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Health Impact of Unauthorized Medicine Sales in an Industrial Distribution Center

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ABSTRACT

Khlong Luang District, Pathum Thani Province, Thailand, has been recognized as a national distribution center for several kinds of goods. The public problems especially those related to medicines in this industrial district could impact the health of people across not only in Pathum Thani but also across Thailand. This first study aims to prioritize the public problems affecting people's health. A multimethod design was employed in this study. First, the public problems affecting people's health were surveyed by the division of consumer protection, department of pharmacy, Khlong Luang Hospital. Second, disease burden was analyzed using the data from the hospital database. Third, three rounds of an interactive multivoting process were conducted to prioritize public problems affecting people's health. In 2019, 48.5% of grocery stores (11 out of 24) sold Ya-Chud (including NSAIDs and steroids). Gastrointestinal (GI) bleeding was the leading cause of hospitalization. The incidence rate of GI bleeding, average LOS, and average cost of inpatient admission from 2020-2022 were 51.55 per 1000 people, 8 days per admission, 538.47$ USD, 80.80 per 1000 people, 4.1 days per admission, 225.66$ USD and 45.45 per 1000 people, 4.5 days per admission, and 464.55$ USD, respectively. The consensus from multivoting indicated that the medicine-related problems of buying Ya-Chud containing NSAIDs for selfcare from grocery stores without pharmacist care is the most important problem affecting people's health. A master plan for addressing public problems focusing on Ya-Chud is urgently needed. Linkages among stakeholders' databases, including community hospitals, community leaders, pharmacies, and private sectors, should be developed for the master plan implementation effectively.

Keywords: health, management, medicine, NSAIDs, prioritization, Ya-Chud

INTRODUCTION

Health and wellbeing are correlated in two ways: health influences well-being, and well-being influences health (UK department of Health, 2014). Several studies on health-related quality of life and work productivity report that if people have health problems, it would impact the loss of work productivity as well as indirect costs because they are not able to work as usual (Nasr et al., 2023; Suarthana et al., 2024; Tomita et al., 2021; Walter, et al., 2020). Development policies often focus on economic matters but lack health considerations (McCartney, 2022). In the fiscal year 2023, the budget for health promotion and disease prevention accounted for only 10% of the entire yearly budget of the National Health Security Office (NHSO) (National Health Security Office, 2023). The budget for the supervision of health products and firms across Thailand, which includes monitoring health products and health business situations by the Food and Drug Administration, the Office of Permanent Secretary, Ministry of Public Health, and Department of Health Service Support, accounts for approximately 0.016% of the national budget, which is approximately $13.92 million USD (Thailand Budget Bureau,

2023) (1 USD = 35.0653 (Bank of Thailand, 2023)). The budget is equal to $0.22 USD per person. This reflects the limitation of the budget in the health sector and the inability to address all public problems at the same time. It is necessary to prioritize public problems to guide planning and drafting a master plan for managing public problems that are more likely to impact people's health.

Khlong Luang District, Pathum Thani Province, Thailand, has been recognized as a national distribution center for several kinds of goods. The public problems especially those related to medicines in this industrial district could impact the health of people across not only in Pathum Thani but also across Thailand. To date, no studies have investigated and prioritized public problems affecting the health of people in the Khlong Luang District area. The findings on burden of disease, severity and difficulty in solving the public problems from this first study will be used to prepare policy proposals for drafting the provincial master plan to guide the administrators and the people on solving public problems efficiently, quickly and sustainably through the participation of people.

MATERIALS AND METHODS

This study used a multimethod design, including, survey of the public problems affecting the health of people in the Khlong Luang District, disease burden analysis using the data from the hospital database, and an interactive multivoting process to prioritize medicine-related problems affecting people's health.

The data from the public problems surveillance were reported by the division of consumer protection, department of pharmacy, Khlong Luang Hospital, a secondary care hospital responsible for people who live in Khlong Luang District, from 2019--2022. The disease burden based on the data from the hospital database from 2020-2022 were descriptive statistical reports. An interactive multivoting process (Auais, et al., 2018; Coonrod et al., 2011; Tume et al., 2015) was performed for 3 rounds. The first round involved gathering the stakeholders' opinions on the public problems affecting people's health in terms of burden and severity. The participants were requested to vote for 3 important public problems that most strongly impact people's health. The second round investigated the difficulty and ease of solving public problems based on the vote results from the first round. The participants were requested to prioritize 3 public problems voted from the first round that should be prioritized for resolving. The final round was to define the severity and route-cause analysis and propose guidelines to solve the public problems voted from the second round on the basis of the interest and awareness of the stakeholders.

The findings from 3 sources of data were used to prioritize and prepare the policy proposals of the provincial master plan to guide the administrators and the people not only in Khlong Luang District but also in other areas that are similar to Khlong Luang District.

Study areas

Khlong Luang District, the 2nd largest district of Pathum Thani Province, has many important organizations, such as Thailand Science Park, Thammasat University, Bangkok University, Nawanakhon Industrial Estate, the Thai Market, the Iyara Market, Dhammakaya Temple, etc., and has the largest population of approximately 300,000 people. In 2019, Thailand reported that there were approximately 369,000 people in the nonregistered population and 147,000 people in the commuter population. The total population is approximately 800,000–1,000,000 people. There are 1,083 factories located in Khlong Luang District, which is the greatest number of factories in Pathum Thani Province. With respect to the number of industrial workers and factories, Khlong Luang District is the place where goods are produced and distributed across Thailand. If there were unqualified goods, services or low-quality products, they could have affected the health and safety of a large number of Thai people.

Sample size and sampling

The quantitative analysis included (1) the public problems surveillance reported by the division of consumer protection, department of pharmacy, Khlong Luang Hospital and (2) the hospitalization data of all patients who were admitted to Khlong Luang Hospital due to health impacts from public problems related to drug use. from 2020–2022.

Qualitative analysis: The stakeholders in the public health system of Pathum Thani Province were the studied population. The studied sample included purposively those who were involved in consumer protection in the Khlong Luang District area, such as village health volunteers (VHVs);

village headmen; officers from two local government organizations (LGOs), including Khlong Municipality and Khlong Luang Municipality; and health personnel at Tambon Health Promoting Hospital (n=20).

Data analysis

Quantitative analysis

Health outcomes, including the incidence rate, length of stay (LOS), and cost of illness associated with inpatient admission due to health impacts from public problems related to the use of illegal medicines sold by grocery stores, were analyzed using descriptive statistical tests. The currency exchange rates in 2020 (1 USD = 31.2955), 2021 (1 USD = 31.9807), and 2022 (1 USD = 35.0653) announced by the Bank of Thailand were used to convert Thai Baht to USD (Bank of Thailand, 2023).

Qualitative analysis

Qualitative data collected through a 3-round interactive multivoting process were analyzed using content analysis methodology and incorporating comprehensive trustworthiness measures. **The content analysis framework** was employed for analyzing the data from each round individually and then compares themes across rounds to track evolution and consensus-building patterns. Data triangulation with the data retrieved from the literature review, the public problems surveillance the hospitalization database and member checking were employed to ensure trustworthiness.

Ethical considerations

This study was approved by the Human Research Ethics Committee of Thammasat University (Science) (HREC-TuSc). The COA number is 001/2566.

RESULTS AND DISCUSSION

Surveillance of public problems affecting people's health

Five main public problems affecting people's health reported by the division of consumer protection, department of pharmacy, Khlong Luang Hospital from 2019 - 2022 (Table I). The first problem was Illegal drug selling places. In 2020, 48.5% of grocery stores (11 out of 24) sold Ya-Chud (including NSAIDs and steroids) and antibiotics. This reflects the ecosystem of illegal medicine distributions. People can buy Ya-Chud easily without prescription and explanation from neither physician nor pharmacist.

Ya-Chud: Definition and Characteristics

Ya-Chud is a non-prescribed polypharmaceutical preparation consisting of 4-5 unlabeled tablets or capsules packaged in small plastic bags and sold as "combination medicine." These products are distributed without prescription, medical assessment, or proper pharmaceutical oversight, making them readily accessible through vendors, grocery shops, and small pharmacies across Thailand and neighbouring countries.

Composition and Quality Concerns

The drug combinations in Ya-Chud are highly variable and problematic. They commonly contain antibiotics, steroids, and NSAIDs in unspecified quantities and ratios. The medications lack essential safety information including expiration dates, dosage instructions, and contraindication warnings. Preparation is typically conducted by untrained personnel who lack knowledge of drug interactions and contraindications, resulting in potentially inappropriate and unnecessary drug combinations. The quality and authenticity of Ya-Chud components remain highly questionable, as the tablets and capsules may be genuine, counterfeit, substandard, or degraded products. Without proper chemical identification or packaging verification, determining the true nature of these medicines is extremely difficult.

Usage Patterns and Accessibility

Ya-Chud serves as a first-line treatment option for Thai villagers and Burmese migrant workers seeking relief from common ailments including pain, gastrointestinal disorders, cold symptoms, dysuria, and poor appetite. Despite being illegal in Thailand, these products remain widely available through community-based outlets, creating significant accessibility for self-medication practices.

Public Health Implications

The widespread use of Ya-Chud presents serious public health concerns on multiple levels. Sub-therapeutic antibiotic dosing contributes to antimicrobial resistance development and spread, while uncontrolled steroid use poses risks of adverse effects. The practice has been documented to cause serious adverse events, including gastric ulcers, particularly in Laos where similar self-medication patterns exist.

Table I. Surveillance of public problems affecting people's health

Public problems	Reports
Illegal drug selling places	In 2020, 48.5% of grocery stores (11 out of 24) sold Ya-Chud (including NSAIDs and steroid) and antibiotics.
Substandard cosmetic production place	In 2020, 45.7% (32 out of 70)
Substandard food production and selling places	In 2020, 47.4% (9 out of 19) of drinking water production facilities were substandard. All food production facilities were qualified. In 2021, 5% of hawker selling merchandise (1 out of 20) sold substandard fresh food In 2022, 3.7% of grocery stores (5 out of 135) sold substandard fresh food
Substandard healthcare service facilities	In 2020, all pharmacy stores were qualified. 25% of private clinics (2 out of 8) were unqualified. In 2022, 2.9% of pharmacy stores (2 out of 69) were unqualified.
Substandard health products	In 2020, 95% (5 out of 100) of food in sealed containers found incorrect food labels. No contaminated fresh food (from 58 samples) Drinking water products were qualified (from 8 samples) 10% (25 out of 250) of drugs were found unqualified In 2022, 2% (12 out of 580) of fresh food were contaminated. Drugs were qualified (from 690 samples)

Table II. Disease burden based on the hospital database

Year	Incidence rate per 1000 people	Average LOS (days) per admission	Average Cost of illness ($USD) per admission
2020	51.55	8	538.47
2021	80.80	4.1	225.66
2022	45.45	4.5	464.55

The combination of unregulated access, inappropriate drug combinations, and lack of medical supervision makes Ya-Chud a significant challenge for public health authorities in the region, requiring comprehensive intervention strategies to address both availability and community education needs (Newton et al., 2008; Sunpuwan, et al., 2019). The second problem was substandard cosmetic production places. Thirty-two out of 70 (45.7%) cosmetic production places were identified as substandard in 2020. The third problem involves substandard food production and selling locations, such as drinking water production facilities. There were 9/19 (47.4%) drinking water production facilities identified as substandard in 2020. The fourth problem was substandard healthcare service facilities. Two out of 8 (25%) private clinics were not qualified in 2020. The last problem was substandard health products. Twenty-five out of 250 (10%) drug samples were identified as substandard in 2020. However, in 2022, 100% of the 1,380 drug samples were qualified.

Descriptive analysis of disease burden based on the hospital database

The descriptive statistical reports using hospital utilization data of Khlong Luang Hospital from 2020-2022 revealed that upper gastrointestinal bleeding (UGIB) was the most common chief complaint of patients who were admitted to the hospital. On the basis of the patients' history review, most of the patients self-medicated with Ya-Chud (a set of medicines combined with NSAIDs, steroids, muscle relaxants, and vitamins) and herbal products (Table II).

Table III. First-round vote: public problems in the Klong Luang district

Theme of public problems	Voted frequency (n)	Subtheme of public problems (n)
Uses of medicines and health products	18	- People can buy Ya-Chud from grocery stores (n=7) - Substandard of cosmetic products and illegal (n=3) - NCD patients are using the other's medication (n=3) - People request for antibiotics to treat every illness (n=2) - Over use of pain killer drugs (n=1) - Over claim online advertisement of dietary supplement (n=1) - People buy dietary supplements and medicines for self-medication that might be causing chronic diseases (n=1)
Waste and environment	14	- Smell pollution from garbage in the community (n=6) - Polluted water in canal (n=3) - Dust and smoke pollution (n=1) - Cleanness of fresh market (n=1) - stray dog - Uses of chemical substance for agriculture (n=1) - Aedes mosquito problem (n=1)
Health behavior	13	- Patients deny getting treatment at hospital or nonadherence for treatment of illness (n=6) - Malnutrition, i.e., drinking soft drink beverage instead of spring water (n=2) - Alcohol drinking and smoking (n=2) - Not wearing face mask (n=1) - Falling in elderly (n=1) - Not exercising (n=1)
Healthcare facilities	6	- Substandard of food/drinking water production places (n=2) - There is no registered physician in private clinic (n=1) - No labels on food container (n=1) - There is no registered pharmacist in drug store (n=1) - Inconvenient to travel to healthcare facilities (n=1)
Addict substances	4	- Drug addicted teenagers making chaos, such as driving a loud racing car (n=2) - Addict substances use in teenager such as drinking boiled Kratom water, smoke marijuana, 4x100 (one of addict substances formulation) (n=1) - Adverse event from chewing and swallow Kratom leaves (n=1)
Teenager and working aged people	4	- pregnancy problems in teenagers (n=2) - mental health in working age (n=2)

The incidence rate of GI bleeding, average LOS, and average cost of inpatient admission from 2020-2022 were 51.55 per 1000 people, 8 days per patient, and $538.47 USD, 80.80 per 1000 people, 4.1 days per patient, and $225.66 USD and 45.45 per 1000 people, 4.5 days per patient, and $464.55 USD, respectively.

This findings was consistent to other studies about NSAIDs for self-manage pain, inflammation, and fever that can cause serious harms to body organs or systems if used inappropriately (Owusu, et al., 2022). Gastrointestinal (GI) injury (e.g., dyspepsia, upper GI bleeding, peptic ulcer disease, and life-threatening GI perforation), and acute renal injury (e.g., interstitial nephritis) are among the most common serious adverse events resulting from inappropriate NSAIDs use (Doomra & Goyal, 2020; Oliviu, 2017) (Caillet et al., 2017). NSAID-induced adverse drug reactions (ADRs) could lead to hospital admission (Patsuree et al., 2016).

Table IV. Second-round vote: Prioritization of public problems in the Klong Luang district

Public problems	Important of problem	Number of votes
Uses of medicines and health products	Self-medication with Ya-Chud	8
	Antibiotic use	4
	Over claim advertisement of dietary supplement	2
	Overuse of pain killer drugs	1
	Substandard drinking water	1
	Substandard of cosmetic products and illegal	1
Waste and environment	Waste in community	2
	Smell pollution from garbage in community	1
Addict substances	Addict substances use in teenager	2
	4x100 (one of addict substances formulation)	1
Healthcare facilities	Lack of healthcare professional	1
Health behavior	Patients deny getting treatment at hospital	1

Studies from Thailand and Nigeria reported that physicians and pharmacists who educate patients on ADRS of NSAIDs are more likely to focus on the GI harms than the kidney-related harms (Phueanpinit et al., 2018; Showande & Akinbode, 2024). Another study in the Netherlands using time-trend analysis to assess the risk of NSAID-induced UGIB in the total population reported that there is no evidence for the association between the prescribing of NSAIDs and incidence of severe UGIB in the Netherlands between 2013 and 2018. This finding may indicate high prevalence of over-the-counter NSAIDs use (Bedene et al., 2022). In many developing countries, people can buy a wider range of nonprescription NSAID products. The users of nonprescription NSAIDs were generally unaware of their potential adverse effects, implying the possibility of inadequate safety education from physicians and pharmacists (Babelghaith et al., 2019; Mullan et al., 2017; Owusu et al., 2022).

Prioritization of public problems through an interactive multivoting process

The first-round vote aimed to explore the general concern of public problems affecting health in Khlong Luang district. There were 6 public problems, including the use of medicines and health products, waste and the environment, health behavior, healthcare facilities, narcotic substances, and teenage and working-age individuals (Table III). The problem of self-medication with Ya-Chud was the most frequent problem voted by the participants (18/20). The second frequent problem voted was smell pollution from garbage in the community (14/20). The third frequent problem voted was lacked health awareness, such as alcohol consumption, smoking, and not exercising. The other public problems voted were unqualified in private clinics or pharmacy stores, substandard food/drinking water production places, drug addictions, pregnancy problems in teenagers, and mental health problems in working-age individuals. The second-round vote prioritized the public problems affecting people's health from the first-round vote (Table IV). The problem of the use of medicines and health products was the most important problem. Ya-Chud and antibiotic use were prioritized as the first and second issues, respectively, affecting people's health. The third-round vote was to rank the severity of the public problems affecting people's health (Table V and Figure 1). The problem of smell pollution from garbage in the community was the most severe because the location of the community is close to the solid waste landfill. In addition, people are not aware of separating garbage before throwing it away and illegally dumping garbage in the community. The participants proposed a solution method for reducing household waste and providing knowledge and training on waste management. Everyone in the multivoting process agreed that the indicator for the problems must be reduced by 25 - 50% within 6 months and that there should be no recurrence. The second most severe public problem was the problem of the use of medicines and health products, especially Ya-Chud, and antibiotic use as self-medication by people in the community. The largest market in Khlong Luang district, which is the enormous distributor of several kinds of health products and food across the country, is suspected to be the source of Ya-Chud.

Table V. Third round: Severity of the public problems affecting people's health in the Klong Luang district

Public problems	Problem should be solved	Number of votes for severity of the problem	Cause of the problem	Guide to initial solution
Waste and environment	Community garbage	9	- the location of the community is closed to the solid waste landfill - people are not aware to separate garbage before throwing it away - illegally dumping garbage in the community	- reducing household waste and providing knowledge and training on waste management
Uses of medicines and health products	Self-medication with Ya-Chud	8	- muscle pain in elderly - self-medication - sharing medication to others - discontinue medication without prescription - one source of Ya-chud is from the biggest market in Khlong Luang district	(no comment)
	Antibiotic use	3	- ask for medicine in advance without indication	(no comment)
	Illegal health products	3	- the purchaser understands that it is the personal right - illegal health products are sold in the shops and online	- proactive education on label - follow up by networking of the health center
Healthcare facilities	Substandard drinking water	2	- illegal drinking water production - lack of government measurement	(no comment)
	Lack of healthcare professional	5	-healthcare professional don't want to show up at the private clinic and drug store	- Enforce the law: 100% of private clinics must have registered physician and 50% of drug stores must have registered pharmacist.
Addict substances	4x100 (one of addict substances formulation)	3	- use as combination with other addict substances	- campaign to reduce use of addict substance and provide knowledge within 1 year
Health behavior	Not wearing face mask	3	- people do not aware of COVID-19 infection especially those who had been infected before.	- campaign to wear face mask
	Sharing medicines and stop using medicine without prescription	4	- patient do not go to the hospital because of inconvenience in travelling	- proactive education - follow up by networking of the health center
	Eating food that is not hygienic	1	- advertisement on social media	(no comment)

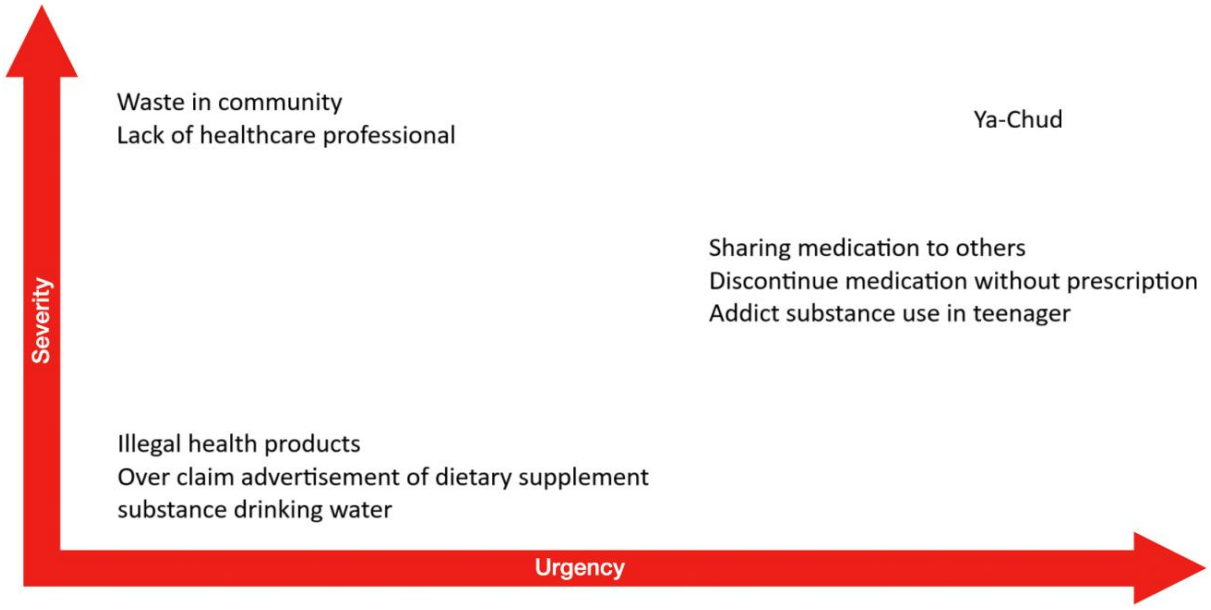

Figure 1 Severity and urgency of public problems affecting people's health in the Khlong Luang District

The proposed solution for this problem was to eliminate Ya-Chud from grocery stores within 6 months.

This voted is consistency to the qualitative study in Thailand (Sunpuwan et al., 2019). This study conducted in-depth interviews and focus group discussion with drug suppliers and community members based on health service utilization model. The results showed thematic of factors driven people buying Ya-Chud for self-medication, including overcrowding, long waiting times, and a perceived unwelcoming environment at public health-care service outlets. Migrants and older people were most likely to seek and use Ya-Chud, especially for mild illness. Availability, easy access through a user's network, low cost, and perceived effectiveness were identified as factors that enable access and use of Ya-Chud. Though illegal in Thailand, Ya-Chud is likely to remain available for self-medication by community members, due to the persisting demand by the elderly and migrant workers. There is an urgent need to replace these mixed medications with better choices. The qualitative study also proposed about safer Ya-Chud that may be a preferred, first-line health-care option, which could help reduce congestion in the formal health-care setting. At the same time, enforcement of regulatory compliance needs to be continued in order to stop the supply of unsafe Ya-Chud.

The third most severe public problem was healthcare facilities, such as private clinics and drug stores, which do not have registered healthcare professionals. The cause of this problem is that healthcare professionals do not want to show up at the healthcare facilities they are supposed to work. The proposed solution for this problem was to enforce the law. Within 6 months, 100% of private clinics must have registered physicians, and 50% of drug stores must have registered pharmacists.

However, the public problems affecting people's health those were prioritized based on the multiple votes of the participants living in the community, including community leaders, healthcare professionals from health centres, and village health volunteers. The participants acknowledged public problems and were aware of their effects on people's health. Nonetheless, their opinions might differ from those of the general population in the district.

The findings of this study revealed that the most severe public problem was drug use in the community, such as self-medication with Ya-Chud. This is the first concern due to findings reported in the Table I on the issue of the presence of illegal drug stores. So the first solution is to take decisive legal action against these stores. There was consistency in findings among reports of

community surveillance, hospital databases, and multiple voting processes. Ya-Chud was sold not only in several grocery stores but also in drug stores (Thongmuang, 2017). In addition, studies have reported that drug stores are the main distributors of Ya-Chud to grocery stores (Boonyoung & Muenpa, 2019; Chanla-or, 2023; Phetcharaburanin & Saokaew, 2019). Another public problem that was the most severe but not urgent was waste in the community. This might be because there were no hospital admissions for this problem.

Finally, preparation of provincial master plan might need comprehensive evidence from wider stakeholders in other communities across the province. Employing the cultivating community-based participatory research methodologies could allow for comprehensive assessment, understand the area of concern and prioritize the future public problems affecting people's health (Hoerger et al., 2023). Study of community health system reform cycle in 7 countries reported some key findings such as reform requires a carefully choreographed effort to enroll key stakeholders to support change by spotlighting a locally relevant gap in the existing health system's performance, and reform should be viewed as an ongoing adaptive and evolutionary process; learning, governance, and management systems must be designed with this trajectory in mind. This study also recommended that critically examine projects that implement term-limited, externally driven interventions and adapt designs to promote sustained, well-integrated community health programs at scale (Chen et al., 2021). Another study proposed the Four-I model, including four attributes concerning resource flows: interactions among divers agents, integration of multiple systems, interconnectivity between organizational levels, and iteration over time could guide question and a related framework useful for designing the provincial master plan effectiveness and efficiently (Nogueira, 2022).

Limitations

This study has limitations for routine reports of community surveillance which depends on the key performance indicator requested by the Ministry of Public Health. If there was no key performance indicator regarding the problem, the problem would not have been recorded. The findings from this study might be lower than the actual values.

Recommendation

Further studies are needed to expand the sample to the general population. Finally, there should be a policy proposal for the government sector to have an information system to address public problems, especially those related to medicines and could impact the health of people, and display updated information to the public routinely.

CONCLUSION

A master plan for addressing health impact of unauthorized medicine sales is needed since it is the most urgent and severe of the public problems. Linkages among stakeholders' databases, including community hospitals, community leaders, and private sectors, should be developed to serve the plan.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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