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Illicit Cigarettes Consumption:

Empty packs survey in six Indonesian cities

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Illicit Cigarettes Consumption: Empty packs survey in six Indonesian cities

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TABLE OF CONTENTS

Table of Contents	**4**
List of Tables	**5**
List of Figures	**5**
Executive Summary	**6**
1. Introduction	**7**
2. Methodology	**9**
Sample Design and Size	11
Collection of Empty Packs	13
Data Collection: Tax Stamps and Pictorial Health Warning (PHW) Image Attributes	14
Data Analysis: Classification of Licit and Illicit Packs	14
3. Results	**16**
Overview	16
Licit/Illicit Packs	17
4. Discussion	**19**
5. Conclusion	**21**
Appendix	**24**

LIST OF TABLES

Table 1. Characteristics of selected cities	10
Table 2. Number of empty packs to be collected by chosen cities	12
Table 3. General overview of the sample	16

LIST OF FIGURES

Figure 1. Location of the six cities included in this study	11
Figure 2. Levels of administrative areas in Indonesia	11
Figure 3. Prescribed walking protocol	13
Figure 4. Analysis framework	15
Figure 5. Licit/illicit packs by category of compliance	17
Figure 6. Illicit packs by types of cigarette	18
Figure 7. The licit/illicit proportion by cities	18
Figure A1. Legitimate excise tax stamp on cigarette pack	24
Figure A2. Legitimate excise tax stamp under UV light	24
Figure A3. Legitimate PHWs	25

EXECUTIVE SUMMARY

Illicit cigarettes pose a significant challenge to Indonesia's efforts to reduce its high smoking prevalence. Moreover, the trade of these products can cause significant revenue loss for the government. Evidence on the magnitude of illicit cigarettes in Indonesia remains limited, and this research contributes new, important findings on the topic. This study aims to estimate the level and nature of consumption of illicit cigarettes in six large cities in Indonesia.

This study employed an empty-pack survey method with a cluster sampling design. Data collection involved gathering discarded empty cigarette packs from the streets from October 23 to November 4, 2024, in six major cities—Bandung, Jakarta, Makassar, Medan, Semarang, and Surabaya. The analysis of tax stamps and pictorial health warnings (PHW) compliance was then performed to classify packs as licit or illicit.

Out of 8,179 collected packs, 7,417 (90.76 percent) were deemed eligible for analysis. Among these, 799 packs (10.77 percent) were identified as illicit. The majority of illicit packs were unregistered brands that lacked both tax stamps and pictorial health warnings (63.58 percent). A comparative analysis across the selected cities revealed that Makassar (21.48 percent) and Surabaya (20.61 percent) exhibited the highest prevalence of illicit cigarette consumption. These findings underscore the urgent need for government measures, including specifically enhanced surveillance in high-risk areas—particularly port cities—as well as enforcing regulations against micro- and small-scale illicit manufacturers, and a robust track-and-trace system to curb the circulation of illicit tobacco products.

1 INTRODUCTION

With more smokers than any other country in Southeast Asia, Indonesia continues to confront formidable obstacles in its fight against tobacco use. According to the Global Adult Tobacco Survey 2021, there were 69.1 million smokers in Indonesia. The survey also reveals that smoking is highly prevalent, particularly among adult males (64.7 percent) (1). Globally, a tobacco excise tax that increases the price of tobacco products has been shown to be an effective policy to reduce tobacco use (2). However, tobacco products remain affordable for most Indonesians (3,4) as Indonesia's tobacco excise tax tariff is among the lowest in the world (5).

The tobacco excise tax structure in Indonesia is also very complex. The tax structure currently consists of eight brackets, which are determined based on the type of tobacco products, the scale and method of production, and the retail price range (6). For cigarettes—the most consumed tobacco products among Indonesians—there are three brackets of excise tax for each different type, namely hand-rolled kreteks (*sigaret kretek tangan*/"SKT"), machine-rolled kreteks (*sigaret kretek mesin*/"SKM"), and machine-rolled white cigarettes (*sigaret putih mesin*/"SPM"). Within each of those brackets, three different tiers of excise tax tariff gradually increase with each tier.

This structure was initially designed to accommodate and protect small cigarette producers. However, because large-scale cigarette companies can sub-contract their production to these small-scale producers, the structure incentivizes them to aim their products to fall within lower excise tax brackets/tiers (7). Consequently, the market as it is currently structured will always be supplied with many cigarettes that are sold relatively much cheaper, creating the "downtrading" phenomenon—that is, smokers switching to lower-priced cigarette alternatives (8).

Aside from the problems of affordability and the excise tax structure, the presence of illicit cigarettes is also harmful to Indonesia. As they are typically sold at very affordable prices, illicit cigarettes are often considered attractive options, particularly for young people and people of lower socioeconomic status (9). Illicit cigarettes also cause tax revenue loss to the government. One study in Indonesia from 2018 noted that illicit cigarettes caused significant and unnecessary loss of cigarette excise tax revenue (10). However, unlike in a few neighboring countries like Malaysia and Laos (11), the illicit cigarette trade in Indonesia is mainly dominated by domestic tax evasion. Cigarette smuggling in Indonesia was found to be only around five percent of domestic sales by the Ministry of Health (12). This is at least partly due to the fact that the majority of Indonesian smokers (more than 90 percent) consume kreteks or cigarettes with both tobacco and cloves that are produced domestically (12).

Estimating the magnitude of illicit cigarettes in Indonesia is challenging, although there are previous studies that have attempted to do so, with various limitations. Researchers at the University of Gadjah Mada attempted to investigate the supply side of illegal cigarettes in Indonesia by purchasing cigarette packs from selling points (local retailers or *warung*). They found that the circulation of illicit cigarette packs in Indonesia increased from 6.1 percent in 2010 to 12.1 percent in 2016 and decreased to 7.0 percent in 2017 (13).

The other two studies used a gap analysis method to estimate the magnitude of illicit cigarettes. Using a gap analysis method, the researchers at the University of Indonesia (Ahsan et al.) estimated that illicit cigarettes were 17 percent and 9 percent of the total consumption in 2004 and 2013, respectively (14). Using an improved gap analysis method, another team at the University of Indonesia (Kasri et al.) also estimated that

illicit cigarette consumption was at five percent in 2013 and 19 percent in 2018 (10). While the gap analysis method can indicate the magnitude of illicit cigarettes by comparing the gap between national sales, consumption, and tax revenue received by the government, it lacks precision and is primarily suited for identifying general trends (15).

Another study conducted by Prakarsa in 2018, interviewed 1,440 adult smokers in six provinces and collected 1,201 cigarette packs, of which two percent were found to be illicit through careful validity checks of excise tax stamp attributes and pictorial health warning images (11). However, the sample size in the study was considered relatively small, and thus, the results may not representative. The last known study that measured the magnitude of illicit cigarettes was conducted by Oxford Economics, which used empty-pack surveys and found that illicit consumption increased from 8.5 percent in 2012 to 9.6 percent in 2017 (13). The study was also heavily criticized due to its non-transparent methodology and the fact that it was funded tobacco multinationals.

This study seeks to provide a comprehensive and updated assessment of the magnitude of illicit cigarette consumption in six major cities in Indonesia, a critical issue with far-reaching implications for public health, government revenue, and regulatory enforcement. Given the dynamic nature of the illicit cigarette market—shaped by constantly evolving tax policies, enforcement measures, and market behaviors—this study aims to generate robust, evidence-based insights to inform policymakers and stakeholders. Specifically, it seeks to (1) estimate the overall prevalence of illicit cigarette packs across six major cities in Indonesia, representing diverse geographic and socioeconomic conditions; and (2) conduct a systematic classification of illicit cigarette packs based on their noncompliance with tax stamp regulations and pictorial health warning (PHW) requirements. By refining methodological approaches and incorporating a broader contextual analysis, this study will offer crucial updates on illicit cigarette consumption. The findings are expected to support more effective tax administration, enhance enforcement mechanisms, and contribute to Indonesia's broader tobacco control agenda.

2 METHODOLOGY

This study employed an empty cigarette pack survey methodology—a widely recognized approach for estimating the prevalence of illicit tobacco products. Data collection took place from October 23 to November 4, 2024, across six major cities in Indonesia. The study design and data collection process followed international best practices, specifically referencing the toolkit on measuring illicit trade in tobacco products developed by the Economics for Health team at Johns Hopkins University (2020), providing standardized guidelines for collecting and analyzing discarded cigarette packs (15). This methodology ensures the reliability and comparability of findings, offering a robust evidence base for policy discussions on tobacco control and illicit trade mitigation.

The selection of the survey cities followed a systematic multi-criteria approach to ensure a reasonably representative demographic and geographic distribution of the illicit cigarettes across a small number of major urban areas in Indonesia. The process began with a comprehensive listing of all cities and regencies in the country.

From this list, cities were assessed based on five key criteria:

1. **Population size** – Larger cities generally have higher tobacco consumption and are more likely to be key markets for legal and illicit cigarette trade.
2. **Population density** – Higher-density areas have greater accessibility to cigarette distribution networks, including illicit sources. Sampling high-density areas also ensures high coverage of population and cost efficiency.
3. **Smoking prevalence** – Cities with a higher proportion of smokers were prioritized to ensure sufficient sample availability for the study.
4. **Estimated number of smokers** – Beyond smoking prevalence, the absolute number of smokers in a city was considered to capture areas with significant market potential for illicit trade.
5. **Geographical representation** – To reflect the regional diversity of Indonesia, the selection included cities from the islands of Java, Sumatra, and Sulawesi, ensuring coverage of different economic, regulatory, and logistical environments that might influence illicit cigarette trade patterns.

After applying these selection criteria, six cities were identified as the survey sites: Bandung, Jakarta, Makassar, Medan, Semarang, and Surabaya (Figure 1). This selection ensures a balanced representation of urban centers from different parts of the country.

Each selected city plays a strategic role in Indonesia's cigarette market and reflects distinct characteristics relevant to the illicit cigarette trade:

- Jakarta, Bandung, Semarang, and Surabaya are the four most densely populated cities on Java Island, collectively home to nearly 18 million people based on Indonesia's 2022 National Socio-economic Survey (SUSENAS). Java is the country's economic and political hub, with approximately 56 percent of Indonesia's total population residing on the island (16). Given its high tobacco consumption, Java Island serves as a significant market for both licit and illicit cigarette sales, making these cities critical for inclusion.

- Medan – As the largest city in Sumatra, Medan was selected to represent western Indonesia. It has the highest population density in Sumatra and is a key economic hub with strong trade links to neighboring countries. The city's proximity to potential illicit cigarette supply routes, including those from Malaysia, makes it a significant area for monitoring illicit trade patterns.

- Makassar – Representing eastern Indonesia, Makassar is Sulawesi's largest and most densely populated city. It is a major port city with a high volume of commercial trade, potentially serving as a transit hub for illicit tobacco products entering from international and domestic sources. Makassar's selection ensures the study captures regional variations in illicit trade across different islands.

Furthermore, these cities exhibit higher smoking prevalence and a more significant number of smokers compared to other major urban areas, according to the 2022 SUSENAS. This confirms their relevance and strategic importance for studying illicit cigarette distribution patterns. The characteristics of these cities are summarized in Table 1.

Table 1. Characteristics of selected cities

City	Island	Province	Number of Population	Population density (people/km²)	Adult (aged 15+) smoking prevalence (%)	Smoking population
Jakarta*	Java	DKI Jakarta	10,660,851	16,389	21.24%	1,751,526
Bandung	Java	West Java	2,583,710	15,409	28.44%	569,274
Semarang	Java	Central Java	1,877,230	5,022	20.48%	299,987
Surabaya	Java	East Java	2,923,780	8,341	19.86%	451,815
Medan	Sumatra	North Sumatra	2,326,112	8,778	20.46%	361,973
Makassar	Sulawesi	South Sulawesi	1,566,845	8,903	16.59%	197,160

Source: The 2022 Indonesia's socioeconomic survey (SUSENAS)
* comprises 5 administrative cities: North Jakarta, Central Jakarta, West Jakarta, East Jakarta, and South Jakarta

By adopting a systematic selection process that accounts for population dynamics, smoking behaviors, and geographical distribution, this study ensures that its findings provide a comprehensive and reasonably representative estimate of the illicit cigarette trade in Indonesia. The results will contribute to evidence-based policy recommendations, helping authorities strengthen tobacco tax enforcement and combat illicit cigarette circulation in high-risk areas.

Figure 1. Location of the six cities included in this study

Sample design and size

While smaller geographic area classifications, such as census blocks, are typically ideal to be determined as primary sampling units (PSUs) for an empty pack survey (15), this study opted to use sub-sub-district or Kelurahan (the fourth level of administrative areas) within each city for PSUs due to restricted access restriction to census block data (Figure 2).

Figure 2. Levels of administrative areas in Indonesia

Level 1
Provinces *(Provinsi)*
one province consists of several districts
Level 2
Districts (Regencies/*Kabupaten* and Cities/*Kota*)
one district consists of several sub-districts
Level 3
Sub-districts *(Kecamatan)*
one sub-district consists of several sub-sub-districts
Level 4
Sub-sub-districts *(Kelurahan or Desa)*
one sub-sub-district district consists of several residential communities
Level 5
Residential communities *(Rukun Warga)*
one residential community consists of several household communities
Level 6
Household communities *(Rukun Tetangga)*
one household community consists of several households

Source: Law No. 23, 2014

In selecting the PSUs as collection sites, we encountered a challenge due to the unavailability of demographic data at the PSU level, such as individual age, education attainment, and income. Consequently, the Probability Proportional to Size ("PPS") sampling method could not be applied to select PSUs with potentially higher prevalence of smokers as priority samples. Considering that the majority of smokers in Indonesia are men, we utilized data on the total number of men residing in each PSU obtained from the Ministry of Home Affairs (17).

The minimum sample size of this study was determined by the following formula:

$$n = \frac{Z^2_{1-\alpha/2} \cdot P(1-P) \cdot DEFF}{\delta^2} \qquad n = \frac{Z^2_{1-\alpha/2} \cdot P(1-P) \cdot DEFF}{\delta^2}$$

where:

$Z^2_{1-\alpha/2}$ $Z^2_{1-\alpha/2}$ = quantile of the standard normal distribution for 95% confidence

(critical Z score is $Z_{1-0.05/2} = 1.96$)

P = proportion of illicit packs

δ = estimation error for the proportion of illicit packs

$DEFF$ = design effect

The sample size was determined by the estimated proportion of illicit packs, *P*. In this study, *P* was set to be 10 percent, the average of two estimated sizes of illicit packs based on the two previous studies (10,18). *DEFF* was set to be equal to 2, as the estimates of design effect were not available (15). With a confidence level of 99 percent (or 1 percent margin of error), the formula resulted in 6,920 packs to be collected.

Then, by multiplying the share of smokers per city (the number of smokers per city divided by the total number of smokers in all six cities) and the minimum sample size of 6,920, the minimum number of packs collected by cities is shown in Table 1. To ensure a timely and efficient field data collection, we assigned a total of 49 pack collectors and 10 field supervisors[a]. During the field data collection, we collected a total of 8,172 packs (1,252 or 18 percent more packs).

Table 2. Number of empty packs to be collected by chosen cities

City	Number of smokers per city*	Minimum sample size per city	Empty packs collected during the fieldwork
Jakarta	1,751,526	3,337	3,856
Bandung	569,274	1,085	1,312
Semarang	299,987	572	665
Surabaya	451,815	861	1,082
Medan	361,973	690	779
Makassar	197,160	376	485
Total	**3,631,735**	**6,920**	**8,179**

*Obtained from the Indonesia's socioeconomic survey (SUSENAS), 2022

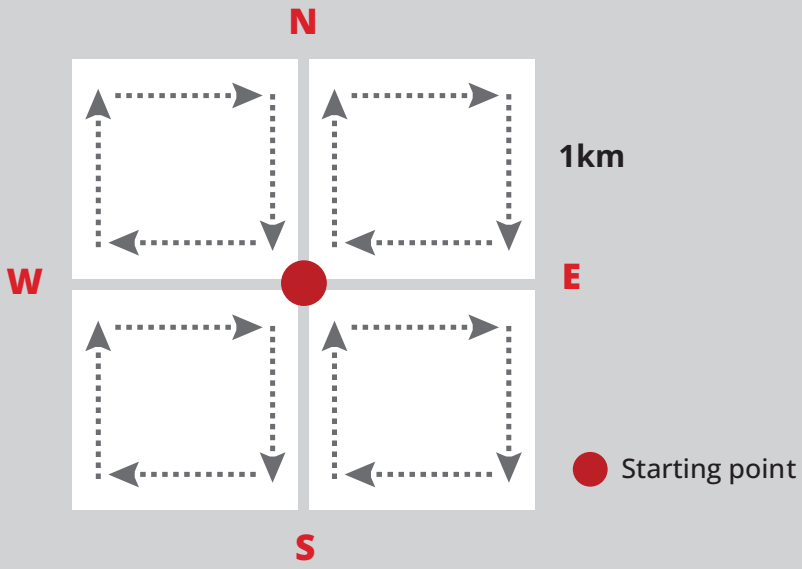
[a] The number of pack collectors and field supervisors assigned per city:
Jakarta : 24 pack collectors and 5 supervisors
Bandung : 7 pack collectors and 1 supervisor
Semarang : 4 pack collectors and 1 supervisor
Surabaya : 6 pack collectors and 1 supervisor
Medan : 5 pack collectors and 1 supervisor
Makassar : 3 pack collectors and 1 supervisor

Collection of empty packs

Trained pack collectors systematically collected every discarded cigarette pack along designated routes. Each route began at the center of each selected fraction and extended around four city blocks (each side one kilometer long) following a prescribed pattern (Figure 3). For instance, starting from a randomly generated point within the sampled PSUs, pack collectors might walk north for one kilometer. Afterward, they would turn right and continue walking until they completed a square with a total walking distance of 4 km. This pattern could be repeated four times, each time beginning in a different starting direction.

We monitored the pack collectors' walking routes using a GPS tracking app called Gaia GPS (19) to ensure compliance with the prescribed route. If the number of packs collected along the specified route did not meet the minimum sample requirements, a new starting point was generated within the same PSU. If the collectors still failed to meet the minimum sample requirements after exploring all feasible starting points within the PSU, new starting points would then be generated in a new PSU.

Figure 3. Prescribed walking protocol



Several parameters were set. First, the route's starting points were generated if there was a cigarette selling point(s)—such as a convenience store, supermarket, or local stall—within a 100 meter distance in the area. Second, areas such as tourist sites, busy public transportation terminals, and central business districts were avoided to focus on local consumption. Third, the pack collectors were permitted to collect cigarette packs only from the street surface for safety and hygiene reasons. This means they were not allowed to gather packs from trash cans. Lastly, the collectors focused exclusively on collecting conventional cigarette packs, excluding e-cigarettes and other tobacco product packs.

Data collection: Tax stamps and pictorial health warning (PHW) image attributes

We gathered information on cigarette packs' tax stamps and pictorial health warning (PHW) image attributes, which were later used to classify the packs into licit and illicit categories. For the tax stamp, we followed guidelines set by the Ministry of Finance, which specifies the attributes that must appear on a legitimate excise tax stamp (see Figure A1) (20). The data input staff inspected the packs and filled out responses to a series of questions regarding the presence and visibility of various attributes, such as the national symbol, the budget year, the hologram, and others. They also verified that key information on the tax stamp matched the information on the respective cigarette pack, including the type of cigarettes, number of sticks, and budget year. Additionally, the tax stamp attributes that are only visible under UV light and are reflective of unique patterns and fibers (Figure A2) were inspected.

The data input staff thoroughly examined the image and warning message on the PHW. It is imperative that any legitimate PHW on cigarette packs is precisely similar to one of the regulated images and warning messages stipulated by the Ministry of Health (MoH)'s regulation (Figure A3) (21).

Data analysis: Classification of licit and illicit packs

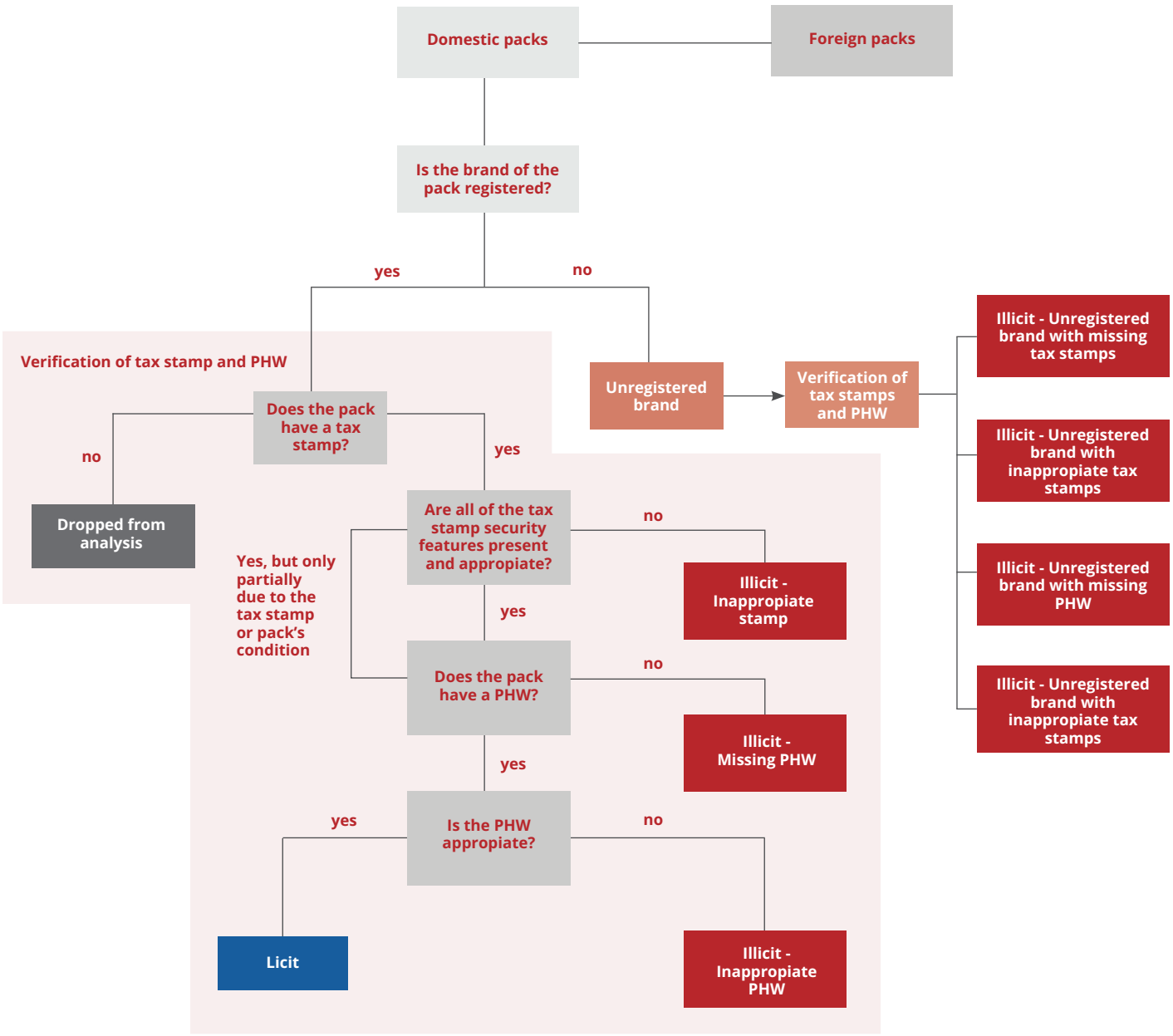
In unsold conditions, four identifiers can be used to classify domestic illicit packs as illicit based on compliance with tax stamps and PHW regulations (11). The first identifier is the absence of an excise tax stamp. The second is the inappropriateness of the tax stamp, which includes scenarios where one or more security features are absent or incorrect—for instance, discrepancies between the stated information in the tax stamp and the actual product details, such as the type of cigarettes, number of sticks, and production year. The third is the absence of a PHW. The fourth is the inappropriateness of the PHW, which means that the picture and the messages do not conform to the regulated standards. Generally, a pack is classified as illicit if it fulfills one of these four conditions. However, since the condition of empty packs varied widely (for example, some packs were partially damaged or some of the tax stamps were wholly or partially ripped off without any visible trace), we adopted an alternative approach. Besides checking the tax stamp and PHW, our alternative approach also involves checking the registration status of the brand on the packs to classify them into licit and illicit categories.

Figure 4 depicts the framework we used to classify packs into licit/illicit categories. We first verified the registration status of the collected packs' brand with the assistance of the Ministry of Finance. This step allowed for the immediate classification of specific packs as illicit categories, particularly those associated with unregistered brands that are likely to be illegal. Subsequently, we proceed to verify the tax stamp and PHW of those packs to determine why they are illegal. We further assessed whether a tax stamp was present for packs with registered brands. If the tax stamp was absent, we excluded the pack from further analysis due to the uncertainty of its previous compliance with tax stamp regulations. If a tax stamp was present, we examined the presence and appropriateness of its security features.

We classified a pack as illicit if the condition of the pack and/or the stamp was undamaged and the security features were found to be incorrect, incomplete, or not matching the required standards. On the other hand, if the condition of the pack and/or the stamp were only partially damaged, we considered the pack as potentially legal if sufficient features and relevant information remained accurate. In this step, we also utilized UV light to validate the legitimacy of the tax stamp. For packs deemed potentially legal, we assessed the presence and appropriateness of the PHW. If the PHW was absent or inappropriate, we classified the pack as illegal. Meanwhile, if the PHW was both present and appropriate, the pack was ultimately classified as legal.

As for foreign packs, we could determine whether the packs were foreign since their brand and health warning labels were written in a foreign language. However, we excluded them from our analysis since we could not determine whether they were legally brought to the country or smuggled.

Figure 4. Analysis framework



Source: Authors' elaboration

3 RESULTS

Overview

Table 3 provides a detailed description of the sample. From a total of 8,179 collected packs, almost all of them (99.91 percent, or 8,172 packs) were identified as domestic packs. Comparing the number of collected packs across the cities, the number of collected packs in Jakarta is the highest, which accounts for 47.15 percent (or 3,856 packs) of total collected packs, followed by Bandung (16.04 percent, or1,312 packs), Surabaya (13.23 percent, or 1,082 packs), Medan (9.52 percent, or 779 packs), Semarang (8.13 percent, or 665 packs), and Makassar (5.93 percent, or 485 packs).

Among the collected packs, the packs of SKM (*sigaret kretek mesin*, machine-rolled kreteks) dominated our sample the most (64.26 percent, or 5,251 packs), followed by SKT (*sigaret kretek tangan*, hand-rolled kreteks) and SPT (*sigaret putih tangan,* hand-rolled white cigarettes) (27.92 percent, or 2,282 packs). Meanwhile, the packs of SPM (*sigaret putih mesin*, machine-rolled white cigarettes), SKTF (*sigaret kretek tangan filter*, hand-rolled filter kreteks) and SPTF (*sigaret putih tangan filter,* hand-rolled white filter cigarette) were less common to be found compared to SKM, SKT, and SPT. Notable regional variations were also present, with Makassar showing the highest proportion of SKM cigarettes (83.30 percent) compared to other cities. Surabaya had the highest percentage of unidentified cigarette types (11.65 percent), which significantly higher than the average across other regions. Regarding foreign packs, a total of seven packs were found, with one of them originating from China, while the origin of the rest of them is unknown.

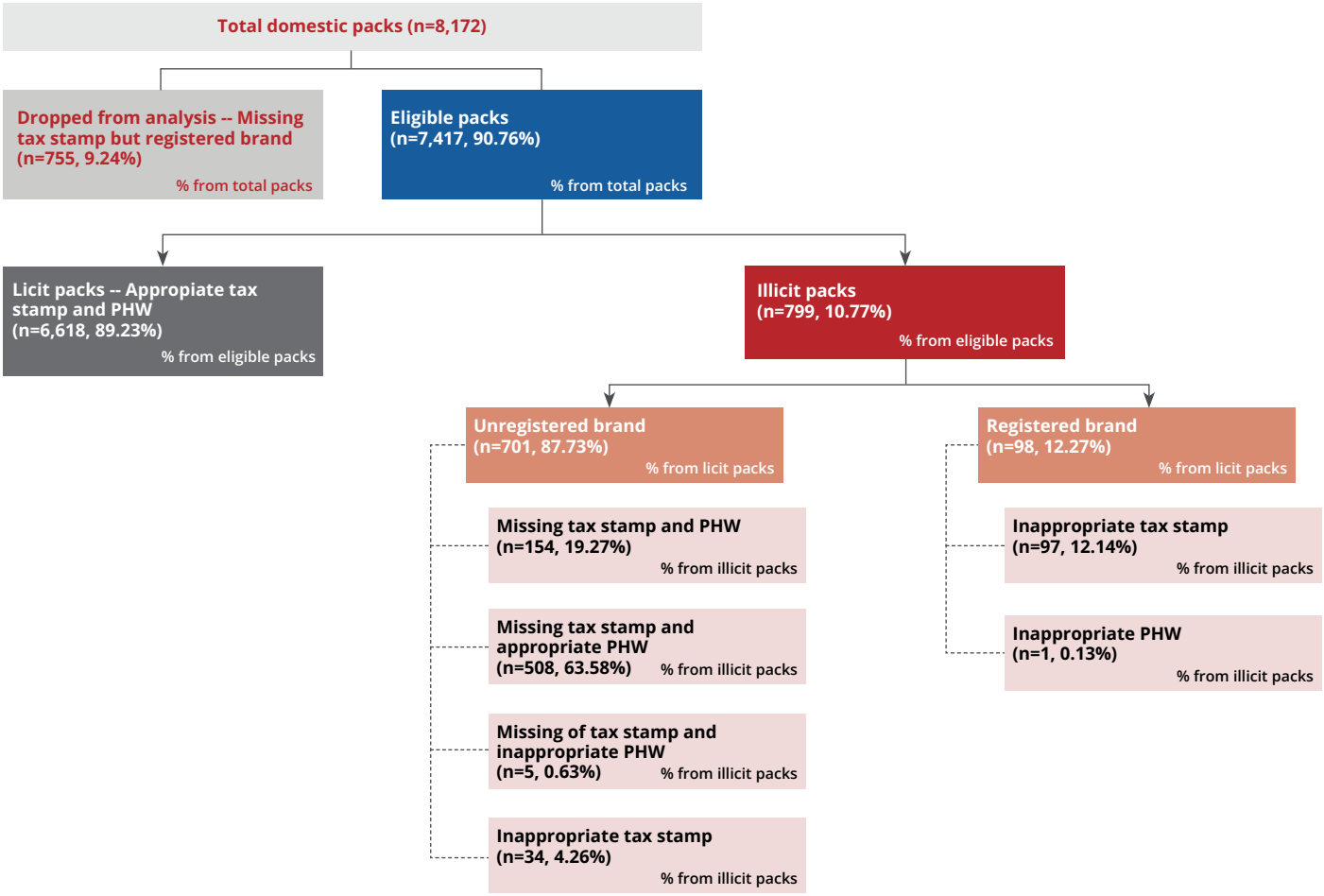
Table 3. General overview of the sample

	City													
	All		Jakarta		Bandung		Semarang		Surabaya		Medan		Makassar	
Total packs collected	8,179		3,856		1,312		665		1,082		779		485	
Domestic packs	8172 (99,91%)		3,855 (99.97%)		1,306 (99.47%)		665 (100%)		1,082 (100%)		779 (100%)		485 (100%)	
Type of cigarettes[a]	n	%	n	%	n	%	n	%	n	%	n	%	n	%
SKM	5,251	64.26	2,445	63.42	778	59.57	421	63.31	700	64.70	503	64.57	404	83.30
SPM	180	2.20	83	2.15	24	1.84	13	1.95	20	1.85	24	3.08	16	3.30
SKT and SPT	2,282	27.92	1,175	30.48	400	30.63	219	32.93	234	21.63	202	25.93	52	10.72
SKTF and SPTF	9	0.11	3	0.08	2	0.15	1	0.15	2	0.18	1	0.13	0	0.00
Other (not stated on the pack)	459	5.51	149	3.87	102	7.81	11	1.65	126	11.65	49	6.29	13	2.68
Foreign packs[a]	7 (0.09%)		1 (0.03)%		6 (0.53%)									
Country of origin	n	%	n	%	n	%	n	%	n	%	n	%	n	%
China	1	14.28	1	100	0									
Unknown	6	85.72	0	0	6	100								

Source: Authors' calculations
Note: [a] Proportion (%) is calculated from the total number of collected pack
Abbreviations: SKM, *sigaret kretek mesin* (machine-rolled cigarette); SPM, *sigaret putih mesin* (machine-rolled white cigarette); SKT, *sigaret kretek tangan* (hand-rolled kreteks); SPT, *sigaret putih tangan* (hand-rolled white cigarette); SKTF, *sigaret kretek tangan filter* (hand-rolled filter kreteks); SPTF, *sigaret putih tangan filter* (hand-rolled white filter cigarette)

Licit/Illicit packs

Figure 5. Licit/illicit packs by category of compliance



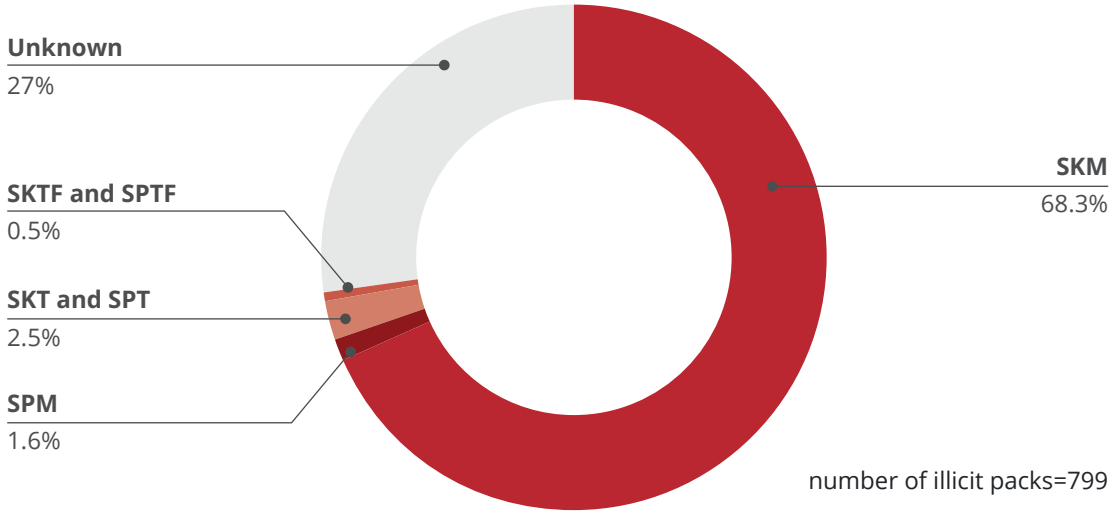
Source: Authors' calculation

Figure 5 shows the distribution of licit and illicit packs by compliance. Out of a total of 8,172 domestic packs collected, 7,417 packs (90.76 percent) were eligible for analysis. The remaining 9.24 percent (or 755 packs) were excluded from the analysis as they were brand packs with missing tax stamps. Among the eligible packs, 6,618 packs (89.23 percent) were identified as licit, and 799 packs (10.77 percent) were identified as illicit. Among the illicit packs, 701 packs (87.73 percent) were unregistered brand packs, and 98 packs (12.27 percent) were registered brand packs. The latter had two compliance issues: inappropriate tax stamps (12.14 percent, or 97 packs) and inappropriate PHW (0.13 percent, or 1 pack).

Figure 5 also outlines the non-compliance characteristics of illicit unregistered brand packs. The most common form of non-compliance—found in 508 (63.58 percent) unregistered brands of illicit packs—was the absence of a tax stamp despite having an appropriate PHW. This was followed by 154 packs (19.27 percent) of unregistered brand illicit packs without tax stamps or PHWs. Furthermore, 34 packs (4.26 percent) of unregistered illicit brand packs had inappropriate tax stamps.

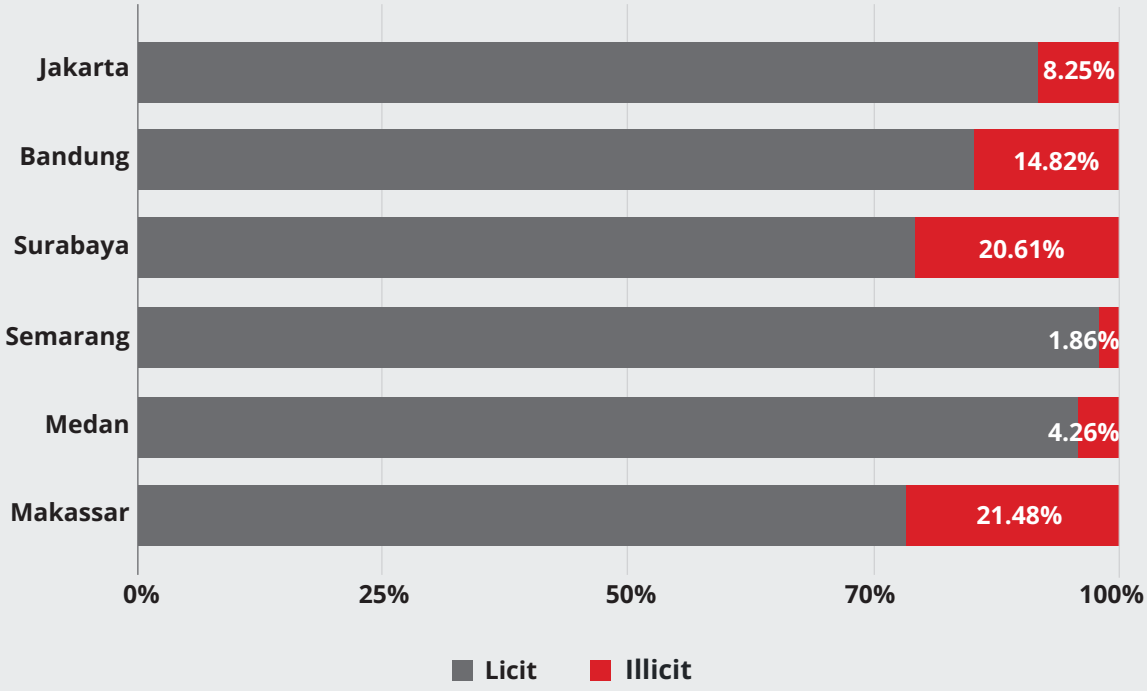
Figure 6 shows the breakdown of illicit packs by type of cigarettes, with SKM accounting for the largest share (68.24 percent, or 546 packs). The comparison of licit and illicit packs' proportion across cities highlights the geographical variation of illicit pack prevalence (see Figure 7) The highest prevalence was found in Makassar (21.48 percent) and Surabaya (20.61 percent), where about one in five packs were illicit, while the lowest was in Semarang (1.86 percent).

Figure 6. Illicit packs by types of cigarette



Source: Authors' calculation

Figure 7. The licit-illicit proportion by cities



Source: Authors' calculation

4 DISCUSSION

In this study, we have estimated that the overall percentage of illicit packs in six major Indonesian cities is 10.77 percent. This result is very close to ~10 percent, which is the average of two estimated sizes of illicit packs based on the two previous studies in Indonesia (10,18). We found that the prevalence of illicit packs in Makassar (21.48 percent) and Surabaya (20.61 percent) is significantly higher than the countrywide average. There are two factors that likely contribute to this phenomenon. First, the province of East Java, where Surabaya is located, is the province with the largest tobacco plantation area and the highest number of tobacco factories (22,23). At the same time, evidence also shows that it is the province with the highest number of court offenses and prosecutorial activities related to illicit cigarettes (24). This suggests a positive correlation between a large tobacco plantation area, a high number of factories, and a high presence of illicit cigarettes, particularly in this province. Second, Surabaya and Makassar are likely to be connected, as they are port cities that connect the main logistics supply between the center and east sides of Indonesia. A large amount of illicit cigarettes may be transported from Surabaya to Makassar, considering the province of South Sulawesi, where Makassar is located, has relatively small areas of tobacco plantations and a small number of cigarette factories (22). Nevertheless, further research is needed as none of the present evidence can fully explain this phenomenon.

Among the 799 observed illicit packs, we found that most illicit packs are unregistered brand packs (87.73 percent). Meanwhile, we found the registered brand illicit packs relatively less common (12.14 percent). This suggests that most of the illicit products are marketed under unregistered brands. These unregistered brand packs are likely produced by micro or small-scale manufacturers who did not legally register their products and operate illegally. In Indonesia, owning a cigarette-rolling machine to start a small-scale cigarette business is relatively easy as it is not restricted by law (25). For the tax stamp, we found that most illicit packs were devoid of tax stamps. This indicates that many illicit manufacturers opt to sell their products without tax stamps rather than counterfeiting them. On the other hand, almost all of the packs displayed a proper PHW, including the illicit ones. This observation implies that it was easy for illicit manufacturers to produce a proper PHW on their products.

Our findings yield two significant implications for future policy change. First, this study emphasizes the necessity for the government of Indonesia to take further steps to control the kretek/cigarette supply chain. Indonesia currently relies only on tax stamps and field enforcement operations. Some straightforward and evidence-based changes could complement these measures readily and at low cost. The government should intensify monitoring and enforcement efforts in high-risk port cities such as Surabaya and Makassar, where illicit cigarette prevalence is notably high. These major ports are strategic entry points that may facilitate the movement of illicit products. Likewise, free trade zones (FTZs) require closer scrutiny, as emerging evidence suggests they may also serve as channels for the illicit cigarette trade (26,27). Second, the government should strongly consider ratifying the WHO Framework Convention on Tobacco Control and the WHO Protocol to Eliminate Illicit Trade in Tobacco Products. The latter treaty, among other provisions, emphasizes licensing all producers including micro and small-scale cigarette manufacturers, which would be a crucial next step to control supply (28). Strengthening oversight of these smaller producers—particularly those operating without registration—should be a policy priority. This may include regulating the sale and ownership of cigarette-making machinery to prevent misuse and enhance traceability within the supply chain.

Ultimately, the government should strongly consider the implementation of an effective track and trace system that

would allow the tax authorities to know where any product is at any given time, from where it came and where it is going. Countries of all income levels, including Kenya (29) and Saudi Arabia (30) have successfully implemented such systems and are reaping the rewards, including far fewer cheap illicit products and markedly higher excise tax revenues. Furthermore, best practices counsel that the systems be entirely paid for by the tobacco companies, though they should not permitted to have any involvement in managing the system whatsoever. The industry benefits because they are much less likely to be undersold by cheaper illicit brands. There are well-known and experienced vendors independent of the tobacco industry who specialize in such systems, and technical assistance is available from international governmental organizations to ensure their successful implementation.

Several necessary clarifications must be made regarding our study results. Although the overall prevalence of illicit cigarettes in our sample is substantial, it should not be interpreted as a nationally representative estimate. Furthermore, the wide variation in prevalence across surveyed cities, with some cities showing significantly higher rates while others, such as Semarang and Medan, report much lower levels, indicates that illicit cigarette prevalence is unlikely to be driven by the excise tax. This is because the tax is applied uniformly at the national level and does not vary across jurisdictions.

This study possesses several notable strengths while also acknowledging certain limitations. One of the key strengths is the incorporation of tax stamp authenticity inspection in identifying illicit cigarette packs. By directly verifying tax stamp compliance, this study provides a more accurate and reliable measure of the extent of the illicit cigarette trade in Indonesia. Without this inspection, estimates of illicit cigarette prevalence would rely solely on packaging characteristics, which could lead to misclassification and underestimation of the issue.

Another major strength lies in the robust sampling design, which ensures a large sample size and wide coverage of sampling units. The study systematically selected survey locations across six major cities, employing a methodologically sound approach that enhances the validity and generalizability of findings within urban settings. The selection of cities was based on critical demographic and geographic factors, including high population density, high smoking prevalence, a large number of smokers, and strategic geographical representation. These factors ensure that the study captures variations in illicit cigarette trade dynamics across different urban areas in Indonesia.

However, the study also has certain limitations. Since the data sources are of discarded empty packs, there are potential inaccuracies stemming from the condition of the collected tax stamps. Many of these stamps were damaged, partially torn, or entirely ripped, which could affect the ability to assess their authenticity accurately. Although trained field staff followed standardized procedures to minimize errors, some uncertainty remains in cases where tax stamps were not fully intact and could not be included. That said, we have every reason to believe that the distribution of these "unreadable" packs was random, and they should not meaningfully affect the overall results.

Additionally, despite the extensive coverage of major urban settings, this study—like other empty-pack surveys (31–34)—does not provide nationally representative estimates. The exclusion of smaller cities, rural areas, and remote regions means that illicit cigarette trade patterns in these locations remain unexamined. Given that illicit cigarette distribution channels may differ between urban and rural areas—due to differences in law enforcement intensity, accessibility, and market demand—future research should consider extending the survey to semi-urban and rural settings to obtain a more comprehensive national picture.

Despite certain limitations, this study offers valuable and timely insights into the illicit cigarette trade in Indonesia. While the findings may not fully capture the extent of potential tax stamp misconduct and cover the national landscape, they nonetheless highlight critical issues related to the circulation of illicit tobacco products, particularly in urban areas. These insights provide an evidence-based foundation for policymakers to strengthen enforcement mechanisms, improve tax compliance, and formulate targeted interventions to curb the spread of illicit cigarette packs. As such, the study contributes meaningfully to ongoing policy efforts aimed at addressing the public health and economic challenges posed by the illicit tobacco market.

5 CONCLUSION

This study provides critical evidence on the prevalence of illicit cigarette packs across six major Indonesian cities, highlighting a challenge to tobacco control efforts, public health objectives, and government revenue collection. The circulation of illicit cigarettes undermines the effectiveness of excise tax policies, weakens smoking reduction initiatives, and leads to significant fiscal losses for the government. These findings underscore the urgent need for more robust measures to secure the kretek/cigarette supply chain, and curb illicit trade and ensure compliance with existing tobacco regulations.

To address this issue, the Indonesian government must better secure the high-risk areas such as cities with big ports and prioritize licensing and ultimately the implementation of a comprehensive track-and-trace system that enables authorities to monitor cigarette production, distribution, and retail sales more effectively. Such measures can significantly enhance regulatory oversight, detect tax evasion, and prevent the infiltration of illicit products into the market. Strengthening enforcement through inter-agency coordination involving customs, law enforcement, the judiciary and health authorities is also crucial to disrupting illicit supply chains. Finally, this study particularly reinforces the need to shut down unregistered micro and small-scale manufacturers that appear to be supplying the market with unregistered brands of illicit cigarettes. To address this issue, restriction on the ownership and the purchase of cigarette making machines also need to be put in place.

Given the limitations of this study, future research should adopt a more comprehensive and multidimensional approach to understanding the dynamics of the illicit cigarette trade in Indonesia. Beyond expanding the geographical scope, subsequent studies should incorporate larger and more representative sample sizes, as well as utilize diverse methodologies—including household surveys, vendor interviews, and supply chain analyses—to triangulate and validate findings. While the study primarily examines the prevalence of illicit cigarette packs, future research should investigate both the demand and supply dimensions of the illicit trade. Key areas of inquiry include:

- consumer behavior and the socio-economic factors that influence the purchase of illicit cigarettes;
- the structure and operations of distribution networks, including cross-border smuggling routes, domestic unlicensed production, counterfeiting and retail-level participation; and
- the effectiveness and enforcement gaps within current regulatory frameworks in curbing illicit cigarette circulation.

By broadening the scope of research and enhancing evidence-based policymaking, Indonesia can strengthen its tobacco control strategy, safeguard public health, and improve excise tax compliance, thereby advancing a more sustainable and coordinated response to the illicit tobacco market.

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Appendix

Figure A1. Legitimate excise tax stamp on cigarette pack

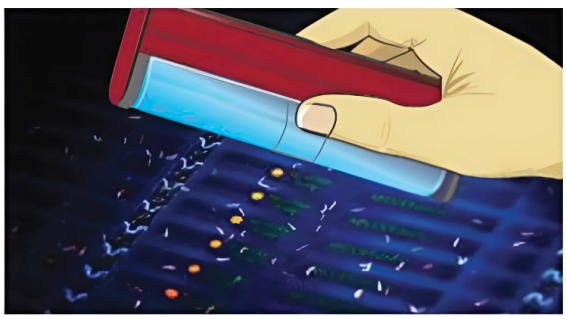
1,2 cm x 11,7 cm **Series I**

1,7 cm x 17,7 cm **Series II**

2,5 cm x 4,8 cm **Series III Without Adhesive**

Source: Directorate General of Excise and Customs, Ministry of Finance of the Republic of Indonesia, 2024
Notes: a) National symbol, b) The Directorate General of Customs and Excise logo, c) excise tax tariff, d) budget year, e) minimum per-pack retail price, f) "INDONESIA" text, g) "CUKAI HASIL TEMBAKAU" text, h) number of individual cigarettes, i) type of tobacco product, j) hologram, k) personalization

Figure A2. Legitimate excise tax stamp under UV light



Source: Directorate General of Excise and Customs, Ministry of Finance of the Republic of Indonesia, 2024

Figure A3. Legitimate PHWs

Mouth cancer

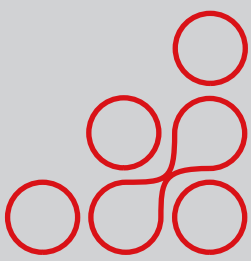
Lung cancer

Throat cancer (ver.1)

Throat cancer (ver.2)

Cancer patient

Source: Directorate General of Disease Prevention and Control, Ministry of Health of the Republic of Indonesia, 2018



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