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The impact of a multi-faceted intervention on non-prescription dispensing of antibiotics by urban community pharmacies in Indonesia: a mixed methods evaluation

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ABSTRACT

Introduction Non-prescription antibiotic dispensing is prevalent among community pharmacies in several low- and middle-income countries. We evaluated the impact of a multi-faceted intervention to address this challenge in urban community pharmacies in Indonesia.

Methods A pre-post quasi-experimental study was carried out in Semarang city from January to August 2022 to evaluate a 7-month long intervention comprising: (1) online educational sessions for pharmacists; (2) awareness campaign targeting customers; (3) peer visits; and (4) pharmacy branding and pharmacist certification. All community pharmacies were invited to take part with consenting pharmacies assigned to the participating group and all remaining pharmacies to the non-participating group. The primary outcome (rate of non-prescription antibiotic dispensing) was measured by standardised patients displaying symptoms of upper respiratory tract infection, urinary tract infection (UTI) and seeking care for diarrhoea in a child. χ^2 tests and multivariate random-effects logistic regression models were conducted. Thirty in-depth interviews were conducted with pharmacists, staff and owners as well as other relevant stakeholders to understand any persistent barriers to prescription-based dispensing of antibiotics.

Findings Eighty pharmacies participated in the study. Postintervention, non-prescription antibiotics were dispensed in 133/240 (55.4%) consultations in the participating group compared with 469/570 (82.3%) in the non-participating group (p value <0.001). The pre-post difference in the non-prescription antibiotic dispensing rate in the participating group was 20.9% (76.3%–55.4%) compared with 2.3% (84.6%–82.3%) in the non-participating group (p value <0.001). Non-prescription antibiotics were less likely to be dispensed in the participating group (OR=0.19 (95% CI 0.09 to 0.43)) and more likely to be dispensed for the UTI scenario (OR=3.29 (95% CI 1.56 to 6.94)). Barriers to prescription-based antibiotic dispensing included

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Previous studies suggest that educational interventions can help improve antibiotic dispensing practices, especially among health professionals such as doctors, nurses and other allied medical staff working in hospitals and health centres.

⇒ Far less is known about their impact among community pharmacies, including when they are combined with other approaches such as awareness campaigns, peer supervision, branding and certification.

WHAT THIS STUDY ADDS

⇒ Preintervention, we found a high rate of non-prescription antibiotic dispensing by community pharmacies of 76.3% and 84.6% in the participating and non-participating groups respectively.

⇒ Our multifaceted intervention resulted in a 20.9% reduction in the rate of non-prescription antibiotic dispensing in the participating group to 55.4%.

⇒ In the participating group, those who continued dispensing antibiotics without a prescription reported doing so because of financial motives, customer demand and the absence of a pharmacist in their outlet.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Multifaceted interventions targeting community pharmacists and their customers have a pivotal role to play in addressing inappropriate dispensing of antibiotics and tackling antimicrobial resistance.

⇒ An antimicrobial stewardship programme led by community pharmacists in collaboration with local health departments is urgently needed to promote the judicial use of antibiotics in Indonesia.

fear of losing customers, customer demand, and no supervising pharmacist present.

Interpretation Multifaceted interventions targeting community pharmacies can substantially reduce non-prescription antibiotic dispensing. Future studies to evaluate the implementation and sustainability of this intervention on a larger scale are needed.

INTRODUCTION

Antibiotics are one of the most commonly prescribed drugs worldwide, with a 46% increase in consumption between 2000 and 2018.[1] Inappropriate antibiotic use, which includes inappropriate dispensing by a non-qualified and/or unlicensed dispenser,[2] is shown to lead to longer hospital stays, higher medical costs and increased mortality,[2 3] as well as being a major driver of antibiotic resistance.[4] Most evidence on the prevalence of antibiotic resistance and antibiotic dispensing practices comes from hospital settings.[5] However, antibiotics are also widely dispensed without a prescription or appropriate advice at community pharmacies, including for the treatment of viral infections, against which they are ineffective.[6–8]

Community pharmacies, also known as retail pharmacies, are an important source of healthcare worldwide and play a key role in antibiotic stewardship in community settings including providing information, education and communication to patients, optimisation of antibiotic treatment to outpatients, and communication and/or education to other health professionals.[9 10] However, concerns about the growing problem of antibiotic dispensing without a prescription have led many countries including Indonesia to introduce laws prohibiting the practice. Despite this, around two-thirds of antibiotics dispensed by community pharmacies worldwide, continue to be sold without a prescription.[7 11 12] In Indonesia, this estimate is even higher at around 70%.[8] Antibiotics are commonly given in incorrect doses and without appropriate counselling by a non-pharmacist, which is also against the law in Indonesia[13] and many other low- and middle-income countries (LMICs).[14]

Indonesia and the rest of the world urgently need to change the way antibiotics are used. Even if new antibiotics are developed, without behaviour change, antibiotic resistance will remain a major threat. Community pharmacists are ideally placed as antibiotic stewards to help contain the threat of antimicrobial resistance (AMR). The engagement of community pharmacies and the identification of effective behaviour change interventions are among the WHO's global research priorities for AMR.[15]

However, a variety of factors are known to influence the dispensing of antibiotics without a prescription including the desire among pharmacy staff and owners to maximise income especially in highly competitive medicine retail markets,[12 16] customer pressure,[17 18] lack of knowledge among pharmacy staff[19] and weak industry and legal regulation by government authorities.[2 12] Multifaceted interventions that target multiple barriers simultaneously are needed,[20] yet very few studies report on the implementation and evaluation of such interventions.[21 22] Existing studies in pharmacy settings typically focus on a single intervention most commonly educational and training activities,[23–25] and target clinical pharmacists working at hospitals and clinics that have different roles and responsibilities to community pharmacists.[26]

The current study evaluated the impact of a multifaceted intervention targeting pharmacists and their customers which combined educational sessions, an awareness campaign, peer supervision, branding and certification in an effort to reduce the use of non-prescription antibiotics in community pharmacies in Indonesia. We compared rates of non-prescription antibiotic dispensing before and after the intervention using standardised patients (SPs), a widely used approach for measuring the quality of healthcare.[27] Evidence from this study could feed into the national strategy for antimicrobial stewardship in Indonesia and similar contexts where the involvement of community pharmacists as potential agents of change has not been addressed or considered.

METHODS

Design

PINTAR (Protecting Indonesia from the Threat of Antibiotic Resistance) was a controlled, pre-post quasi-experimental study conducted from May 2021 to September 2022. Preintervention data collection took place in November 2021, which was after the second wave of the COVID-19 pandemic in mid-2021. The postintervention data was collected in September 2022. During the course of the intervention, the number of new COVID-19 cases increased slightly in February 2022 (see online supplemental appendix 1).

Setting

This study was conducted in Semarang, a city located in Central Java Province in Indonesia with a population of around 1.7 million[28] (online supplemental appendix 2). In 2021, the city had 279 registered community pharmacies consisting of 214 independent pharmacies and 65 chain pharmacies. An independent pharmacy is a pharmacy which is privately owned and managed by a pharmacist or a small business owner.[29] Chain pharmacies are usually operated under private or state-owned companies and follow a centralised management franchise system.[30] In Indonesia, pharmacies can be attached to general practitioners (GPs) or specialist private practices and/or clinical laboratories located in the same compound.[31]

Participants and recruitment

The primary unit of intervention in this study was the community pharmacy with pharmacists-in-charge as the participants. All community pharmacies in Semarang were invited to participate in the intervention and identified either through the city health office registry or by staff in the city health office. Advertisements about the study were shared with pharmacists-in-charge of each outlet via a WhatsApp group managed by the Indonesian Pharmacist Association (IAI) of Semarang City. Online information sessions were also held with pharmacists, pharmacy owners and branch managers of chain pharmacies in Semarang to provide more detailed information about the study.

Recruitment of participants took place from May 2021 to January 2022. Invitation letters, study information sheets and consent forms were sent by the research team to all pharmacists-in-charge via the WhatsApp group. Those who responded to the invitation were telephoned or messaged by the research team who answered any remaining questions. Scanned copies of all consent forms were sent to the research team via WhatsApp and hard copies were collected 1 week before the intervention commenced. Consenting pharmacists from each community pharmacy were assigned to the 'participating group'. Those who refused to participate or did not respond after two reminders, were assigned to the 'non-participating group'. Flowchart of recruitment is shown in online supplemental appendix 3.

Sample size

A sample size of 80 community pharmacies, hence 80 community pharmacists, in each group was required to detect an overall reduction in non-prescription antibiotic dispensing from 50% to 27% among child diarrhoea cases, 74% to 51% among urinary tract infections (UTI) and from 56% to 33% among upper respiratory tract infections (URTI) (80% power, two-sided alpha=5%). These prevalence rates were reported in our previous SP surveys of non-prescription antibiotic dispensing in Indonesia.[8]

Intervention

The intervention was primarily delivered online via the WhatsApp messaging application, which is the most popular messaging application in Indonesia.[32] Based on the location of the pharmacies, participants were assigned to WhatsApp groups, each with 8–9 members, facilitated by a trained senior pharmacist and one administrator from the research team. These groups remained the same throughout the intervention. The four intervention components are detailed in online supplemental appendix 4. Each component was delivered sequentially over a 7-month period (online supplemental appendix 5).

Component 1: online educational sessions (month 1)

Online educational sessions were conducted over a 3-week period via the WhatsApp groups, commencing in the first month of the intervention. These groups were facilitated by a trained senior pharmacist supported by an administrator from the research team. The three learning modules were based on a case-based approach, whereby participants worked in groups to discuss and solve open-ended problems[23] (online supplemental appendix 6). The learning modules were developed by the research team, drawing on existing literature on international and national guidelines for AMR[33 34] as well as the national guidelines for pharmaceutical services in pharmacies.[35–37] Drafts of the curriculum and modules were discussed in a workshop attended by the AMR national officer of WHO Indonesia, representatives from the Ministry of Health and the national committee for AMR control, academics from the faculties of Pharmacy and Medicine at the Universitas Gadjah Mada, national and local IAI as well as the pharmacist facilitators. Daily attendance, active participation and weekly quizzes were assessed by the facilitators. Participants were asked to disseminate key learnings and materials to other staff at their own pharmacy through available applications (usually WhatsApp) or in-person meetings.

Component 2: awareness campaign (months 2–7)

After completing component 1, a campaign using printed information, education and communication (IEC) materials targeting pharmacy customers was conducted in all participating pharmacies for six consecutive months. Leaflets, posters, flyers, notebooks, flipbooks with messaging on appropriate antibiotic use were displayed at each participating pharmacy. These materials were designed by the research team with input from a range of groups including behaviour change experts from UNICEF and Diponegoro University, a communication expert from a local academy for tourism, and local community representatives attending a public event organised by the city health office. Monthly visits to each pharmacy were conducted by the research administrator to monitor the uptake of campaign materials and refresh stocks as needed.

Component 3: peer supervision (months 3 and 6)

Peer supervision visits were designed to provide motivational support for participating pharmacists in improving antibiotic dispensing behaviour. Peer supervisors, who were also WhatsApp group facilitators, were trained by the research team on how to conduct supportive supervision using a manual designed specifically for the PINTAR study (available on request from the lead author, AF) assisted by a group administrator. Peer supervisors made two visits to participating pharmacies. The first visit was conducted virtually via the Zoom platform 2 months after the completion of component 1 to discuss changes and barriers to antibiotic dispensing experienced after the educational sessions. This was followed by virtual small group meetings to develop an action plan to address these barriers. The second visit was conducted face-to-face 3 months after the first visit to discuss the implementation of action plans, followed by a large group face-to-face meeting in which all participating pharmacists made a joint pledge to use antibiotics responsibly.

Component 4: branding and certification (months 2–7)

Standing banners displaying messages that antibiotics will only be sold to customers with a prescription were installed by the research team at participating pharmacies. Pharmacies that actively participated in the intervention were recognised on social media platforms including Instagram, asked to give a talk on antibiotic use on community radio and invited to take part in a podcast on antibiotic resistance with the city health office that was streamed to local health professionals and communities. Certification and credit points from the national IAI were awarded to those pharmacists that completed all educational sessions (component 1), shared knowledge of good antibiotic dispensing practices with their coworkers and displayed IEC materials at their outlets for at least 6 months (component 2). These were assessed by the research team and local IAI using a scoring criteria form. Credit points from the IAI could go towards the renewal of a pharmacist's 5-year professional license.

Assessment and outcome evaluation

Demographic data collected at baseline from each participating pharmacist included: age; sex; educational level; years of experience as a community pharmacist; date operational license was issued; size of the pharmacy (ie, number of staff); and whether a GP or specialist practice was linked to the pharmacy.

SP surveys

SP surveys were conducted to assess the primary outcome (non-prescription dispensing of an antibiotic, with or without the client requesting it) at 2-months preintervention and 1-month postintervention. SPs were recruited from the local community. Eight SPs were employed for the preintervention survey, two males and six females. For the postintervention survey, seven SPs were involved of which only one was male. Preintervention, all SPs took part in a 5-day training workshop conducted by the research team and by an expert in SP training from the Universitas Gadjah Mada.

SPs visited all pharmacies in Semarang where they presented the main symptoms for three clinical scenarios: UTI; URTI; and child with diarrhoea. These scenarios were chosen because they were either commonly occurring self-limiting viral infections not requiring antibiotic treatment (ie, URTIs and diarrhoea) or for the UTI scenario where, symptoms are often caused by a bacterial infection and antibiotics should only be dispensed on prescription (online supplemental appendix 7). Each pharmacy was visited three times on different days by an SP portraying one scenario. The process for requesting antibiotics involved three steps. First, after describing their symptoms, SPs requested some medication (unspecified). Second, if antibiotics were not offered, SPs would ask for one. Third, if staff from the pharmacy still did not offer to dispense an antibiotic, the SP showed a paper note or text message from a mobile phone with the name of the antibiotic they wanted to purchase (amoxicillin).

After each interaction, SPs completed an electronic questionnaire on a project smartphone using the KOBOCollect application. Data collected included: (1) age and gender of the attending staff based on SP's observation, (2) whether the attending staff member was a pharmacist or not—this was determined by observing staff nametags or by directly asking them, (3) distance from the pharmacy to the city health office, (4) pharmacy structure, that is, standalone pharmacy or pharmacy attached to a GP/specialist clinic; (5) pharmacy ownership (chain pharmacy or independent pharmacy); (6) whether any other IEC materials on antibiotic stewardship were displayed; (7) waiting time to be attended to by pharmacy staff; and (8) behaviour of pharmacy staff during interactions including: any questions about symptoms; type and dosage of any antibiotics dispensed; and any advice provided on what to do if symptoms persisted. If antibiotics were not given, any reasons for this were also recorded. Receipts and packaging from the antibiotics were photographed and securely stored by the research team.

In-depth interviews

A purposive sample of 30 participants representing a cross-section of stakeholders involved in the study were interviewed to explore any barriers to maintaining good antibiotic dispensing practices. Interviewees included: eleven participating pharmacists; six pharmacy staff (eg, pharmacy technician); six pharmacy owners; and seven stakeholders from the local district health office, the pharmaceutical division of the Ministry of Health, and the local pharmacist's association. Interviews were conducted 1 month after the intervention had been completed at the participant's place of work by trained qualitative researchers. All interviews were audio-recorded (with permission) and conducted face-to-face except for two that were conducted via the Zoom platform. Each interview lasted 45–60 minutes and was conducted in Indonesian language.

Data management and analysis

Data from the KOBO Toolbox were downloaded into Microsoft Excel and exported to STATA V.14 (StataCorp, College Station, TX, USA). Descriptive statistics were used to analyse rates of antibiotic dispensing and characteristics of participating pharmacies and pharmacists. Mean and medians were used to describe continuous variables depending on normality of the distribution. Differences in rates of non-prescription antibiotic dispensing were compared between non-participating and participating groups using χ^2 tests. Given the clinical scenarios are not independent observations (ie, applied to the same pharmacy), a random effects model was selected to evaluate the intervention.[38 39] Multivariate random effects logistic regression was used to determine predictors of non-prescription antibiotic dispensing among all participants at postintervention. Predictors included the type of clinical case as well as pharmacist and pharmacy characteristics.[27 40 41] All variables in the univariate analysis with a p value less than 0.05 were included in the multivariate analysis.

Table 1 Characteristics of pharmacies at preintervention

Variable	Participating n (%) N=80	Non-participating n (%) N=190
Median distance to the pharmacy from the city health office (km)	7.3 (IQR=7.1)	5.7 (IQR=5.7)
Pharmacy structure		
Standalone pharmacy	41 (51.2)	130 (68.4)
Pharmacy attached to GP/specialist clinic	39 (48.8)	60 (31.6)
Pharmacy ownership		
Independent pharmacy	51 (63.7)	154 (81.1)
Chain pharmacy	29 (36.3)	36 (18.9)

GP, general practitioner.

For the qualitative component, all interviews were transcribed verbatim by the interviewers and then translated from Bahasa Indonesia into English for analysis. Coding and categorisation using an inductive approach[42] were performed independently by two researchers (AF and MH) using OpenCode software (University of Umeå, Sweden). Coding schemes were compared, with any discrepancies in codes resolved through discussion until a consensus was reached. Periodic debriefing with the larger research team was also undertaken to ensure rigour in the qualitative analysis.[43] When no new themes were appearing, it was concluded that data saturation had been reached.

RESULTS

Characteristics of pharmacies and pharmacists

Of the total 270 pharmacies in Semarang, 81 consented to take part in the intervention. The characteristics of the pharmacies are displayed in table 1, showing that there was a higher proportion of chain pharmacies and pharmacies attached to GP/specialist clinics in the participating group than in the non-participating group.

A total of 95 pharmacists were enrolled across the 81 participating pharmacies (results not shown here). One pharmacy and two pharmacists dropped out of the study due to time constraints. Therefore, a total of 93 pharmacists from 80 pharmacies completed the intervention (online supplemental appendix 2). Of these, 80 participating pharmacists were female and 13 male with a median age of 33 years (IQR=8). The median number of years working as a community pharmacist was 8 years (IQR=7) and the median number of years working in their current pharmacy was 4 years (IQR=6). One-third of pharmacists worked for a chain pharmacy.

At preintervention, the rate of antibiotic dispensing without a prescription in the participating group was significantly lower compared with the non-participating group (76.3% vs 84.6%, respectively, p value=0.02). At postintervention, the rate of antibiotic dispensed without a prescription in the participating group was 55.4% compared with 82.3% in the non-participating group, that is, a 26.9% difference (p value <0.001). Between preintervention and postintervention, the rate of antibiotic dispensed without a prescription in the participating group fell by 20.8% (76.3%–55.4%) compared with 2.3% (84.6%–82.3%) in the non-participating group (p value <0.001) (figure 1).

For all clinical scenarios at postintervention, the rate of non-prescription antibiotic dispensing in the participating group was significantly lower than for the non-participating group (table 2). The largest difference between participating and non-participating groups in the rate of non-prescription antibiotic dispensing was 42.4% for the URTI scenario (41.3% in the participating group vs 83.7% in the non-participating group; p value <0.001), followed by 23.3% for the diarrhoea scenario (52.5% in the participating group vs 75.8% in the non-participating group; p value <0.001) and finally, 14.9% for the UTI scenario (72.5% in the participating group vs 87.4% in the non-participating group; p value=0.003); all differences were statistically significant.

Meanwhile, the reduction in the dispensing rate of non-prescription antibiotics for the participating and non-participating groups between preintervention and postintervention are as follows: URTI 38.7% versus 4.2%

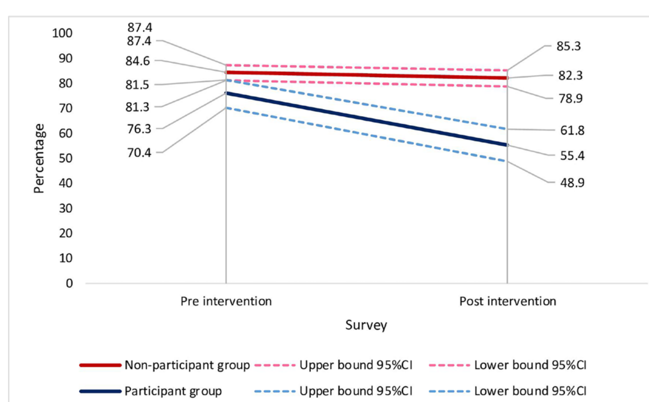

Figure 1 Rate of dispensing antibiotics without a prescription at preintervention and postintervention.

Table 2 Rates of non-prescription antibiotic dispensing for each and all clinical scenarios

	Child diarrhoea		UTI		URTI		Total	
	Antibiotic dispensed n (%)	P value	Antibiotic dispensed n (%)	P value	Antibiotic dispensed n (%)	P value	Antibiotic dispensed n (%)	P value
Preintervention								
Non-participating	147/190 (77.4)	0.090	168/190 (88.4)	0.118	167/190 (87.9)	0.092	482/570 (84.6)	0.005
Participating	54/80 (67.5)		65/80 (81.3)		64/80 (80.0)		183/240 (76.3)	
Postintervention								
Non-participating	144/190 (75.8)	<0.001	166/190 (87.4)	0.003	159/190 (83.7)	<0.001	469/570 (82.3)	<0.001
Participating	42/80 (52.5)		58/80 (72.5)		33/80 (41.3)		133/240 (55.4)	

URTI, upper respiratory tract infection; UTI, urinary tract infection.

(p value <0.001); child diarrhoea 15.0% versus 1.6% (p value <0.001); and UTI 8.8% versus 1.0% (p value=0.003).

Predictors of dispensing antibiotics without a prescription at postintervention

Postintervention, the univariate analysis also showed that the likelihood of dispensing an antibiotic without a prescription was lower in the participating group and in pharmacies attached to a GP/specialist clinic. In contrast, dispensing an antibiotic without a prescription was more likely in pharmacies that dispensed antibiotics without a prescription at preintervention, in pharmacies attended by older pharmacy staff, where SPs were female, and for the UTI scenario. The multivariate analysis showed that the likelihood of dispensing an antibiotic without a prescription was less likely in the participating group than the non-participating group but more likely in pharmacies that dispensed antibiotics without a prescription at preintervention and for the UTI scenario (table 3). Subgroup analysis of chain and independent pharmacies also showed that being in the participant group resulted in lower odds of dispensing antibiotics without prescription after adjusting for other covariates (results are not shown).

Types of antibiotics dispensed

Figure 2 shows the change in the proportion of antibiotics dispensed between the participating group and non-participating group at preintervention and postintervention. Between preintervention and postintervention, an increase in the use of amoxicillin was seen in both groups which was probably influenced by the SP request, but the increase was larger in the non-participating group. The use of fradiomycin/gramicidin decreased in both groups while the use of pipemidic acid increased in the participating group but remained the same in the non-participating group. A decline in the use of nifuroxazide was evident in both groups.

Reasons for dispensing antibiotics without a prescription

Despite the significant decline in the rate of non-prescription antibiotic dispensing, our SP survey showed that around 50% of participating pharmacists did not change their behaviour. Our interviews revealed several reasons for this. First, pharmacists were fearful of losing customers who would then choose an alternative pharmacy. One owner mentioned, 'We have experienced that if we refuse to give antibiotics without prescription, we lost customers' (205-3, pharmacy owner).

For this reason, requests for non-prescription antibiotics were not refused outright but often partly met by staff offering a smaller dosage than recommended. One pharmacy staff member mentioned, 'If I stop (dispensing antibiotics) then it will affect sales, so sometimes I offer small doses, for example, 1–2 blisters' (386-2, pharmacy staff).

While many pharmacists realised that giving non-prescription antibiotics was prohibited, they admitted to succumbing to pressure exerted by pharmacy owners to maximise sales: 'Well … I always say [to customers] they must come with a prescription, but my boss [the owner] objects. One time there was a customer who insisted and debated with me. Eventually, I got a warning—[the owner] sent me a warning letter' (278-1, pharmacist). Another interviewee said the owner gave them a particularly harsh warning: '… if you don't give antibiotics, you will receive no salary!' (403-1, pharmacist).

Interviewees reported that it was common for customers who were initially refused an antibiotic to push pharmacy staff to give them antibiotics. 'Sometimes I would offer them other alternative, but if they say, 'I want amoxicillin', they would refuse other drugs' (396-2, pharmacy staff). Interviewees also noted that some customers would bargain for lower dosages of antibiotics, send another family member to try and buy antibiotics without a prescription, or ask for antibiotic lozenges as a 'milder' form of antibiotic.

Some interviewees stated they were more inclined to give non-prescription antibiotics to customers showing signs of infection, needing antibiotics for children or older people, with a history of using the same antibiotic, employed as a health worker or claiming to have an old prescription at home. 'If they said that they have been prescribed before, I would give them [antibiotics]. But I would also mention that next time they should see a

Table 3 Predictors of dispensing antibiotics without a prescription at postintervention

Predictors	Antibiotic dispensing		Univariate analysis		Multivariate analysis	
	No n (%)	Yes n (%)	OR (95% CI)	P value	OR (95% CI)	P value
Arms						
Non-participating group	101 (48.6)	469 (77.9)	1		1	
Participating group	107 (51.4)	133 (22.1)	0.12 (0.06 to 0.25)	<0.001	0.14 (0.07 to 0.30)	<0.001
AB dispensing without a prescription at preintervention						
No	84 (40.4)	61 (10.1)	1		1	
Yes	124 (59.6)	541 (89.9)	8.09 (4.29 to 15.25)	<0.001	6.97 (3.51 to 13.84)	<0.001
Pharmacy structure						
Standalone pharmacy	105 (50.5)	408 (67.8)	1		1	
Pharmacy attached to GP/ specialist clinics	103 (49.5)	194 (32.2)	0.30 (0.14 to 0.64)	0.002	0.56 (0.27 to 1.15)	0.117
Distance between the pharmacy and the department of health office (in km)			0.95 (0.87 to 1.04)	0.300		
Was a pharmacist available during the visit?						
No	102 (49.0)	349 (58.0)	1			
Yes	106 (51.0)	253 (42.0)	0.68 (0.39 to 1.17)	0.164	0.64 (0.36 to 1.14)	0.131
Gender of attending pharmacy staff						
Male	15 (7.2)	59 (9.8)	1			
Female	193 (92.8)	543 (90.2)	0.76 (0.32 to 1.78)	0.529		
Age of attending pharmacy staff						
40 years or below	184 (88.5)	477 (79.2)	1		1	
41 years or above	24 (11.5)	125 (20.8)	2.21 (1.08 to 4.53)	0.030	1.92 (0.90 to 4.09)	0.090
Visit time						
Night	55 (26.4)	152 (25.3)	1			
Day	153 (73.6)	450 (74.7)	1.07 (0.60 to 1.92)	0.807		
Gender of SP						
Male	46 (22.1)	95 (15.8)	1		1	
Female	162 (77.9)	507 (84.2)	2.01 (1.12 to 3.60)	0.018	0.98 (0.44 to 2.21)	0.960
Scenario						
Child diarrhoea	84 (40.4)	186 (30.9)	1		1	
UTI	46 (22.1)	224 (37.2)	4.20 (2.29 to 7.70)	<0.001	3.41 (1.63 to 7.12)	0.001
URTI	78 (37.5)	192 (31.9)	1.22 (0.73 to 2.03)	0.447	0.97 (0.50 to 1.86)	0.926

xtlogit.
AB, antibiotics; SP, standardised patient; URTI, upper respiratory tract infection; UTI, urinary tract infection.

doctor first. Usually they argue that it is too far or closed on Sundays' (338-1, pharmacist).

Another reason given for dispensing non-prescription antibiotics was a lack of oversight from a qualified pharmacist. Despite regulations stipulating that antibiotics can only be dispensed by a pharmacist on presentation of a prescription, this was not always the case. A representative from the Ministry of Health said: 'For pharmacists, the big problem [in the pharmacy] is attendance. The attendance of pharmacists is not that good. There is an impression that pharmacists are not always present' (Ministry of Health staff).

Finally, our intervention focused primarily on pharmacists-in-charge who were subsequently responsible for sharing materials and learnings from the educational sessions with colleagues in their workplace. Some pharmacy technicians and other attending staff admitted they had a limited knowledge of guidelines and regulations on antibiotic use. One interviewee stated, 'I did not know any regulation on antibiotics. Or maybe I was not up to date.

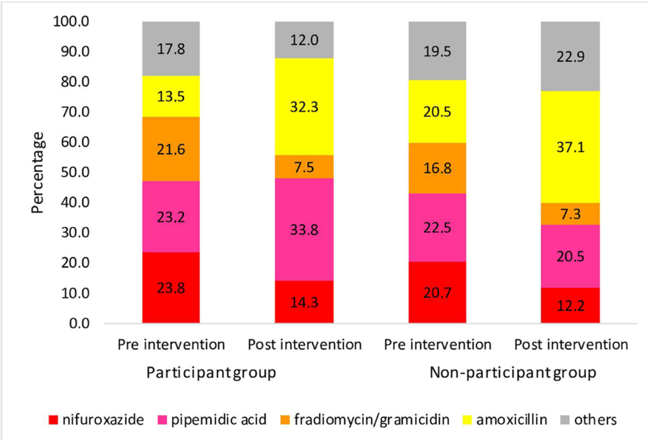

Figure 2 Types of antibiotics dispensed without a prescription at preintervention and postintervention.

Because the regulation about antibiotics is not really clear, unlike [the regulation on] psychotropic agents' (386-2, pharmacy staff).

DISCUSSION

To control the spread of AMR, many countries including Indonesia have introduced laws and policies to prevent the dispensing of antibiotics without a prescription. These laws appear to be having limited impact on the antibiotic dispensing practices of community pharmacies which are often the main source of antibiotics in the community.[12] While multi-faceted interventions targeting various groups and combining different activities, have shown promise in public health facilities, comparatively little is known about their effectiveness in the community pharmacy setting. Our preintervention and postintervention SP surveys, showed that an intervention consisting of online educational sessions, awareness campaign, peer supervision, branding and certification, has the potential to reduce the rate of antibiotic dispensing without a prescription by around 21%, starting from a baseline of 76.3%. A reduction of this size could translate into important gains for Indonesia, a country of around 275 million people and an antibiotic consumption rate that has increased 2.5-fold between 2000 and 2015.[44]

The multivariate analysis revealed two important predictors of non-prescription antibiotic dispensing. First, those in the non-participating group were more likely to dispense antibiotics without a prescription, reflecting the positive effect of the intervention. Second, it showed that antibiotics were more likely to be dispensed without a prescription to SPs displaying UTI symptoms. This could be driven for example by the high frequency of UTI complaints in pharmacies and the complexity of diagnosing UTIs in some patient groups such as older adults.[45 46] The latter may have led some pharmacy staff to question the value of testing, erring on the side of caution by dispensing non-prescription antibiotics.[47] Pharmacy staff serving repeat clients with suspected UTIs may also be more willing to dispense non-prescription antibiotics—a finding corroborated by our qualitative results which showed that some pharmacy staff were more inclined to dispense non-prescription antibiotics to clients if they had a history of using the same antibiotic.

While our intervention resulted in a significant reduction in the dispensing of non-prescription antibiotics, it was concerning to find that around half of all pharmacies in the participating group were still dispensing antibiotics without a prescription after completing the intervention. Participants in our study reported several systematic barriers to improving antibiotic dispensing behaviour that related to the behaviour of customers, owners and pharmacy staff. Previous studies have shown that while most pharmacists have adequate knowledge of what it means to appropriately dispense antibiotics, pressure exerted by customers, owners and even the pharmaceutical industries in the larger ecosystem, prevent many staff from putting that knowledge into practice.[18 30 48] Moreover, while licensed pharmacists are required to be present at community pharmacies during business hours and are expected to provide oversight on antibiotic use,[49] many studies including this one have demonstrated that this is rarely the case.[30]

To date, most interventions to improve the quality of antibiotic use in community pharmacies have focused on educational approaches addressing the cognitive skills of staff with modest improvements in dispensing behavior.[22 50] It has been posited that the lack of multifaceted approaches may explain the absence of strong evidence of the effectiveness of pharmacist-based interventions in the field.[8 18] Studies that have evaluated multifaceted interventions typically rely on self-reported measures of antibiotic dispensing without a prescription which might be subject to observer bias.[51 52] Our multifaceted intervention, evaluated covertly using SPs, improved antibiotic dispensing practices through educational sessions that combined different learning methods for pharmacists[22 24] and educational campaigns targeting customers.[53] These educational approaches were supported by promoting adherence to regulation on antibiotic use using peer supervision, which has been used in previous studies among drug sellers in similar settings.[54 55]

Strengths and limitations

A major strength of the intervention and the study design was the way it was embedded into the real-world activities of pharmacies and city health office teams responsible for supervising and monitoring community pharmacies. For example, the accreditation component of the intervention was linked to the continuing professional education scheme for community pharmacists in Indonesia.[56] The use of the SP methodology was another strength of the study. This approach is widely referred to as the 'gold standard' for measuring the quality of healthcare due to its ability to avoid typical biases or confounding issues often associated with alternative measures such as interviews and vignettes.[27 57 58] In contrast, a key limitation of this study was that only around one-third of all pharmacies in Semarang agreed to take part in the intervention. This may have partly been due to a tradition of limited engagement with community pharmacies by local health authorities,[59] exacerbated during the recent COVID-19 pandemic.[31] From a methodological viewpoint, it could also be argued that the 7-month evaluation period and the one-month interval between completion of the intervention and the SP survey was too short to determine whether the improvements observed are sustainable. Spill-over effects from participating pharmacists to non-participating pharmacists cannot be ruled out - these could result from the unintentional dissemination of new knowledge through existing Whatsapp groups or local events run by pharmacist associations. To address this concern, rules for sharing materials were established at the start of the intervention when it was also noted that all participants would have access to the intervention materials at the end of the study. Measurement of spill-over effects was not within the scope of the study and could be a topic for future research. Finally, while quasi-experimental designs used in real-world settings tend to have higher external validity,[60] the risk of selection bias and its impact on internal validity cannot be excluded.

CONCLUSIONS AND RECOMMENDATIONS

An antimicrobial stewardship programme led by community pharmacists in collaboration with local health departments is urgently needed to promote the judicial use of antibiotics in Indonesia. Our study has taken an important step in this direction by designing a multifaceted intervention targeting pharmacy staff and customers that has the potential to substantially reduce non-prescription antibiotic dispensing among community pharmacies in urban settings. There is however still a way to go in changing antibiotic dispensing practices on a large scale. Our qualitative results, highlighting several persistent barriers to behaviour change, can help to further refine the PINTAR intervention for expanded implementation in Indonesia and other LMICs experiencing high rates of non-prescription antibiotic dispensing among community pharmacies. Any future adaptation and scale-up of the intervention should also consider the use of innovative recruitment and retention approaches to ensure high participation and sustained behaviour change among those working in the community pharmacy setting.

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Patient consent for publication Not applicable.

Ethics approval This study involves human participants and the data collection, management and analysis were conducted in compliance with a protocol approved by the medical and health research ethics committees of the Universitas Gadjah Mada (KE/FK/0161/EC/2019) and the University of New South Wales (HC191012). On ethics approval, a research permit and a letter of introduction to the study was provided by the Semarang city government. Supporting letters for the intervention were also obtained from the Indonesian Pharmacist Association of Semarang City. Copies of the permit and letters were sent via WhatsApp to all participating pharmacies. Informed consent for the SP survey was waived by both committees, but written informed consent was obtained from all interviewees. All intervention procedures were conducted following the safety precautions for COVID-19 prevention including the use of facemasks and physical distancing during face-to-face interactions.

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