all the administered knowledge questions correctly. However, 11% of the respondents were not aware that antibiotics don't treat viral infections, 56.5% of the respondents were not aware that antibiotics don't always kill normal flora and 15% of the respondents were not aware that antibiotics should not always be indicated for fever. Those results correlate with a study in Pakistan that highlighted the good knowledge of community pharmacists, where 84.5% of the respondents agreed that antibiotics could treat bacterial infection. However, 39% of the respondent was not aware that antibiotics are not useful for viral infections.[1]

This study revealed that community pharmacists are not familiar with ASPs, 76% of the respondents believed that ASPs is a programme that would increase the treatment duration to ensure therapeutic efficacy, and 55.5% of them believed that ASPs encourage the OTC prescription of antibiotics agents, despite that 81% of the respondent claim to attend a course/workshop about ASPs.

After defining the meaning of ASPs to the recruited pharmacists, most of the respondents (87%) agreed that ASPs should be applied at the community pharmacy level. This finding is similar to other study conducted in Pakistan with percentage of 78% agreed on that [1] but with less percentage in Yemen (50.7%),[23] and in Ethiopia (26.5%).[17] More than half of respondents, 65% agreed that the responsibility of ASPs relays on community pharmacists; which aligns with the findings in Yemen study 62.5%.[23] However, these percentages were higher in Malaysia (93%).[24] While almost all the participants agreed that the responsibility relays on community pharmacists in Pakistan [1] and Ethiopia.[17] However, another study carried in Malaysia finds that only 27.6% of community pharmacists agreed that ASPs should be incorporated at the community pharmacy level, which conflicts with this study which revealed that 87% of community pharmacists agreed that ASPs should be applied at the community pharmacy level.[24] The researchers of that study explained their finding that there is an under-utilization by community pharmacists in Malaysia to combat the antimicrobial resistance, although there is a positive support to incorporate ASPs at the community pharmacy level throughout the world.[24, 25]

Based on the importance of ASPs, most pharmacists believed that ASPs would reduce antimicrobial resistance and improve the collaboration between health care providers. About 89% of the respondents agreed that ASPs would reduce inappropriate use of antibiotics; this finding is in line with a study in Tasmania, where the percentage was 8.4%. Also, about 80% of our respondents believed that ASPs will reduce health costs.[26] This result correlates with Rizvi et al.'s study, where 78% of pharmacists believed that ASPs will reduce health cost.[26]

In this study, pharmacists believe that ASPs will improve patient outcomes. This result was similar to that results in another study, where 87.5% of Pakistani pharmacists agreed that ASPs would improve patient outcome.[1] Moreover, 85.5% of respondents agreed that ASPs would reduce antimicrobial resistance; this result correlates with Ethiopia's study, where the percentage was 82.5%.[17]

In this study, community pharmacists believed that their incorporation in ASPs will enhance the public image of pharmacists and will enhance the job satisfaction of pharmacists; this finding correlates with a study in Tasmania were 82.1% and 79.1% of participant agreed that their incorporation in ASPs would enhance both public image and job satisfaction of pharmacists, respectively.[26]

Regarding the perceived barriers of community pharmacists towards the application of ASPs, the lack of training in ASPs and lack of cooperation from physicians were the main barriers, while in Tasmania, the main barriers were the lack of access to patient health data and the lack of cooperation of General physician.[26] This

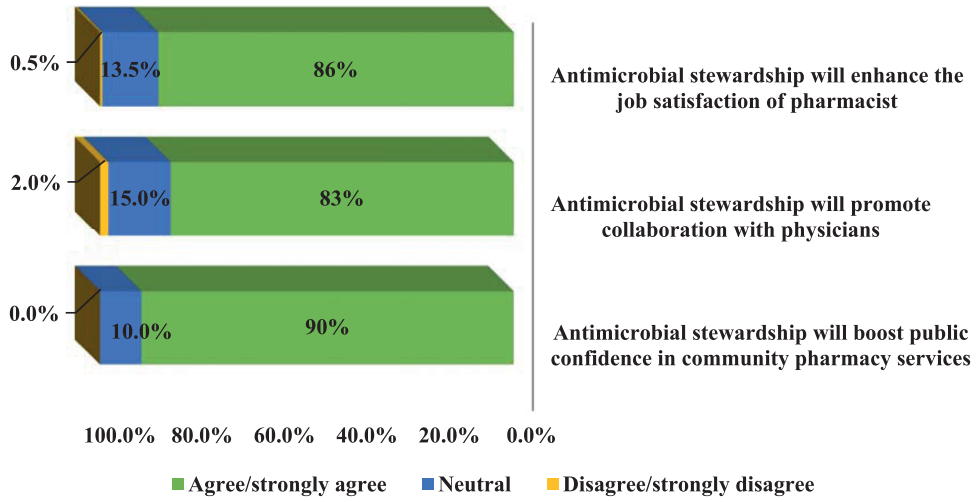


**Figure 3** Perceived motivators to participate in antimicrobial stewardship ($n = 200$).

**Table 4** Regression analysis to evaluate factors affecting the knowledge score of community pharmacists regarding the knowledge about antibiotics and antimicrobial stewardship programmes ($n = 200$)

| Parameter | Knowledge score | | | |
|---|---|---|---|---|
| | β | *P*-value# | β | *P*-value$ |
| Age (years) | 0.117 | 0.1 | --- | --- |
| Gender | | | | |
| Male | Reference | | | |
| Female | 0.147 | 0.038# | 0.141 | 0.045* |
| Educational level | | | | |
| Bachelor | Reference | | | |
| Post graduate | –0.12 | 0.864 | --- | --- |
| Community practice experience | 0.143 | 0.043# | 0.138 | 0.500 |
| Site of work | | | | |
| Independent community pharmacy | Reference | | --- | --- |
| Chain community pharmacy | –0.016 | 0.820 | | |
| Place of residence | | | | |
| Amman | Reference | | | |
| Other | 0.073 | 0.307 | --- | --- |
| Number of patients you provide a service to them/day | | | | |
| <50 | Reference | | | |
| ≥50 | –0.071 | 0.316 | ---- | ---- |
| Have you ever attended a course/ workshop about Antimicrobial Stewardship programmes? | | | | |
| No | Reference | | | |
| Yes | 0.033 | 0.647 | --- | --- |

# using simple linear regression, $ using multiple linear regression, # factors that are eligible for entry into multiple linear regression analysis: * significant at 0.05 significance level.

study highlighted that the university courses 91.5% are the primary resource for knowledge and can target pharmacists to perform ASPs tasks efficiently.

Based on the regression analysis, this study highlighted factors that may affect pharmacists' knowledge about ASPs. Results showed that females have a higher knowledge score than males. No explanation for this finding was found.

## Limitation and strengths

This is the first study in Jordan to evaluate community pharmacists' knowledge and perception towards ASPs in Jordan, with a randomly wide sample of community pharmacists participated in this study. However, this study is based on a convenience sample that was collected via electronic questionnaire which might be subjected to selection bias. Also, most of the participants were from Amman (the capital of Jordan) and thus, the study findings might not be representative to the entire community pharmacy population.

## Conclusion

This study highlighted that community pharmacists have a good in antibiotics and a positive perception regarding ASPs. Pharmacists

showed great support for their involvement in ASPs, and they also encouraged the incorporation of ASPs in the community pharmacy level. Incorporation ASPs in the community pharmacy level is crucial to control antimicrobial resistance throughout the world.

## Authors Contributions

Doaa Saleh: Data collection and entry, data analysis and manuscript writing. Rana Abu Farha: Idea conception and study design, data analysis and manuscript writing. Feras Darwish El-Hajji: Idea conception and study design and manuscript writing.

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## Conflict of Interest

None of the authors have any conflict of interest.

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