

Community Pharmacies, Drug Stores, and Antibiotic Dispensing in Indonesia: A Qualitative Study

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Abstract

Background

Inappropriate dispensing of antibiotics at community pharmacies is an important driver of antimicrobial resistance (AMR), particularly in low- and middle-income countries. Thus, a better understanding of dispensing practices is crucial to inform national, regional, and global responses to AMR. This requires careful examination of the interactions between vendors and clients, sensitive to the context in which these interactions take place.

Methods

In 2019, we conducted a qualitative study to examine antibiotic dispensing practices and associated drivers in Indonesia, where self-medication with antibiotics purchased at community pharmacies and drug stores is widespread. Data collection involved 60 in-depth interviews with staff at pharmacies and drug stores (n = 31) and their clients (n = 29), conducted in an urban (Bekasi) and a semi-rural location (Tabalong) to capture different markets and different contexts of access to medicines. Interview transcripts were analysed using thematic content analysis.

Results

A common dispensing pattern was the direct request of antibiotics by clients, who walked into pharmacies or drug stores and asked for antibiotics without prescription, either by their generic/brand name or by showing an empty package or sample. A less common pattern was recommendation to use antibiotics by the vendor after the patient presented with symptoms. Drivers of inappropriate antibiotic dispensing included poor knowledge of antibiotics and AMR driving patient demand, financial incentives to maximise medicine sales in an increasingly competitive market, the unintended effects of health policy reforms, and weak regulatory enforcement.

Conclusions

Inappropriate dispensing of antibiotics in community pharmacies is the outcome of complex interactions between vendors and clients, shaped by wider and changing socio-economic processes. Concerted action should be taken to address this complexity and involve such providers in the development and implementation of AMR national action plans.

Introduction

Antimicrobial resistance (AMR) occurs when microbes evolve in response to the medicines that are used to treat them, reducing their therapeutic effectiveness. It is estimated that drug resistant infections will

cause 10 million deaths annually by 2050 if appropriate measures are not taken [1]. In addition, infections caused by drug resistant microbes can lead to a two-fold increase in adverse outcomes in comparison with similar infections caused by susceptible strains; adverse outcomes may be clinical (including death) or economic due to higher costs of care and indirect costs associated with loss of income [2, 3].

While AMR occurs naturally, it is accelerated by widespread misuse and overuse of antimicrobials worldwide [4]. Indeed, global estimates indicate that 60% of antibiotics are sold without prescription in community pharmacies [5] and self-medication with antibiotics is a common practice, particularly in low- and middle-income countries (LMICs) [6]. Thus, a better understanding of these practices is crucial to inform national, regional, and global responses to AMR. In turn, this requires careful examination of the types of interactions between vendors and clients, sensitive to the context in which these interactions take place.

This paper examines these issues within the country context of Indonesia. Surveys of antibiotic use in Indonesia have consistently reported inappropriate dispensing in the private sector amidst concerns about alarming rates of AMR [7, 8]. Notably, a study in Semarang province found that resistance of *Streptococcus pneumoniae* to cotrimoxazole was 45% and non-susceptibility rates to penicillin were around 24% [9]. *Escherichia coli* isolates from hospital discharged patients also showed high rates of resistance to ampicillin (73%), cotrimoxazole (56%) and ciprofloxacin (22%) [10].

In light of this, the government has taken several steps to tackle this problem, including the adoption of the first action plan on AMR in 2017 [11]. As in many other countries, however, AMR policy and interventions in Indonesia have largely focused on the public health system with little attention to the private sector [12]. In addition, the evidence to inform policy has been derived primarily from prevalence or knowledge, attitude and practice surveys [13, 14], with inadequate understanding of contextual drivers of AMR and associated practices. Considering this gap in knowledge, our paper presents findings from a qualitative study that aimed to better understand how and why non-prescribed antibiotics are dispensed at community pharmacies and other private drug stores in Indonesia. After a description of the research context and the methods, the following sections report the study findings and discuss their implications for AMR policy in Indonesia and similar contexts.

Private drug sellers and AMR in Indonesia

Indonesia is the fourth most populous country in the world, with a population of more than 270 million [15]. Following decades of economic growth, the country recently advanced to upper-middle income status in its World Bank income-based classification. Health care is delivered by a mixed public-private health system [16]. The public health sector is decentralised and consists of community health centers (*puskesmas*) at the subdistrict level and state hospitals at the district and provincial levels. The private sector is large and diverse. It includes not-for-profit faith-based organisations, for-profit private practices, clinics and hospitals, and practitioners of traditional medicine. In 2014, the government introduced a new health insurance scheme – the *Jaminan Kesehatan Nasional* (JKN) - to increase access to care and

move towards universal health coverage. This scheme provides Indonesian citizens who pay the monthly premium (or are eligible for an exemption) with access to care and essential medicines, including antibiotics, at public health facilities and participating private health facilities including community pharmacies [17].

As in many other LMICs, pharmacies and other private drug sellers are generally the first port of call for around 90% of patients with mild illness [18]. This is a prolific and dynamic business sector which includes big retail chains, independent pharmacies (*apotek*), drug stores (*toko obat*) and unlicensed grocery stores (*warung*) which also sell over-the-counter drugs such as common cold medicines, antipyretics, and analgesics. The expansion of this sector can be traced back to the 1970s when Suharto's government embraced economic liberalisation, opening the country to foreign investments. In this period, more than 30 international pharmaceutical companies established operations in Indonesia, and generic products began to be manufactured locally [19]. In the 2010s, the government implemented several pricing policies to make generic drugs more affordable, promoting further expansion of the pharmaceutical sector [20]. Today, it is estimated that more than 22,000 pharmacies and 5,000 licensed drug stores operate throughout the country, supported by more than 2,400 pharmaceutical staff [21].

By Indonesian law, antibiotics can only be sold by a pharmacist after presentation of a prescription and drug stores are not allowed to sell antibiotics [22]. In addition, a qualified pharmacist must always be available at pharmacies during opening times, although ownership of a pharmacy is not restricted to pharmacists [23]. Despite these regulations, past studies [7, 14] and a recent survey [8] found that inappropriate antibiotic dispensing was widespread at community pharmacies, raising concerns about their role in promoting AMR.

In order to address these problems, in 2017 the government adopted a national action plan to combat AMR in line with the WHO global guidelines [24]. Amongst other provisions, this plan aims to improve awareness and knowledge of AMR in the general public and among health professionals (including pharmacists); and to "strengthen the enforcement of regulations on antimicrobial post-marketing surveillance". Since 2015, the Ministry of Health has also implemented a community-based program to promote responsible self-medication, called the "Community Smart Use of Medication Movement" (*Gerakan Masyarakat Cerdas Menggunakan Obat*), known as GeMa CerMat, where pharmacists are trained to provide information on medicines to their communities. Despite some progress, the implementation of these initiatives has been slow and private sector engagement remains a significant policy challenge [25].

Methods

Research design and settings

The qualitative study presented here was part of a larger study of AMR in Indonesia conducted in 2019, which found high rates of inappropriate dispensing and poor consultation practices at pharmacies and other drug stores [8]. In the same study locations, we conducted interviews to better understand the how

and why of non-prescribed antibiotic dispensing. In keeping with the principles of phenomenology [26], the qualitative study focused on individual experiences and perceptions of the social actors involved in the final stage of antibiotic dispensing – those who sell antibiotics and their clients. Data collection involved in-depth interviews, conducted in an urban location (Bekasi) and a semi-rural location (Tabalong) to capture different markets and contexts of access to medicines. Bekasi is an industrial area located in West Java Province and a satellite city of the national capital Jakarta. It has a population of 3.5 million, largely consisting of internal migrants and commuters from other parts of Java. Tabalong is a district located in South Kalimantan Province with a population of 250,000. In 2019, the number of pharmacies in Bekasi and Tabalong was 534 and 31 respectively, while the number of drug stores was 87 and 31 respectively [27].

Study participants and data collection

In both study settings, a list of all registered pharmacies and drug stores was obtained from the district health office, and was sorted by subdistrict. In each subdistrict, two pharmacies and/or drug stores were randomly selected and contacted to schedule a visit to conduct the interviews. In each pharmacy and drug store, we aimed to recruit two categories of respondents: (1) vendors responsible for drug dispensing, including pharmacists, pharmacy technicians, shop attendants, and owners - collectively defined here as “private drug sellers” (PDS); and (2) adult clients, who were approached and invited to participate in the interview after they had completed their interaction with the PDS.

All interviews were conducted in Indonesian (Bahasa Indonesia) by the first author and other Indonesian researchers with training in social research methods using a topic guide, tailored to each category of participants. Most interviews with PDS focused on background information on the type of business; supply and sales of antibiotics; antibiotic dispensing practices; awareness of antibiotic resistance; and awareness of regulations and compliance. Interviews with clients mainly focused on health seeking behaviour and their use and knowledge of antibiotics. All interviews were audio-recorded and lasted between 25 and 70 minutes.

Data management and analysis

The interviews were transcribed verbatim and processed to generate an initial set of codes after iterative, inductive reading of the transcripts. The coding scheme was subsequently reviewed and refined after discussion with the study team to reduce subjective biases. The analysis was informed by two main concerns: to understand the types of interactions leading to inappropriate dispensing of antibiotics; and to explore factors shaping these interactions and their outcomes. Thematic content analysis and coding were performed using N-Vivo version 9. All methods were performed in accordance with the relevant guidelines and regulations, including the ethical principles in the Declaration of Helsinki.

Results

Overview

In total, 23 pharmacies and 8 drug stores participated in the study between June and July 2019. As detailed in Table 1, interviews were conducted with 31 PDS staff (owners, pharmacists, and attendants) and 29 adult clients in the 19-65 age range. In Bekasi, pharmacies and drug stores of different types and size were clustered near clinics or residential complexes or lined along the main city roads. In Tabalong, most pharmacies were located near the district centre although a few drug stores were in peripheral areas. The majority of PDS were small independent businesses serving about 15 or 20 customers every day; only a few pharmacies in Bekasi were part of retail chains. By Indonesian law, pharmacies and drug stores must supply medicines, including antibiotics, from wholesale distributors. However, a few pharmacists admitted they would regularly restock at large retail pharmacies since these would offer better deals and, unlike wholesalers, would not apply minimum order requirements.

Table 1. Study sample

	Bekasi	Tabalong	Total
Owner	4	8	12
Pharmacist	2	1	3
Owner/pharmacist	7	5	12
Drug store owners/attendants	3	1	4
Clients	16	13	29
Total	32	28	60

Pharmacists in both locations explained that people often medicate with drugs purchased at their stores because they have little time to visit a health centre where they often have to wait in long queues and pay for a medical consultation:

“Well frankly... if they go to the doctor, they will be charged 75,000 or 100,000 rupiah [US\$ 5-7] for the consultation. That’s quite a lot. If they come to my place, they can get some information about how the medicine works, and they don’t have to pay that much... that’s why they like it” (Male pharmacist, Bekasi).

Similarly, clients said that pharmacies and drug stores are more accessible than public health facilities and open in the evening:

“It takes time to go to the primary health centre. It’s far, then we have to wait. I only visit the health centre if I feel really sick” (Male client, 49, Tabalong)

“I don’t have time to go to the health centre in the morning (...) I must work.” (Female client, 54, Bekasi)

Antibiotic dispensing patterns

The analysis of the interviews suggests that antibiotics could be easily purchased without prescription at pharmacies and drug stores:

“Is it easy to get antibiotics? Well... you can find them everywhere” (Male client, 33, Bekasi)

“Maybe 10% of my sales are antibiotics, and the proportions of prescribed and non-prescribed antibiotics is about 30 and 70%.” (Female pharmacist, Bekasi)

“Drug stores are not supposed to keep antibiotics, but they often sell ampicillin and amoxicillin. Sometimes they also sell cipro[floxacin] and cefadroxil although this is less common.” (Male owner/pharmacist, Tabalong)

“It is so easy to get [unprescribed] antibiotics here... sometimes even the small vendors around here have them.” (Male owner/pharmacist, Tabalong)

A common pattern of non-prescribed antibiotic dispensing was the direct request of antibiotics by clients as part of a self-medication strategy, based on previous experiences in the public sector or advice from relatives or friends. As reported by PDS, many clients walked into a pharmacy or drug store and ordered a specific antibiotic either by giving a generic/brand name or showing a used package:

“Not many people ask for advice, they usually come to buy specific drugs (...) When they want to buy antibiotics, they usually ask for amoxicillin” (Female pharmacy technician, Bekasi)

“Many customers were prescribed antibiotics from the primary health centre and then they buy [the same antibiotic] from us. They remember the name and mention it to us.” (Male pharmacist, 66, Bekasi)

“They come into my shop and say what they want to buy, like ‘I want amoxicillin and paratusin [a cough and cold medicine]” (Female pharmacist, Bekasi).

These accounts were mirrored in interviews with customers:

“How did you first get the antibiotics? From the physician at the primary health centre, I was sick and given prescription. A long time ago? Yes. Did you buy the same medicine again? Yes, but I no longer visit the health centre for consultations” (Male client, 39, Tabalong)

“Some time ago I got the medicine with the doctor’s prescription. And then it was finished, so I bought it again (...) I usually bring the used package, or I tell the name.” (Female client, 39, Bekasi)

“I bought amoxicillin at the drug store, with no prescription. I brought sample package from my neighbour – I was told that I can get the medicine at the drug store or pharmacy” (Female client, 47 Bekasi)

A less common pattern involved PDS recommending an antibiotic, often based on a superficial assessment of the patient

“I will suggest antibiotics to those who look sick, for example those with toothache or respiratory infection...” (Female pharmacist, Bekasi)

“I will not recommend antibiotics if my clients don’t need them. I recommend antibiotics only if there are signs of infection” (Female pharmacist, Tabalong)

Lastly, some pharmacists said that they would refer clients with severe symptoms to health care facilities, especially when the patient was a child:

“If the patient is really unwell, I would recommend them to go to the hospital, for example if a child has fever for more than 3 days” (Male pharmacist, Tabalong).

Drivers of inappropriate antibiotics dispensing

In addition to the interactions between clients and PDS concerning the sale of antibiotics, the interviews sought to explore factors that shaped these interactions and their outcomes, described in turn below.

Misconceptions about antibiotics

Lack of knowledge or misinformation about antibiotics were common in the study locations. Most vendors with no pharmacy background were not aware of AMR. In addition, pharmacists in both Bekasi and Tabalong explained that their customers demanded antibiotics indiscriminately for any condition:

“There are many clients asking for antibiotics, maybe 30-40%. They want antibiotics for everything... even for muscle pain...I don’t know what’s wrong. Sometimes they are very stubborn... if we try to explain that antibiotics should be used for other [diseases], they often insist... they still want them” (Female pharmacist-owner, Bekasi)

“Most people here believe that all diseases can be treated with antibiotics” (Male pharmacist, Tabalong)

In keeping with these comments, many clients believed that antibiotics are “powerful” (*manjur*) medicines that can be used to effectively treat a common cold, inflammation, toothache, muscle pain, cough, and even as an energy booster:

“[Antibiotics] reduce fever faster... they improve our antibodies” (Female client, 28, Tabalong)

“When I have a cough, I usually take amoxicillin, paracetamol and konidin [cold medicine]. if I only take konidin, I don’t feel any effect. But when I mix it with amoxicillin and paracetamol, I immediately get better.” (Male client, 65, Tabalong)

“*Why did you take amoxicillin?* I often feel tired and sleepy... I am a driver, so it is dangerous if I’m sleepy” (Male client, 39, Tabalong)

A few clients stated they felt ignorant or lacked knowledge about antibiotics and therefore were reluctant to use them without expert advice. For example, a customer in Bekasi said:

“I never buy such drugs [antibiotics] because I don’t really know. If I don’t have the prescription, I don’t want to take them.” (Male client, 60, Bekasi).

Poor knowledge of antibiotics was often associated with malpractices such as storage of leftover antibiotics at home for future use, as these citations illustrate:

“What kind of medicine do you keep at home? Amoxicillin, paracetamol... How frequently do you buy these medicines? I buy them when they run out, sometimes every week. Do you use them for all family members? Yes” (Male client, 22, Bekasi)

“When was the last time you were sick? I think 3-4 months ago. What did you have? Nothing special...just fever and headache. What did you do? I immediately took antibiotics. Where did you get them? I had some at home” (Male client, 33, Bekasi)

“We have medicine stock at home... When somebody is sick, I give paracetamol and amoxicillin. That’s all.” (Female client, 48, Tabalong)

Market competition and the unintended consequences of health policy reform

The struggle to survive in an increasingly competitive market was another driver of inappropriate antibiotic dispensing. Some pharmacists reported a daily revenue of IDR 300,000-500,000 (USD 20-30) and a net profit of only IDR 50,000-100,000 (US\$ 3 – 7) due to high operational costs and competition. Further, the financial viability of some pharmacies had been negatively affected by the introduction of the JKN, which entitles members to receive subsidised care and medicines at designated health facilities and participating pharmacies. Pharmacists who were not part of this scheme complained they had experienced a decline in clients and income, and were therefore more likely to use coping strategies such as the dispensing of non-prescribed medicines:

“I can say that pharmacies are no longer profitable, because of the JKN. So don’t be surprised if many pharmacies are going bankrupt” (Male owner, Tabalong)

“It has been very difficult for three years. We have high operational costs and we make little profit... I feel like I am volunteering... I am working only for personal satisfaction - what we earn is not much.” (Female pharmacist, Tabalong)

“It’s getting hard... you know... If we deny antibiotics, they can buy them with no prescription at other places... and our income will decrease” (Female pharmacist, Bekasi)

In addition, due to financial constraints, some owners of pharmacies admitted they could no longer employ a full-time pharmacist. In Tabalong, this problem was compounded by challenges to attract and retain qualified pharmacists as these would prefer to work in the cities rather than in rural areas. As a result, pharmacies in both locations were often staffed by unqualified attendants, with little knowledge of antibiotics and regulations governing their use.

Limited decision-making power of pharmacists who do not own the pharmacy

Other pharmacists explained that inappropriate dispensing could occur even when a qualified pharmacist was available. One pharmacist in Bekasi said that this was often a result of the power imbalance between the pharmacist and the pharmacy owner, since the latter had the “highest level of decision-making”, and therefore could influence dispensing practices even when these were not in line with the regulations. Similarly, another pharmacist said that “we sell antibiotics without prescription because we have no power... we have no power to say... ‘No, we cannot not sell them’” (Female pharmacist, Bekasi).

Weak enforcement of regulations

There was widespread consensus that the enforcement of regulations was weak, despite the active role of professional pharmacist associations in both study locations. In Bekasi, one drug store owner said she could sell antibiotics easily due to lack of supervision:

“Did you receive any visits from the district health office recently? Never. So you can sell antibiotics easily? Yes... I can sell drugs like amoxicillin. Why amoxicillin? Because it is a common drug everywhere.” (Female drug store owner, Bekasi)

This narrative was echoed in the views of some pharmacists, who confirmed that dispensing practices at both pharmacies and unlicensed sellers were not really monitored:

“There should be strict monitoring (...). Drug stores are not supposed to sell antibiotics, but they often have ampicillin and amoxicillin. Sometimes they also sell cipro and cefadroxil although this is less common.” (Male pharmacist, Bekasi)

Discussion

This study sought to gain a better understanding of antibiotic dispensing practices at community pharmacies and other drug stores in Indonesia. As documented in the interviews, participants perceived that self-medication with drugs purchased at PDS provides a convenient and low-cost strategy to relieve mild symptoms. Further, we identified two types of interactions or scenarios resulting in inappropriate dispensing. In the first type, clients walk into the shops and order antibiotics without prescription, either by their generic/brand name or by showing an empty package or sample. In the second scenario, which we found to be less common, vendors “prescribe” antibiotics to clients who presented with symptoms and asked for advice, often based on superficial assessment. As found in other studies, these two patterns highlight the role of both “direct” and “indirect” self-medication practices in driving inappropriate antibiotic use [28, 29].

Our findings also cast light on different drivers of inappropriate antibiotic dispensing in the study locations (Fig. 1). On the demand side, similar to recent findings in China (Wang et al. 2019) [30] and Thailand [31], many participants in our study believed that antibiotics are multi-purpose anti-inflammatory drugs which can be used to treat almost any condition. In general, self-medication with

antibiotics was seen as an appropriate, affordable and convenient practice to relieve symptoms, while concerns about long waiting times and costs discouraged the utilisation of public health facilities as found in other studies [32]. On the supply side, economic challenges and market competition, combined with widespread availability of cheap antibiotics and disinformation on AMR, induced pharmacies to sell non-prescribed antibiotics. While some of these issues have been highlighted in previous work in Indonesia [18, 33] and elsewhere in Asia [34–38], a key finding in our study is that policy reforms to improve access to affordable services and medicines may have unintended and undesirable effects on pharmacy practice and, ultimately, the control of AMR. Since the introduction of the JKN in 2014, a substantial increase in the utilisation of public health centres has been reported [39]. In contrast, independent pharmacies outside the JKN network face new economic challenges as many of their former clients choose to receive subsidised care (and medicines) in the public sector. As documented in some interviews, this may induce coping strategies to minimise economic loss such as the inappropriate dispensing of antibiotics. Thus, our study highlights the need for stronger private sector engagement in policies to promote UHC and appropriate antibiotic use, especially in countries such as Indonesia where the private sector is such a popular source of care.

Lastly, our study highlights shortcomings in the regulatory enforcement and monitoring of drug sales, particularly in relation to human resources. As discussed, one important gap is that many pharmacies operate without qualified pharmacists – a trend that is well known in Indonesia (Hermansyah, 2018) as in other parts of Asia [34, 40]. This is a complex problem which can be associated with multiple factors including weak supervision from local authorities, challenges to attracting and retaining qualified personnel in rural areas, and inadequate salaries. However, in keeping with findings in India [41, 42], our study also found that attendance by pharmacists does not guarantee appropriate dispensing, partly due to potential conflicts of interest between their professional ethics and the economic incentives of those who own and manage the pharmacies. Another reason is that some pharmacists were reluctant to deny antibiotics to clients who asked for them, suggesting that the educational curriculum in universities should be reformed to include specific training on interpersonal communication skills to manage patient demand for medications [43, 44].

In sum, as illustrated in Fig. 1, the findings from this study highlight the multi-faceted nature of AMR and the complex mix of drivers of antibiotic dispensing in the community, inviting some reflections on policy implications. In the communities, recent evidence indicates that interventions to educate pharmacists alone may be ineffective unless these are supported by campaigns on proper antibiotic use in the general population [45]. Given that community members are often introduced to the use of antibiotics in the public sector, doctors and nurses at public health centres could be involved in educational campaigns, providing more information on AMR when prescribing. Yet it is well recognised that interventions solely focused on individual behaviour are unlikely to succeed, given the key role of wider contextual drivers [46]. Past experiences indicate that multi-faceted interventions are more effective than single interventions to reduce inappropriate antibiotic use. For example, positive outcomes have been achieved in other LMICs where stronger regulatory enforcement was combined with educational programmes such as training of dispensers and public awareness campaigns [47–50]. Available evidence also suggests

that interventions targeted to different stakeholders (including doctors, nurses, pharmacists, patients, and the public) are more likely to be effective than those that only focus on one group [51]. On the supply side, incentive systems could also be devised such as a certification of good practices with antibiotics dispensing as a prerequisite to hold the operational license or inclusion in public health schemes such as the JKN network.

Study limitations

The findings presented here offer qualitative insights into antibiotic dispensing practices and their determinants in the study locations but cannot be generalised to the whole country and beyond. In addition, all interviews were conducted inside the pharmacies and drug stores; In these environments, participants (both clients and vendors) may have felt some pressure to provide socially desirable answers and perhaps understate the extent and willingness to engage in unauthorised practices. We should also mention that this study focused on behaviour and practices in urban and rural communities. Therefore, it did not include other important categories of stakeholders influencing antibiotic dispensing such as policy makers, implementers of programs to control AMR, and representatives of professional associations and business interests in the pharmaceutical sector.

Conclusion

Findings from this study reveal that inappropriate dispensing of antibiotics is the outcome of a complex set of interactions between vendors and clients, shaped by wider and changing socio-economic processes. As such, it contributes knowledge and insights that can be used to refine existing models and conceptual frameworks of behavioural patterns and their determinants leading to inappropriate dispensing [42]. In Indonesia, as in many other LMICs with large and informal private sectors, concerted action should be taken to embrace such providers in plans to reduce AMR. This thereby would help avert unintended effects of market competition and adverse policy impacts such as encouraging inappropriate antibiotic dispensing as observed in this study.

List Of Abbreviations

AMR: Antimicrobial resistance

JKN: Jaminan Kesehatan Nasional (National Health Insurance)

LMICs: Low- and middle-income countries

PDS: private drug seller

UHC: Universal health coverage

WHO: World Health Organization

Declarations

Ethics approval and consent to participate

Research was conducted in compliance with a protocol approved by the ethical committee of Universitas Gadjah Mada (KE/FK/0161/EC/2019), the University of New South Wales (HC190043). Information on the aims and objectives of the study was provided to all participants prior to the interviews. Written informed consent to participate was obtained for all interviews. All data were anonymized. All methods were performed in accordance with the relevant guidelines and regulations, including the ethical principles in the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

The anonymised dataset is available from the first author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

ML, VW, AP, AF, LPLW, SY, MK designed the study. AF collected the data. AF and ML analysed the data. AF and ML drafted the manuscript. All authors provided critical input, reviewed the draft, and approved the final manuscript.

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References

1. **Review on Antimicrobial Resistance. Antimicrobial Resistance: Tackling a Crisis for the Health and Wealth of Nations;** 2014.
2. Gandra S, Barter DM, Laxminarayan R: **Economic burden of antibiotic resistance: how much do we really know?** *Clinical Microbiology and Infection* 2014, **20**(10):973-980.
3. Friedman ND, Temkin E, Carmeli Y: **The negative impact of antibiotic resistance.** *Clinical Microbiology and Infection* 2016, **22**(5):416-422.
4. Malik B, Bhattacharyya S: **Author Correction: Antibiotic drug-resistance as a complex system driven by socio-economic growth and antibiotic misuse.** *Sci Rep* 2019, **9**(1):15184-15184.
5. Auta A, Hadi MA, Oga E, Adewuyi EO, Abdu-Aguye SN, Adeloye D, Strickland-Hodge B, Morgan DJ: **Global access to antibiotics without prescription in community pharmacies: A systematic review and meta-analysis.** *Journal of Infection* 2019, **78**(1):8-18.
6. Ocan M, Obuku EA, Bwanga F, Akena D, Richard S, Ogwal-Okeng J, Obua C: **Household antimicrobial self-medication: a systematic review and meta-analysis of the burden, risk factors and outcomes in developing countries.** *BMC Public Health* 2015, **15**:742-742.
7. Puspitasari HP, Faturrohman A, Hermansyah A: **Do Indonesian community pharmacy workers respond to antibiotics requests appropriately?** *Tropical Medicine & International Health* 2011, **16**(7):840-846.
8. Wulandari LPL, Khan M, Liverani M, Ferdiana A, Mashuri YA, Probandari A, Wibawa T, Batura N, Schierhout G, Kaldor J *et al*: **Prevalence and determinants of inappropriate antibiotic dispensing by private drug sellers in Indonesia: a mixed methods study.** Under review.
9. Farida H, Severin JA, Gasem MH, Keuter M, Wahyono H, van den Broek P, Hermans PWM, Verbrugh HA: **Nasopharyngeal carriage of Streptococcus pneumonia in pneumonia-prone age groups in Semarang, Java Island, Indonesia.** *PLoS One* 2014, **9**(1):e87431-e87431.
10. Severin JA, Mertaniasih NM, Kuntaman K, Lestari ES, Purwanta M, Lemmens-Den Toom N, Duerink DO, Hadi U, van Belkum A, Verbrugh HA *et al*: **Molecular characterization of extended-spectrum β -lactamases in clinical Escherichia coli and Klebsiella pneumoniae isolates from Surabaya, Indonesia.** *Journal of Antimicrobial Chemotherapy* 2010, **65**(3):465-469.
11. Parathon H, Kuntaman K, Widiastoety TH, Muliawan BT, Karuniawati A, Qibtiyah M, Djanun Z, Tawilah JF, Aditama T, Thamlikitkul V *et al*: **Progress towards antimicrobial resistance containment and control in Indonesia.** *BMJ* 2017, **358**:j3808-j3808.
12. Wulandari LPL, Wiseman V: **Engaging the private sector to improve antimicrobial use in the community.** *Public Health and Preventive Medicine Archive* 2018, **6**(2):79.
13. Herawati F, Setiasih, Alhabsyi MM, Gunawan W, Palijama DE, Diah LF, Adriansyah NA, Yulia R, Avanti C: **A patient caregiver survey in Indonesia: Knowledge and perception of antibiotic use and microbial resistance.** *Journal of Infection and Public Health* 2020, **13**(12):2087-2091.

14. Hadi U, Duerink DO, Lestari ES, Nagelkerke NJ, Werter S, Keuter M, Suwandojo E, Rahardjo E, van den Broek P, Gyssens IC: **Survey of antibiotic use of individuals visiting public healthcare facilities in Indonesia.** *International Journal of Infectious Diseases* 2008, **12**(6):622-629.
15. World Bank. **Indonesia** [<https://www.worldbank.org/en/country/indonesia/overview>]
16. Hort K, Patcharanarumol W (eds.): **The Republic of Indonesia Health System Review.** New Delhi: World Health Organization, Regional Office for South-East Asia; 2017.
17. Nugraheni WP, Mubasyiroh R, Hartono RK: **The influence of Jaminan Kesehatan Nasional (JKN) on the cost of delivery services in Indonesia.** *PLoS One* 2020, **15**(7):e0235176-e0235176.
18. Brata C, Fisher C, Marjadi B, Schneider CR, Clifford RM: **Factors influencing the current practice of self-medication consultations in Eastern Indonesian community pharmacies: a qualitative study.** *BMC Health Serv Res* 2016, **16**:179-179.
19. Husada R, Tjandrawinata RR: **The Healthcare System and the Pharmaceutical Industry in Indonesia.** In: *The New Political Economy of Pharmaceuticals.* Palgrave Macmillan UK; 2013: 134-151.
20. Anggriani Y, Ibrahim MIM, Suryawati S, Shafie AA: **The impact of Indonesian generic medicine pricing policy on medicine prices.** *Journal of Generic Medicines* 2013, **10**(3-4):219-229.
21. **Mapping of Pharmaceutical Facilities 2013 - 2018 (Aplikasi Pemetaan Sarana Kefarmasian 2013-2018)** [http://apif.binfar.depkes.go.id/index.php?req=view_services&p=pemetaanIndustriFarmasi.]
22. **Undang Obat Keras (St. No. 419 tgl. 22 Desember 1949).** Jakarta; 1949.
23. **Peraturan Pemerintah Republik Indonesia Nomor 51 Tahun 2009 Tentang Pekerjaan Kefarmasian.** Jakarta: Government of Indonesia; 2009.
24. **National action plan on antimicrobial resistance Indonesia (2017-2019).** Jakarta: Government of Indonesia; 2017.
25. Setiadi AP, Wibowo YI, Setiawan E, Mulyono I, Wardhani SA, Sunderland B: **Strategies to implement community training to promote responsible self-medication in Indonesia: a qualitative study of trainers.** *International Health* 2020.
26. Creswell J: **Qualitative inquiry and research design: Choosing among five traditions.** Thousand Oaks, CA: Sage; 1998.
27. [<https://binfar.kemkes.go.id>]
28. Suy S, Rego S, Bory S, Chhorn S, Phou S, Prien C, Heng S, Wu S, Legido-Quigley H, Hanefeld J *et al*: **Invisible medicine sellers and their use of antibiotics: a qualitative study in Cambodia.** *BMJ Glob Health* 2019, **4**(5):e001787-e001787.
29. Torres NF, Solomon VP, Middleton LE: **Patterns of self-medication with antibiotics in Maputo City: a qualitative study.** *Antimicrob Resist Infect Control* 2019, **8**:161-161.
30. Wang W, Wang X, Hu YJ, Wu D, Lu J, Xu Y, Sun C, Zhou X: **The Misconception of Antibiotic Equal to an Anti-Inflammatory Drug Promoting Antibiotic Misuse among Chinese University Students.** *Int J Environ Res Public Health* 2019, **16**(3):335.

31. Haenssge MJ, Charoenboon N, Zanello G, Mayxay M, Reed-Tsochas F, Lubell Y, Wertheim H, Lienert J, Xayavong T, Khine Zaw Y *et al*: **Antibiotic knowledge, attitudes and practices: new insights from cross-sectional rural health behaviour surveys in low-income and middle-income South-East Asia.** *BMJ Open* 2019, **9**(8):e028224-e028224.
32. Yousef A-MM, Al-Bakri AG, Bustanji Y, Wazaify M: **Self-Medication Patterns in Amman, Jordan.** *Pharmacy World & Science* 2007, **30**(1):24-30.
33. Ekawati FM, Claramita M, Hort K, Furler J, Licqurish S, Gunn J: **Patients' experience of using primary care services in the context of Indonesian universal health coverage reforms.** *Asia Pac Fam Med* 2017, **16**:4-4.
34. Mao W, Vu H, Xie Z, Chen W, Tang S: **Systematic review on irrational use of medicines in China and Vietnam.** *PLoS One* 2015, **10**(3):e0117710-e0117710.
35. Jaisue S, Phomtavong S, Eua-anant S, Borlace GN: **Dispensing pattern for acute non-infectious diarrhoea in children at community pharmacies in Thailand.** *Journal of Pharmacy Practice and Research* 2017, **47**(5):383-388.
36. Irawati L, Alrasheedy AA, Hassali MA, Saleem F: **Low-income community knowledge, attitudes and perceptions regarding antibiotics and antibiotic resistance in Jelutong District, Penang, Malaysia: a qualitative study.** *BMC Public Health* 2019, **19**(1):1292-1292.
37. Nepal A, Hendrie D, Robinson S, Selvey LA: **Survey of the pattern of antibiotic dispensing in private pharmacies in Nepal.** *BMJ Open* 2019, **9**(10):e032422-e032422.
38. Nguyen HH, Ho DP, Vu TLH, Tran KT, Tran TD, Nguyen TKC, van Doorn HR, Nadjm B, Kinsman J, Wertheim H: **"I can make more from selling medicine when breaking the rules" - understanding the antibiotic supply network in a rural community in Viet Nam.** *BMC Public Health* 2019, **19**(1):1560-1560.
39. Hermansyah A, Sainsbury E, Krass I: **Investigating the impact of the universal healthcare coverage programme on community pharmacy practice.** *Health & Social Care in the Community* 2017, **26**(2).
40. Nga DTT, Chuc NTK, Hoa NP, Hoa NQ, Nguyen NTT, Loan HT, Toan TK, Phuc HD, Horby P, Van Yen N *et al*: **Antibiotic sales in rural and urban pharmacies in northern Vietnam: an observational study.** *BMC Pharmacol Toxicol* 2014, **15**:6-6.
41. Kamat VR, Nichter M: **Pharmacies, self-medication and pharmaceutical marketing in Bombay, India.** *Social Science & Medicine* 1998, **47**(6):779-794.
42. Barker AK, Brown K, Ahsan M, Sengupta S, Safdar N: **What drives inappropriate antibiotic dispensing? A mixed-methods study of pharmacy employee perspectives in Haryana, India.** *BMJ Open* 2017, **7**(3):e013190.
43. Hermansyah A, Wulandari L, Kristina SA, Meilianti S: **Primary health care policy and vision for community pharmacy and pharmacists in Indonesia.** *Pharm Pract (Granada)* 2020, **18**(3):2085-2085.
44. Khan MS, Bory S, Rego S, Suy S, Durrance-Bagale A, Sultana Z, Chhorn S, Phou S, Prien C, Heng S *et al*: **Is enhancing the professionalism of healthcare providers critical to tackling antimicrobial resistance in low- and middle-income countries?** *Hum Resour Health* 2020, **18**(1):10-10.

45. Chowdhury F, Sturm-Ramirez K, Mamun AA, Iuliano AD, Chisti MJ, Ahmed M, Bhuiyan MU, Hossain K, Haider MS, Aziz SA *et al*: **Effectiveness of an educational intervention to improve antibiotic dispensing practices for acute respiratory illness among drug sellers in pharmacies, a pilot study in Bangladesh.** *BMC Health Serv Res* 2018, **18**(1):676-676.
46. Chandler CIR: **Current accounts of antimicrobial resistance: stabilisation, individualisation and antibiotics as infrastructure.** *Palgrave Commun* 2019, **5**(1):53.
47. Wafula FN, Goodman CA: **Are interventions for improving the quality of services provided by specialized drug shops effective in sub-Saharan Africa? A systematic review of the literature.** *Int J Qual Health Care* 2010, **22**(4):316-323.
48. Leung E, Weil DE, Raviglione M, Nakatani H, World Health Organization World Health Day Antimicrobial Resistance Technical Working G: **The WHO policy package to combat antimicrobial resistance.** *Bull World Health Organ* 2011, **89**(5):390-392.
49. LOCAAL: **Doctors and local media: a synergy for public health information? A controlled trial to evaluate the effects of a multifaceted campaign on antibiotic prescribing (protocol).** *BMC Public Health* 2011, **11**:816-816.
50. Cuevas C, Batura N, Wulandari LPL, Khan M, Wiseman V: **Improving antibiotic use through behaviour change: a systematic review of interventions evaluated in low- and middle-income countries.** *Health Policy and Planning* 2021.
51. Burstein VR, Trajano RP, Kravitz RL, Bell RA, Vora D, May LS: **Communication interventions to promote the public's awareness of antibiotics: a systematic review.** *BMC Public Health* 2019, **19**(1):899-899.

Figures

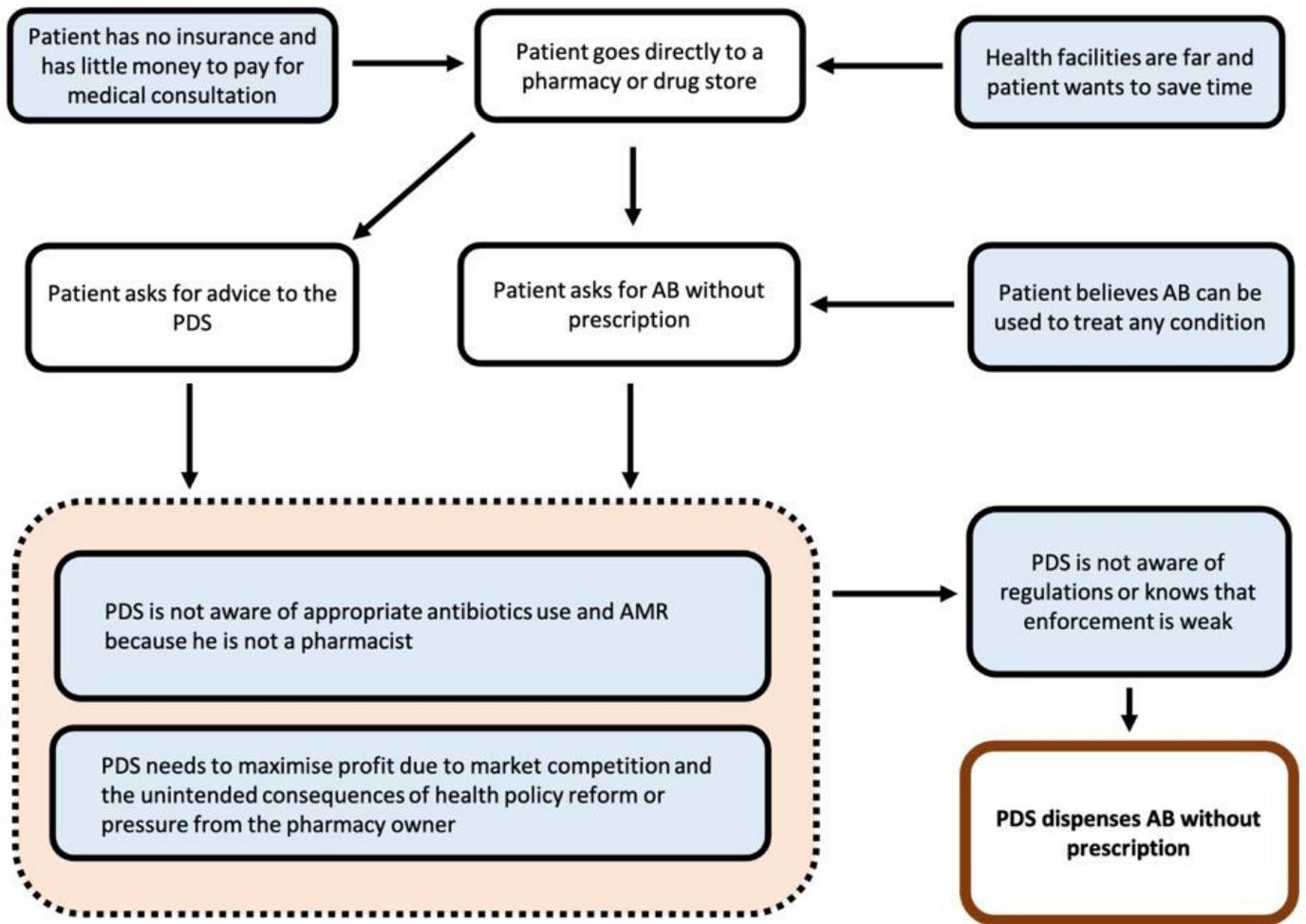


Figure 1

Diagram illustrating pathways leading to inappropriate antibiotics dispensing from the perspective of patients and vendors. Boxes in blue are cognitive processes or states influenced by contextual drivers. Boxes in white are actions.