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PERSPECTIVE

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The potential roles of pharmacy medication sales data to augment the syndromic surveillance system in response to COVID-19 and preparedness for other future infectious disease outbreaks in Indonesia

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Abstract

Background: Indonesia faces a continuous threat from communicable disease outbreaks. The current COVID-19 outbreak, the previous one of SARS, and many other infectious outbreaks encountered in the country warn of the need to develop comprehensive early warning systems to enable timely health responses in the long run. In this article, we argue that over the counter medication sales data at community pharmacies in Indonesia can potentially augment and increase the detection power of the current syndromic surveillance system, particularly in dealing with COVID-19 and other future infectious disease outbreaks in the country.

Main Body: This article discusses the experience of other countries in employing pharmacy medication sales data to serve as potential syndromic surveillance platform and contribute to pandemic responses. We argue why it is worth considering utilising medication sales data from pharmacies in Indonesia to support the current surveillance system which enables the provision of early warnings of disease outbreaks. We then discuss the potential challenges of operationalising these data and suggest a way forward for the development and implementation of the syndromic surveillance system at community pharmacy settings in Indonesia.

Conclusion: While there are several challenges in developing a workable system in Indonesia that need to be addressed, introducing a syndromic surveillance system using pharmacy-setting medication sales data is worth investigating in the country.

KEYWORDS
disease outbreak, Indonesia, medication sales data, over the counter medicine, pharmacy, syndromic surveillance

1 | BACKGROUND

By mid-August 2021, there were more than 3.9 million confirmed COVID-19 cases and more than 120,000 COVID-19 deaths in Indonesia,[1] placing the country second in the total number of cumulative cases and deaths in the Southeast Asia region. The unprecedented economic, social, and health impacts of the COVID-19 outbreak continue to take their toll not only directly on the population, but also on the nation's health system. The high number of confirmed cases, and the lack of infrastructure to adequately respond to disease outbreaks has further constrained the capacity of the already poorly performing Indonesian health system to deal with further outbreaks.[2]

Despite Indonesia's progress in responding to the high burden of infectious diseases, Indonesia still faces persistently high rates of some communicable diseases. For example,[3-6] this challenge is exacerbated by the obstacles bearing on human and infrastructure resources in the country's healthcare system. In 2018, there were only 0.4 physicians and 1.3 nurses per 1000 people, these unevenly distributed across the archipelago and only 33% of them located outside of Java island.[7] In addition, there were only 2877 hospitals and 10,134 community health centres, whose capacities are also significantly constrained by maldistribution and underperformance,[7] compounding the challenges of dealing with any disease outbreak.

Indonesia has been criticised for its delayed response to the COVID-19 pandemic.[8-10] The country was reluctant to admit the presence of cases until early March 2020, despite the increasing reports of confirmed cases in surrounding countries. Concerns were also raised over the low coverage of COVID-19 testing,[11] and suspected under-reporting of COVID-19 cases and death rates.[12]

The pandemic has overwhelmed the already stretched health system in Indonesia. By mid-August 2021, at least 1909 healthcare workers were reported to have succumbed to the disease.[13] Meanwhile, many other healthcare and treatment services were disrupted, including for HIV,[14] tuberculosis,[15,16] and immunisation services.[17]

Indonesia has experienced several series of infectious disease outbreaks, such as SARS in 2003,[18] Influenza H1N1 in 2009,[2,19] and Avian Influenza in humans in 2005–2012,[20] among others. The facts of the country's tropical climate, and its being the fourth-most densely populated country in the world,[21] with high population mobility, constitute the perfect ingredients for emerging and re-emerging diseases to become outbreaks. The series of outbreaks experienced to date should be enough for Indonesia to consider it better to prepare in advance. Pandemics will be continuing events, and it is possible that emerging and re-emerging infectious diseases will become outbreaks in the future.[22] In fact, in the case of the COVID-19 pandemic, the WHO has urged all countries to put in place early warning systems enabling preparatory measures to deal with such a contingency.[23]

Surveillance has been the core of public health responses and has served as an early warning system to prepare for and respond to pandemics. One of the surveillance methods increasingly being explored in the public health field is the syndromic surveillance system. Syndromic surveillance refers to 'detection of individual and population health indicators that are discernible before confirmed diagnoses are made. In particular, prior to the laboratory confirmation of an infectious disease, ill persons may exhibit behavioural patterns, symptoms, signs, or laboratory findings that

can be tracked through a variety of data sources'.[24] The system was developed in an effort to supplement available surveillance methods, and typically relies on data routinely recorded and reported.[24] A syndromic surveillance system tries to leverage data on the syndrome indicative of particular diseases from any facilities which may exhibit signs of an upward trend in such diseases. It identifies the pattern of medical-seeking behaviour or any behaviours related to a particular set of symptoms. If the outbreak of specific interest involves a syndrome of influenza, for example, such patterns as of visits to emergency departments, primary healthcare facilities or hospitals by patients with influenza-like symptoms, of absenteeism in schools or workplaces due to influenza-like illness, or of influenza-related medication purchasing behaviour at the pharmacy level may indicate the occurrence of an outbreak. These data can thus be scrutinised for syndromic surveillance purposes.[25] The assumption is that any changes in the pattern of those behaviours during certain periods can forewarn of any outbreak of a disease with those particular symptoms.

In this article, we argue that community pharmacies in Indonesia, specifically through their medication sales data, can potentially be utilised to augment the current syndromic surveillance system in the country. In the next sections, we discuss other countries' research experiences of using pharmacy sales data for surveillance; the Indonesian context of the expanding role of community pharmacies in the healthcare system and its potential for supplementing the current surveillance system in the country; and how to progress in designing a syndromic surveillance system using pharmacy sales data.

2 | THE POTENTIAL OF PHARMACIES TO PROVIDE USEFUL DATA FOR SYNDROMIC SURVEILLANCE

The potential to employ pharmacies as sentinel syndromic surveillance sites serving an early warning system has been demonstrated in several studies. These provide evidence of the correlation of medication sales at pharmacy level with other reference data to indicate changes in the magnitude of the disease. A systematic review conducted by Pivette et al., for instance, assessed the potential benefits of drug sales data, including those at pharmacy level, to augment surveillance of infectious disease outbreaks,[26] and included studies across Asia, Europe, and the US. That review included studies comparing the trend of sales data with the reference data, that is either medical reports, microbiological laboratory data for confirmed diagnoses, hospital admission or discharge data, or clinical emergency department data. Pivette et al. noted a high correlation between medication sales data, including those from pharmacies, and the reference data in almost all of the studies.

Other than the studies included in the above review, numerous recent studies provide further evidence of this correlation, shown in the following examples. First is the 2015 study by Muchaal et al. in Canada.[27] Muchaal et al. compared (i) the trend of sales of over-the-counter (OTC) respiratory products to laboratory reports of respiratory pathogen detections, and (ii) antiviral prescriptions for confirmed cases of influenza and cases of influenza-like-illness. They found a high correlation between the prescription data and the onset dates and magnitude of confirmed influenza cases and sales of OTC respiratory products with non-influenza respiratory pathogen reports in the community. Other studies conducted in the US in 2011 revealed similar findings.[28] Comparing the trend of prescription sales data from a large US drug retail pharmacy chain with Google Flu Trends surveillance system data as a flu activity indicator, Patwardhan et al. found a close correlation between the two.[28] Another study in Portugal also revealed a high correlation between OTC medicine and other healthcare product sales in pharmacy settings with the number of new suspected and laboratory-confirmed cases published daily by the government.[29] The last, a study in China[30] which compared pharmacy-level sales data with laboratory-confirmed cases of influenza found similar results, with pharmacy sales data highly correlated with the laboratory-confirmed cases.

A study from Portugal reveals that the COVID-19 pandemic crisis has resulted in increased demand for medicines at pharmacies.[31] Were similar sales trends to occur in Indonesian locales, any changes in purchasing behaviour, or in the rate of flu-like symptomatic medications dispensed in pharmacy settings could provide an indication of changing trends in COVID-19 infections, thus assisting as an early warning mechanism.

Particularly during pandemics, the role of pharmacies is, arguably, paramount when medical services are overwhelmed.[32] In fact, in China, pharmacies became one of the first sites to report confirmed COVID-19 cases.[33] Pharmacies can also contribute to the monitoring and resolving of any drug shortages, help to reach out to clients needing pharmaceutical services in remote areas, providing health education to the community, and even be involved in clinical trial studies to identify the efficacy of particular drugs in treating the pandemic disease.[34]

3 | INDONESIAN CONTEXT

At least three syndromic surveillance systems have been implemented in Indonesia. One is surveillance which relies on the disease burden data routinely collected from community health clinics (*puskesmas*) and reported in a cascading manner – from the district, to provincial health offices, and finally to the Ministry of Health at the national level. Another system is EWORS, or Early Warning Outbreak Recognition System, a hospital-based syndromic surveillance which uses computerised linkage data from hospital networks, collecting data on 29 disease signs and symptoms among patients presenting at selected hospitals.[35] The third is sentinel surveillance from the available system, which reports data from the *puskesmas* level, including of Influenza-like illnesses (ILI), and of SARI (severe acute respiratory infection), reported from hospitals.[2,36,37]

Despite the many benefits that these data from *puskesmas* and hospitals offers, these facilities are not the only places where people seek health services. Many people in Indonesia also consider the pharmacy the first point of contact in treating illnesses,[38-40] seeking to obtain medicines, particularly for symptom relief. The role of the pharmacy as the first point of contact becomes more significant in light of an increasing self-medication trend in the country, that is individuals self-purchasing and self-consuming medication without any prior medical advice from physicians.[41-43] A survey in Jakarta of more than 8000 individuals also revealed that 23% of the respondents mentioned self-treatment as the first thing they did when they had diarrhoea.[44] Another survey involving 2520 people found that only 29% of respondents visited community health centres/*puskesmas* or the hospital when they had mild respiratory illnesses, while 61% either used a home treatment (30%) or visited the pharmacy (31%). Similarly, for severe respiratory illnesses, the same survey showed that while 47% of the respondents sought treatment at a health clinic or hospital, another 47% treated their symptoms themselves, using either home remedies or going to a pharmacy, or sought healthcare elsewhere (6%).[45]

The common practice of self-medication suggests that many cases might have been missed in the reported data from clinics (*puskesmas* and hospitals), if people are seeking medicine on their own at pharmacies rather than from clinics or hospitals. Using data from clinic chains alone could thus risk underestimation of the disease burden due to the potentially lower proportion of cases captured from the clinical data.[46] In other words, this preference for private pharmaceutical providers when seeking health services should be taken into account to improve the detection power of syndromic surveillance systems in the country. Especially in the case of COVID-19, self-medicating behaviour might necessarily apply, since those contracting the disease might have such mild symptoms as nasal congestion, dry cough, shortness of breath, fatigue and fever,[47-49] prompting them to seek pharmacy medicines prior to development of breathing difficulties.

A huge number of pharmacy facilities is available in Indonesia. According to data from the Ministry of Health, in 2019 there were approximately 30,000 community pharmacies across the country.[7] Community pharmacies are one of the most accessible health settings for patients because of their convenient opening hours – nearly 15 h per day, 7 days per week. Further, unlike at other health facilitates, customers typically do not need to queue for long before receiving attention.

The role of pharmacies in providing a primary point of healthcare in Indonesia has, over time, been an expanding one. A significant change in the development of community pharmacy practice there can be marked by the introduction in 2009 of the Pharmacy Practice Act 2009.[50] The Act is an overarching regulation governing the entirety of pharmacy operations in Indonesia, including community pharmacies.

The role of pharmacies as the first point of contact for healthcare seekers has become even more pronounced since 2014, when they were included in the primary care network under the national health insurance scheme (JKN), which explicitly mentioned pharmacies as part of the country's primary care network.[39] Under the JKN, the community pharmacy has two vital roles: in pharmaceutical and service quality assurance, and pharmaceutical cost control in primary care. These functions were highlighted in the Ministry of Health Decree No. 73 of 2016 regulating the standard of services in community pharmacies.[51] In the context of the COVID-19 outbreak in Indonesia, the vital role of the community pharmacy during the pandemic crisis has been further emphasised in the Ministry of Health Decree No. 9 of 2020, under which pharmacies are urged to stay open while social restrictions prevail.[52]

4 | THE WAY FORWARD

Given this expanding role of pharmacy outlets in primary care in Indonesia, their easy accessibility, and sizeable number across the country, sales data from pharmacy settings appears a promising avenue complementing available surveillance methods. A centralised system storing medication sales information thus warrants attention, enabling as it would pharmacies to record and report their medication sales on daily basis. The WHO has provided a guideline which can be used in the design and implementation of surveillance systems which might assist the adaption and development of such a system.[53]

Several considerations should, however, be noted in implementing syndromic surveillance using pharmacy sales data in Indonesia. Syndromic surveillance requires systematic and ongoing collection of data, necessitating, therefore, a system which permits pharmacies to record and report medication data sales on a regular basis. In developing the system, it is important that collaboration with data providers, users and analysts of, and responders to the data occurs to ensure the system will not conflict with existing priorities and is relevant to local governments' needs. The introduction and implementation of this surveillance system may also require the involvement of academic groups with expertise in health informatics and public health pharmacy, and consultation with clinical information system vendors for their input on the development of low-cost hardware and software, so that a comprehensive reporting system results.[24,35] In the Indonesian context, collaboration on devising policy and infrastructural requirements for collecting medication sales in each pharmacy throughout the country could include the Ministry of Health, Provincial and District Health Offices, the Indonesian Food and Drug Administration, the Indonesian Pharmacist Association and academic experts.

In practice, the Ministry of Health, Provincial and District Health Offices would lead this orchestra, particularly since theirs is the main authority for retrieving data from community pharmacies under pharmacy reporting arrangements. Community pharmacies, for example, are required to report monthly dispensation of narcotics and psychotropics under the so-called SIPNAP (*Sistem Informasi Pelaporan Narkotika dan Psikotropika* – Information System for Reporting Narcotics and Psychotropics).[54] That report is also linked to the Indonesian Food and Drug Administration for supervision purposes. Other pharmacy types, that is primary care pharmacies, or pharmacy units operating within public healthcare facilities, are also connected to an additional information system, namely SIMBOK (*Sistem Informasi Manajemen Obat dan Perbekalan Kesehatan* – Information System for Managing Pharmaceuticals and Health Supplies) which enables local health offices to oversee the management of pharmaceuticals in every public healthcare facility within its territories.[55]

Of particular importance too, is the involvement of pharmacy staff representatives; as end-users of the system, their perceptions and input will be valuable in attaining optimal practicality, and relevance of the system in their daily operations.[25] A previous study has revealed the interest of pharmacy staff in the availability of an information system which allows them to input, manage, calculate and report medicine stocks efficiently,[56] and this interest should be taken into account in developing the system.

Furthermore, it has been recognised that should the information system be developed specifically for surveillance purposes, poor compliance among users in entering the data on the system might result,[24] which would be seen as less acceptable than harnessing data that is available and used for other purposes.[35] Therefore, any other potential benefits for users, or other purposes to which the information system might be put, such as its use in the regular reporting to authorities by pharmacists to extend their business licence should be considered prior to its development.

Other capabilities of the system, such as evaluating the effectiveness of public health interventions, or identifying resource needs at the pharmacy level, should be explored. Such functions could be utilised by the surveillance system to advocate for collaboration and partnership with other programs for the purposes of sharing resources. Another worthwhile collaboration would be with the antimicrobial resistance (AMR) task force. An AMR task force has been established in Indonesia with the overall goal of protecting the country from the threat of antimicrobial resistance.[57] One of its activities includes undertaking measures to improve antibiotic stewardship and monitor antimicrobial resistance and use.[57] Currently, however, monitoring of antimicrobial use is mainly conducted at the *puskesmas* or hospital settings,[38] despite the abundant evidence of high levels of inappropriate antibiotic dispensing practices at the pharmacy level, that is dispensing antibiotics at clients' requests, even without prescriptions.[58-60] Collaboration with the AMR task force is, therefore, worth advocating for the purpose of developing a single-window information system which not only reports the dispensing of OTC ILI medications, but also antibiotics and other antimicrobial medicines.

The fact that community pharmacies in Indonesia are encouraged to sign up as JKN providers suggests the possibility of their retrieving medication sales from these pharmacies. The national insurance agency responsible for organising payment and recruitment for the JKN – BPJS Health – has devised an information system, the so-called Apotek-Online (Pharmacy Online Reporting System).[61] Under this system, pharmacies can enter claims for payment or reimbursement of pharmaceuticals dispensed at the pharmacy. Exhaustive reporting of the type, quantity and other prescription-related information, including the issuing physician's diagnosis, is required. While the system is currently used by claimants, there is untapped opportunity for the system to be adapted to accommodate a pharmacy-based syndromic surveillance system. What is pivotal is to harmonise such a system with the other operational systems, that is SIPNAP and SIMBOK, and to share information between stakeholders, possibly a difficult task to initiate given the interdependencies such a task would involve.

Several other challenges in the field should also be allowed for. Reports from district health offices suggest a considerable proportion (25%–40%) of pharmacies do not report to SIPNAP despite regular reporting being mandatory.[62-65] In addition, infrastructure and technical issues such as computer hardware, internet coverage, and user-friendliness of the system – which may, in fact, be one of the barriers to pharmacies' reporting via SIPNAP – should also be considered in system implementation.

Last but not least, among the challenges to using pharmacy-level medication sales data for syndromic surveillance is identifying the timeliness of information, as well as grouping the enormous numbers of available medication products to provide salient information.[66] Concerns about the low specificity of the data have also been raised.[67] Some studies have attempted to address these challenges. For example, a study in the Netherlands which focused on timing compared the peak time of laboratory-confirmed case data with several registries, including from pharmacies, and noted a time lag of around 0–5 weeks,[68] with an increase in the correlation coefficient between pharmacy sales data and laboratory-confirmed surveillance data when the analysis was conducted at a 1-week interval.[30] Others have endeavoured to address the selection of medicines, by suggesting only the most popular or frequently purchased products,[69] or only those items commonly purchased by patients presenting with symptoms of respiratory illness, like cough suppressant, chest rub ointments and gels, analgesics, antipyretics and thermometers.[29] However, the possibility of stockpiling in some periods due to discounted prices on some of these products should also be taken into account when analysing this trend.[30]

5 | CONCLUSION

Indonesia faces a continuous threat of communicable disease outbreaks. The current COVID-19 outbreak, SARS previously, and many other infectious outbreaks encountered in the country highlight the urgency of developing comprehensive early warning systems to enable timely health responses in the long run. While syndromic surveillance should not, in any way, be implemented to replace traditional disease surveillance systems, nor be considered the main tool in outbreak detection, it would assist in providing a mechanism to alert and prepare the health system to deal with outbreaks of disease.

Given the expanded role of pharmacies throughout Indonesia, together with their accessibility and wide availability, the development of a system which allows pharmacies to routinely record and report their medication sales data may offer a practicable opportunity to supplement the available health surveillance system, and provide a robust, early alert to trends of disease, and thus outbreaks, in the community. In fact, the use of a multiplatform syndromic surveillance approach would increase detection system power.[70] Moreover, since syndromic surveillance is less reliant on laboratory data, this strategy might be useful in countries with low capacity to conduct mass testing, such as Indonesia. While solutions to the several challenges to developing a workable system in Indonesia need to be found, introducing a syndromic surveillance system using pharmacy-setting medication sales data is worth investigating.

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CONFLICT OF INTEREST

None declared.

ETHICAL STATEMENT

No ethical approval is needed.

AUTHOR CONTRIBUTIONS

Luh Putu Lila Wulandari: conceptualisation; writing - original draft; writing - review and editing. Anak Agung Sagung Sawitri: Writing - original draft; writing - review and editing. Andi Hermansyah: Writing - original draft; writing - review and editing.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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