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Validation and implementation of a national survey to assess antimicrobial stewardship awareness, practices and perceptions amongst community pharmacists in Australia

Tasneem Rizvi[a,*], Angus Thompson[a], Mackenzie Williams[a], Syed Tabish R. Zaidi[a,b]

[a] Pharmacy, School of Medicine, College of Health and Medicine, University of Tasmania, Private Bag 26, Hobart, TAS 7001, Australia
[b] School of Healthcare, University of Leeds, Leeds LS2 9JT, UK

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ABSTRACT

Objectives: Antimicrobial stewardship (AMS) programmes are well established in hospitals, yet such programmes have not been widely implemented in the community. Understanding current practices and perceptions of community pharmacists about AMS may provide insights into the implementation of AMS in community pharmacies. The aims of this study were to validate a questionnaire to measure community pharmacists' perceptions of AMS and to explore barriers and facilitators to their involvement in community-based AMS initiatives.
Methods: A 44-item survey questionnaire comprising sections on demographics, AMS practices and perceptions of community pharmacists, and barriers and facilitators to AMS was hosted online. Community pharmacists were recruited through social media pages of community pharmacist groups across Australia. Cronbach's alpha and exploratory factor analysis were used to measure the reliability and validity of the survey tool, respectively.
Results: A total of 330 community pharmacists started the survey, with 255 of them completing at least one question. Pharmacists were more likely to intervene with general practitioners (GPs) (≥80% of the time) for allergies, dosing and drug interactions and were less likely to intervene if they felt the choice of antibiotic was inappropriate (45%). Major barriers limiting pharmacists' participation in AMS were lack of access both to patient data (82.6%) and to a standard guideline to implement AMS programmes (72.1%). Almost all pharmacists (98%) reported that better collaboration with GPs would improve their participation in AMS initiatives.
Conclusion: Future studies utilising the knowledge gained from this study may provide a framework for AMS in community pharmacy settings.

1. Introduction

The World Health Organization (WHO) has declared antimicrobial resistance (AMR) a major global threat. One of the strategies to reduce AMR is to control inappropriate use of antimicrobials [1]. Antimicrobial stewardship (AMS) is a set of co-ordinated interventions and initiatives to promote the appropriate and judicious use of antimicrobials without compromising patients' quality of healthcare [2]. The Australian Commission on Safety and Quality in Health Care (ACSQHC) recommends AMS programmes (ASPs) in hospitals [3], and pharmacists have a routine and recognised role in these programmes [4].

However, AMR is becoming a growing concern in the community, which is where most antimicrobials (88%) are prescribed, and one-half of these prescriptions are considered inappropriate [2]. Hence, there is an urgent need for engaging suitable resources and stakeholders, including community pharmacists, to support the implementation of such AMS initiatives in the community. Community pharmacists are currently offering several professional services such as health screening, vaccination and chronic disease management, suggesting their desire and willingness to translate their traditional supply-centred role into a more advanced clinical role [5,6].

There is an unmet need to ensure that measures are in place for effective participation of community pharmacists in AMS activities [6,7]. Therefore, to assess the current knowledge and perception of community pharmacists regarding AMS, we developed and tested a questionnaire in one state of Australia (Tasmania) [8]. The

* Corresponding author.
E-mail address: tasneem.rizvi@utas.edu.au (T. Rizvi).

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response of the pilot study was limited and therefore there was a need to validate the questionnaire on a larger scale. Hence, the objectives of this study were to implement and test the survey questionnaire at a national level in order to identify gaps in knowledge and to explore community pharmacists' current practices and perceptions regarding AMS.

2. Methods

2.1. Questionnaire

Data were collected through an online questionnaire that was developed and tested in another similar, but smaller, study (Fig. 1), details of which have been published elsewhere [8]. In brief, the 44-item survey questionnaire, comprising sections on: demographics; current AMS practices; the perceived importance of, barriers to and facilitators of AMS; as well as a section about the awareness of NPS MedicineWise initiatives (see Appendix 1). NPS MedicineWise is an Australian not-for-profit independent organisation that is leading national initiatives to reduce inappropriate antibiotic prescribing [9]. The MedicineInsight programme, Resistance Fighter campaign and Antibiotic Awareness Day are some of the key initiatives of NPS MedicineWise to make stakeholders aware of the AMR threat and to educate them regarding rational antibiotic use [9].

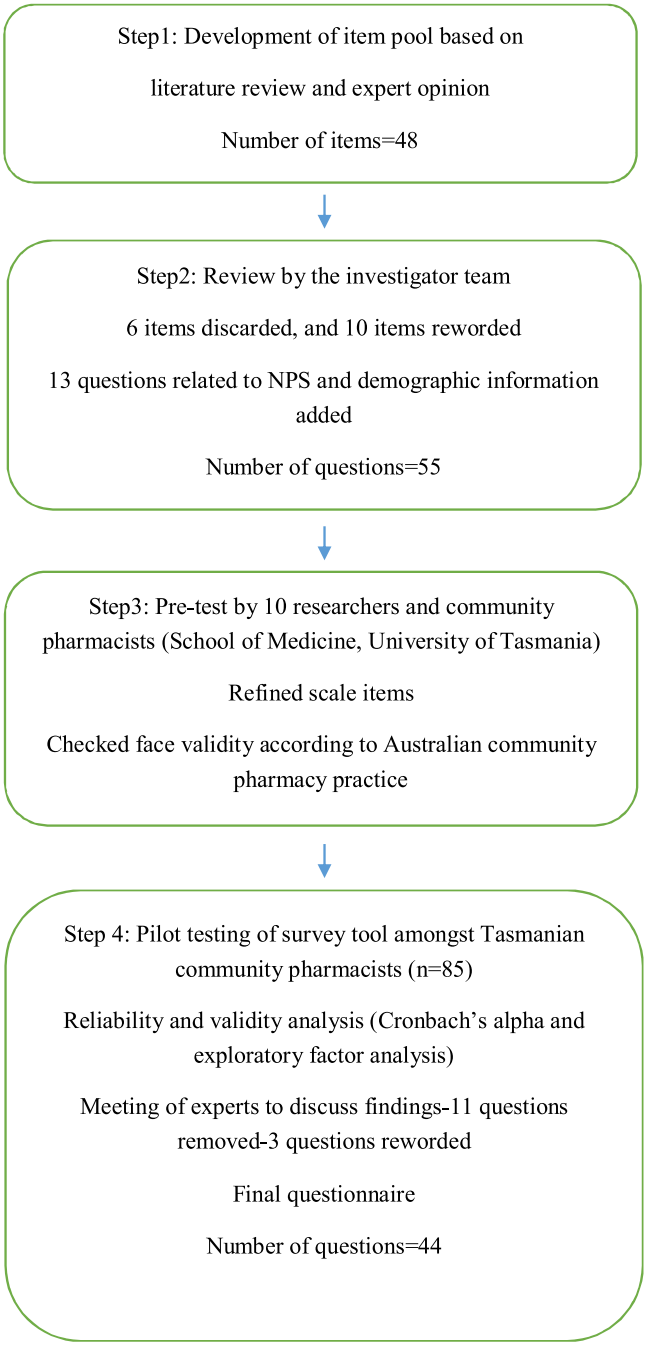

Fig. 1. Development of the questionnaire.

2.2. Survey implementation

The survey was hosted on the web survey platform LimeSurvey®, which is an open-source survey tool, between November 2016 to February 2017 [10]. Community pharmacists were invited through e-mails to the leading pharmacy chain stores and the Pharmaceutical Society of Australia. Advertisements on Facebook pages of pharmacist communities representing various states of Australia were also posted. The invitation e-mails and advertisements contained a link to the questionnaire along with a mobile-enabled scanning code (QR code) and details on how to enter a draw to win one of twenty A$50 gift cards. At the end of the survey, the winners of the draw were randomly selected.

2.3. Data analysis

Data collected via LimeSurvey® was exported to Microsoft Excel® (Microsoft Corp., Redmond, WA, USA) and IBM SPSS Statistics v.22 (IBM Corp., Armonk, NY, USA) for analysis. A mixed methods approach was adapted to analyse the results of different sections of the survey. Demographics were tabulated as numbers, frequencies, percentages and averages. Principal axis factoring (PAF) technique was used to determine the validity of perception scales, namely perceived importance of, barriers to implementation and facilitators of AMS in community pharmacies. Cronbach's alpha (α) was used to determine the reliability of the identified factors.

3. Results

3.1. Demographics

Table 1 presents the demographic characteristics of the community pharmacists who participated in the survey. A total of 330 community pharmacists accepted the invitation by clicking on the link, with 255 of them completing at least one question (as participants were able to skip questions). There was a proportionate distribution of responses from different Australian states and territories, with the majority (69.3%) from metropolitan areas. The median age of respondents was 29 years and their median experience was 6 years. The majority (74%) of participants felt that they were aware of the term 'AMS', although 86% of them reported a better understanding of AMS after reading the formal definition.

3.2. Awareness of the national quality initiatives

Most of the respondents knew about the resources provided by NPS MedicineWise related to rational use of antibiotics (74%) and were aware that NPS MedicineWise has dedicated 1 week for antibiotic awareness (73%). Most respondents knew about the 'Resistance Fighter' campaign co-ordinated by NPS MedicineWise (62%). However, fewer respondents reported using the patient education resources available from the NPS MedicineWise website (39%), whilst some respondents were not even aware that such

Table 1
Demographic characteristics of survey respondents (N = 255).

Characteristic	n (%)
Sex (N = 227)	
Male	78 (34.4)
Female	148 (65.2)
Prefer not to disclose	1 (0.4)
State/territory (N = 228)	
NSW	62 (27.2)
QLD	54 (23.7)
VIC	45 (19.7)
ACT	6 (2.6)
SA	20 (8.8)
WA	28 (12.3)
TAS	8 (3.5)
NT	5 (2.2)
Highest level of pharmacy education completed (N = 229)	
Bachelor's degree	177 (77.3)
Master's degree	33 (14.4)
Doctorate degree	3 (1.3)
Other	16 (7.0)
Age (N = 225)	Median 29 years (IQR 26–36 years)
Experience (N = 225)	Median 6 years (IQR 4–12 years)
Geographical location of work (N = 228)	
Metropolitan	158 (69.3)
Rural	63 (27.6)
Remote	7 (3.1)

IQR, interquartile range; NSW, New South Wales; QLD, Queensland; VIC, Victoria; ACT, Australian Capital Territory; SA, South Australia; WA, Western Australia; TAS, Tasmania; NT, Northern Territory.

resources were present (22%). Most of the respondents responded positively regarding the likelihood of pharmacies utilising the resources provided by the NPS MedicineWise (61%).

3.3. Current practices

The most frequent AMS activities reported by community pharmacists were contacting the prescriber about drug interactions (95.2%), allergies (98.4%) and antibiotic doses (83.8%) (Table 2). Pharmacists were less likely (44.8%) to contact prescribers if they considered the selection of an antibiotic to be inappropriate. Most of the respondents reported that they frequently guided patients regarding over-the-counter treatment options (88.9%) and referred patients to a general practitioner (GP) if symptoms were suggestive of infection (76.6%) (Table 2). Participants reported that they frequently provide clear messages on expected side effects (80.0%), however comparatively fewer reported that they explain what should be done if a patient experiences a side effect (74.5%). Similarly, most of the respondents frequently advise patients when it is appropriate to use an antibiotic repeat (85.1%), but fewer reported that they discuss with patients the appropriateness of a repeat antibiotic prescription at the time of dispensing (68.5%).

3.4. Validity and reliability of the perception scales

The survey results related to perception scales are outlined in Tables 3 and 4. The values of the Kaiser–Meyer–Olkin test and Bartlett's test of sphericity were 0.53 and $P < 0.001$, respectively, indicating the suitability of exploratory factor analysis (EFA) in the study sample [11] (see Appendix 2). PAF was used for extraction, and Oblimin with Kaiser Normalisation was used as a rotation technique. The rotated solution for the three perception scales yielded four factors: perceived importance of AMS, comprising 5 items (Cronbach's α = 0.787); perceived operational barriers to AMS, comprising 3 items (Cronbach's α = 0.637); perceived barriers related to GPs' support, comprising 3 items (Cronbach's α = 0.740); and perceived facilitators, comprising 6 items (Cronbach's α = 0.671) (see Appendix 2). The item related to monetary compensation did not load on any factor but was kept as a standalone item owing to its support in the qualitative data and as per the authors' opinion.

3.5. Perceived importance

Most respondents (94.8%) agreed that community pharmacists could play a vital role in implementing AMS in the community setting. Furthermore, a similar proportion of respondents perceived that the associated healthcare costs would be decreased (93.1%) and that inappropriate use of antibiotics would be reduced (91.9%) by improved community AMS. Pharmacists indicated that AMS initiatives in the community setting would increase job satisfaction (83.3%) and enhance the public image (80.9%) of community pharmacists.

3.6. Perceived barriers

The major barriers identified by the respondents were lack of access to patients' records to review the appropriateness of antibiotic prescriptions (82.6%) and lack of access to standard guidelines to implement AMS. Most pharmacists believed GPs are not receptive when pharmacists intervene regarding the choice of antibiotic (78.3%). However, most respondents did not consider lack of time (60.3%) or lack of training (54.4%) as barriers to AMS activities.

3.7. Perceived facilitators

The major facilitator identified by the respondents in carrying out AMS activities in the community was better collaboration with

Table 2
IQR of item scales: current antimicrobial stewardship (AMS) practices in community pharmacies.[a]

Scale/item	Participant's response [n (%)]		Median (IQR)
	Scoring ≤3	Scoring ≥4	
Providing clear messages on expected side effects (n = 255)	51 (20.0)	204 (80.0)	4 (4–5)
Providing clear messages on what should be done if a patient experiences a side effect (n = 255)	65 (25.5)	190 (74.5)	4 (3–5)
Contacting the prescriber if the patient is allergic to the prescribed antibiotic (n = 252)	4 (1.6)	248 (98.4)	5 (5–5)
Contacting the prescriber if the antibiotic dose/frequency is too high or too low (n = 253)	41 (16.2)	212 (83.8)	5 (4–5)
Contacting the prescriber if the prescribed antibiotic involves a drug interaction (n = 251)	12 (4.8)	239 (95.2)	5 (5–5)
Contacting the prescriber if the choice of antibiotic may not be optimal (n = 250)	138 (55.2)	112 (44.8)	3 (2–4)
Recommending OTC/self-care treatment to patients with symptoms of infection not needing antibiotics (n = 252)	28 (11.1)	224 (88.9)	5 (4–5)
Referring patients to a GP when symptoms are suggestive of an infection (n = 253)	6 (2.4)	247 (97.6)	5 (5–5)
Providing advice on when it would be appropriate to use the repeat prescription (n = 255)	38 (14.9)	217 (85.1)	4 (4–5)
Discussing with patient to determine whether it is appropriate for them to use the presented repeat prescription (n = 254)	80 (31.5)	174 (68.5)	4 (3–5)

IQR, interquartile range; OTC, over-the-counter; GP, general practitioner.
[a] Current practices measured on a scale of 1–5, where 1 = do not practice at all and 5 = practice all the time.

Table 3
IQR of item scales: perceived importance of and barriers to antimicrobial stewardship (AMS) in community pharmacies.[a]

Scale/item	Participant's response [*n* (%)]		Median (IQR)
	Scoring ≤4	Scoring ≥5	
Perceived importance of AMS			
Community pharmacists can play an important role in AMS (*n* = 248)	13 (5.2)	235 (94.8)	6 (5–7)
AMS will reduce healthcare costs associated with infections (*n* = 247)	17 (6.9)	230 (93.1)	7 (6–7)
AMS will enhance the public image of pharmacists (*n* = 246)	47 (19.1)	199 (80.9)	6 (5–7)
AMS will enhance the job satisfaction of pharmacists (*n* = 245)	41 (16.7)	204 (83.3)	6 (5–7)
AMS will reduce inappropriate antibiotic use (*n* = 248)	20 (8.1)	228 (91.9)	6.5 (5–7)
Perceived barriers to AMS: operational barriers			
I do not have the required training to participate in AMS (*n* = 239)	130 (54.4)	109 (45.6)	4 (3–5)
I do not have enough time to participate in AMS (*n* = 239)	144 (60.3)	95 (39.7)	4 (3–5)
Limited access to patients' records to review appropriateness of antibiotic prescriptions (*n* = 241)	42 (17.4)	199 (82.6)	6 (5–7)
There are no standard guidelines to implement AMS (*n* = 233)	65 (27.9)	168 (72.1)	5 (4–6)
Perceived barriers to AMS: perceived support from GPs			
GPs are not receptive to pharmacists intervening on the choice of antibiotic (*n* = 240)	52 (21.7)	188 (78.3)	6 (5–7)
GPs are not receptive to pharmacists intervening on the dose and dosage form of antibiotic (*n* = 240)	86 (35.8)	154 (64.2)	5 (4–6)
GPs are not receptive to pharmacists intervening on the duration of antibiotic (*n* = 240)	86 (35.8)	154 (64.2)	5 (4–6)

IQR, interquartile range; GP, general practitioner.
[a] Perceived importance and barriers were measured on a scale of 1–7, where 1 = strongly disagree and 7 = strongly agree.

Table 4
IQR of item scales: perceived facilitators of antimicrobial stewardship (AMS) in community pharmacies.[a]

Item	Participant's response [*n* (%)]		Median (IQR)
	Scoring ≤3	Scoring ≥4	
Increased provision of education activities regarding AMS (*n* = 234)	22 (9.4)	212 (90.6)	4 (4–5)
Public awareness initiatives highlighting community pharmacists in AMS (*n* = 234)	11 (4.7)	223 (95.3)	5 (4–5)
Access to guidelines for common community infections (*n* = 232)	6 (2.6)	226 (97.4)	5 (4–5)
Better collaboration with local GP practices (*n* = 234)	4 (1.7)	230 (98.3)	5 (4–5)
Clarification of the duties of pharmacists' professional organisations (*n* = 229)	38 (16.6)	191 (83.4)	4 (4–5)
Better access to patients' clinical and laboratory data (*n* = 234)	16 (6.8)	218 (93.2)	5 (4–5)
Monetary compensation for the time involved in AMS programmes (*n* = 231)	29 (12.6)	202 (87.4)	5 (4–5)

IQR, interquartile range; GP, general practitioner.
[a] Perceived facilitators measured on a scale of 1–5, where 1 = unhelpful and 5 = most helpful.

local GP practices (98.3%). Mirroring some of the responses to questions about barriers, pharmacists reported that facilitators would be the availability of one standard antibiotic guideline for prescribers and pharmacists, access to patients' clinical and laboratory data, public awareness campaigns, and provision of AMS-related educational activities for community pharmacists. Other facilitators considered somewhat helpful included monetary compensation and clarification of AMS duties expected of pharmacists by their professional organisations.

3.8. Qualitative analysis

A thematic analysis of the qualitative comments is presented in Appendix 3. The major issues highlighted by the respondents in carrying out routine AMS activities included: lack of access to patients' records and laboratory data; inappropriate use of antibiotic repeats; use of different antibiotic guidelines by prescribers; and lack of clarity regarding the AMS role of community pharmacists. Respondents further stressed that their limited role in AMS is due to lack of access to patients' records, which causes uncertainty as to why an antibiotic is in a given dose, dosage form and duration, hence they hesitate to intervene. Respondents also pointed out limited public awareness regarding AMR that leads to unnecessary demand for repeat antibiotic prescriptions. They specifically pointed out inconsistencies and apparent mistakes in doses prescribed for paediatric patients. Participants also pointed out operational limitations in carrying out AMS-related activities and they suggested that community pharmacists should be professionally recognised and compensated for the provision of AMS services. Participants reported that unnecessary prescribing of and consumer demand for antibiotics is gradually decreasing, but that this could be further reduced if a comprehensive AMS model is introduced in the community.

4. Discussion

The proven benefits of pharmacists in ASPs in hospital settings suggest that they can also play an important role in community pharmacy AMS services [12–15]. Whilst pharmacists are willing to contribute to AMS [16], so far the majority of AMS studies involving primary care interventions have been aimed only at GPs working in the USA, Europe or North America [17]. The results of the present study provide an insight into the AMS knowledge as well as the current practices and perceptions of Australian community pharmacists. A mixed methods approach was used to validate the survey tool developed in the pilot study published elsewhere [18]. Reliability analysis and EFA helped to examine the internal structure of the questionnaire.

4.1. Main findings

The results of this national study found that the majority of Australian community pharmacists are aware of the term 'AMS' but do not have an in-depth understanding of it. They need better access to AMS educational resources provided by the pharmaceutical bodies and agencies tasked with improving quality use of medicine, such as NPS MedicineWise. The study found that the majority of pharmacists perceive that the AMS resources of NPS MedicineWise are not effectively promoted and they are unable to easily access them. AMS education, policies and regulations in community settings are still evolving in other countries as well. According to the US Society of Infectious Diseases Pharmacists

(SIDP), pharmacists have an essential role in the implementation of ASPs and, without relevant knowledge of AMS, community pharmacists cannot play their desired role [6,19]. The current findings are in accordance with other studies in which community pharmacists were found to be willing to participate in educational activities related to AMS [20,21]. However, AMS-related educational intervention studies involving implementation of antibiotic guidelines, diagnostic skills and communication skills focus only on clinics and prescribers practicing in them, and there is a paucity of data regarding the role of community pharmacists in AMS [6].

While carrying out their routine pharmacy activities, most respondents agreed that they regularly provide patients with information regarding side effects and how to effectively use repeat antibiotic prescriptions, and guide patients to non-antibiotic symptomatic therapy alternatives. These results can be compared with the studies of Dyar et al. and Blanchette et al. confirming that community pharmacists are playing an important role in patient education, particularly about when and how to take prescribed antibiotics [6,22]. The survey participants also reported that they frequently intervene with prescribers if the dose, dosage form or duration of antibiotic is not appropriate and if there is a potential of drug interaction or allergy. However, pharmacists less frequently intervene with prescribers regarding choice of antibiotics. These results are similar to a study conducted in the USA regarding the role of pharmacists, where most of the pharmacists could not change the selection of antibiotics even knowing that it is not appropriate [23]. This finding may also relate to the lack of access to patients' records by pharmacists, thus not being aware of the exact diagnosis hindering the pharmacist from contacting the prescriber. Presently, community pharmacists in Australia cannot access patient's clinical data to confirm the appropriateness of prescribed antibiotics, but there are a number of initiatives taken recently by national and international bodies aiming to improve community AMS practices. The most recent of these in Australia is that pharmacists will be able to access patients' electronic health records [24]. However, maximum benefits can only be achieved when complete information and ease of access to these data is given to community pharmacists [25].

The majority of responding community pharmacists believe that they can play an important role in AMS and can help reduce inappropriate antibiotic use and healthcare costs. However, most of the survey respondents did not agree that it would help in further professional recognition or enhance their public image in the community. It may be because there is no professional degree or AMS course for specialisation in AMS. This is unlike the situation in the USA [6], North America [26] and Europe [27] where AMS as a specialised community pharmacy service is an emerging and growing profession.

The major barriers identified in this survey were lack of access to patients' records and lack of any standard guideline to practice AMS. Some of the respondents also highlighted the need for better collaboration with GPs regarding dose, duration, dosage form and particularly choice of antibiotic. In 2015, Bryant conducted a survey in Australia and New Zealand which found that physicians and pharmacists perceive lack of education, lack of dedicated staff, and lack of willingness to change as reasons for slow implementation of AMS [28].

The responses of the facilitators scale mirrored the responses of the barriers scale. Most of the pharmacists agreed that professional AMS training, public awareness campaigns, better pharmacist–GP collaboration and access to patients' records would be helpful in effectively carrying out AMS activities.

4.2. Practice implications

The best AMS practices for community pharmacies in Australia, like in many other countries, are not yet defined. The current study provides an insight into the practices, perceptions and awareness of community pharmacists regarding AMS. These findings can help overcome challenges related to the implementation of an effective AMS model in the community. Most of the perceptions of community pharmacists are directing us towards changing the professional behaviours and systems for effective AMS activities. Organisations interested in developing and implementing AMS initiatives in community settings should consider addressing some of the barriers identified in this study so that community pharmacists can be engaged in such initiatives in a meaningful way.

4.3. Limitations

Although responses were received from all the states and territories of Australia, we acknowledge the limitations of response bias thus limiting the generalisability of the findings. Certain community pharmacists are less likely to respond to online surveys, hence having only a limited spectrum of respondents was one of the limiting factors of this study. Similarly, it was difficult to take a representative sample population based on visits to social media website and e-mail links. Owing to an acceptable but low Cronbach's α of the perceived operational barriers and perceived facilitators scales, there is a need that the questionnaire should be confirmed for validity in another confirmatory survey.

5. Conclusions

Here we report the findings of a survey development and validation study to measure the perceptions of Australian community pharmacists regarding AMS. Once validated, the survey tool may assist other researchers who are interested in measuring the perceptions of community pharmacists about AMS in their practice. Pharmacists in this study regarded their role as antimicrobial stewards as an important one, although several barriers related to the practice settings, patients' perceptions and their interaction with GPs were limiting their participation in AMS. Organisations interested in implementing AMS initiatives in community settings should address such barriers to encouraged greater involvement of community pharmacists.

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Competing interests

None declared.

Ethical approval

This study was approved by the Tasmanian Human Risk Ethics Committee (HREC) in April 2016 [approval no. H0015673].

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jgar.2019.08.025.

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