Special communication

Measuring the illicit cigarette market in the absence of pack security features: a case study of South Africa

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ABSTRACT

There are several ways to measure the illicit cigarette market. In South Africa, different methods were used to triangulate results. The aim of this paper is to assist researchers to decide which method is most suitable to their context, especially for countries that do not have security features on cigarette packs (eg, tax stamps). We analysed the methods and results from three published articles that used various approaches to measure cigarette illicit trade in South Africa: (1) gap analysis, (2) price threshold method using secondary data from a national survey, and (3) price threshold method using primary data collected in low socioeconomic areas. We provide methodological insights and background information. We discuss the advantages and disadvantages of each method. The method chosen by researchers will depend on data availability, the existence or absence of security features on cigarette packs and funding. Researchers investigating illicit trade should use more than one method to increase confidence in the obtained results.

INTRODUCTION

As in many countries, independent, reliable estimates of illicit trade in South Africa are required to counter industry claims about the size of the illicit market. The industry has an incentive to exaggerate the size of and growth in the illicit market to discourage governments from raising tobacco excise taxes.1

A comprehensive methodological guide to measure illicit cigarette trade details the various methods available to researchers, depending on market conditions.2 In addition to the methods in this guide, which have been used globally, a new method has been developed (collecting packs from retailers).3

Since illicit trade is inherently difficult to measure, results can be triangulated using different methods, as has been done in India, Mexico, and Poland.1–3 Despite there being several methods to measure illicit trade, it may be impossible to use them all in a specific country. The method chosen is highly context dependent; each country requires a tailor-made approach.

In South Africa, the choice of method was driven by the absence of any security features (eg, tax stamps) indicating tax payment and because illicit manufacturers comply with health warning requirements. South Africa uses an antiquated diamond-shaped excise stamp impression (which is barely visible and easy to counterfeit). These stamps are meaningless: in reality, most packs, including illicit packs, bear the diamond stamp. In addition, about one-third of smokers buy their cigarettes as single sticks, therefore collecting and examining littered packs may not adequately estimate the size of the illicit market. Cigarette packaging laws were last updated in South Africa in 1994.4 South Africa only requires a written health warning on the front (15%) and back (25%) of the pack. The health warning messages have not changed since implementation. Illicit manufacturers comply with these requirements, so warning labels cannot be used to distinguish a legal pack from an illegal one.

Any method that relies on examining packs was therefore infeasible in South Africa. Two methods were selected: (1) gap analysis and (2) the price threshold method. For the price threshold method, prices were obtained in two different ways: (a) from a nationally representative household survey (secondary data), and (b) from a survey of smokers in low socioeconomic areas (primary data).

This paper provides a practical guide on how to measure illicit trade in countries where pack observation methods are infeasible. This paper is based on three standalone academic articles5–7 Table 1 provides a summary of the three articles, including sample sizes, years covered, data, results, advantages, disadvantages, and practical tips.

Gap analysis

Gap analysis compares self-reported consumption estimates (from national survey data) with legal sales (as declared to the excise tax authority). The gap is the difference between total self-reported consumption and legal sales, which approximates the illicit market.

To calculate self-reported consumption, one requires data on smoking prevalence (which is used to calculate the total number of smokers in a population) and smoking intensity (the average number of cigarettes smoked in a time period). Annual self-reported consumption is calculated by multiplying the number of smokers by the average number of cigarettes smoked per day, multiplied by 365. Survey weights allow researchers to scale these estimates to represent the entire population.

Gap analysis results can be presented as trends over time, as absolute numbers, or as a percentage of the total market. Although reporting the percentage is more desirable for policymakers and other stakeholders, it comes at a price: the necessity to make assumptions about under-reporting. Since people tend to under-report socially undesirable behaviours,8–12 self-reported cigarette consumption needs to be adjusted. Reported cigarette consumption may also be affected by question wording, questionnaire content, and sampling
| Paper          | Method                              | Sample size | Years covered | Data required                                                                 | Scope                          | Results                                                                 | Advantages                                                                 | Disadvantages                                                                                                                                                                                                 | Practical tips                                                                                           |
|---------------|-------------------------------------|-------------|----------------|-------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Vellios et al | Gap analysis                        | Minimum: n=15 556, maximum: n=29 458 | 2002–2017      | National survey data, tax-paid cigarette sales data from national government (local and imported) excise and VAT rates for cigarettes | National                      | Illicit trade was between 30% and 35% of the total market in 2017         | Transparent                                                                  | Results are sensitive to under-reporting assumptions                                                                                       | Investigate existing data as variables on smoking may exist                                          |
|               |                                     |             |                |                                                                               |                               |                                                                         | Replicable                                                                  | Requires government data on excise-paid cigarettes, which may not exist or may not be publicly available | Ensure imported cigarettes are accounted for in tax-paid cigarette sales data from government sources |
|               |                                     |             |                |                                                                               |                               |                                                                         | Reliably representative                                                   | Cannot distinguish between tax avoidance (legal) and tax evasion (illegal)                                                        |                                                                                                |
|               |                                     |             |                |                                                                               |                               |                                                                         | Inexpensive                                                                | Relies on self-reported data                                                                                                                 |                                                                                                |
|               |                                     |             |                |                                                                               |                               |                                                                         | Use of existing data                                                       | Presence of roll-your-own cigarettes might not be included in the official statistics, but are reported as cigarette consumption in surveys |                                                                                                |
|               |                                     |             |                |                                                                               |                               |                                                                         | Can be updated each year if surveys are done annually                  | Results are sensitive to under-reporting assumptions                                                            |                                                                                                |
| Van der Zee et al | Price threshold—using existing data | N=22 493   | 2017           | National survey data, excise and VAT rates for cigarettes                     | National                      | 30% of cigarettes consumed in 2017 were illicit                          | Use of existing data                                                       | Estimates of illicit trade are sensitive to choice of price threshold. To account for this, use different levels as a sensitivity analysis | Investigate what national surveys are planned for the coming years and request the addition of questions |
|               |                                     |             |                |                                                                               |                               |                                                                         |                                                                           |                                                                                                                                     |                                                                                                |
| Van der Zee et al | Price threshold—collecting data from smokers | Round 1: n=1234, round 2: n=1193 | 2017 and 2018  | Primary data collection and excise and VAT rates for cigarettes               | Low socioeconomic areas (six townships across four of South Africa’s nine provinces) | In 2017 and 2018, respectively, 35% and 36% of smokers in the sample purchased illicit cigarettes | Researchers can target specific demographic and socioeconomic groups                                                 | Expensive—about R250 000 (US$20 000) per round                                                                                     | State in the information sheet and consent form that the survey is not linked to the police |
|               |                                     |             |                |                                                                               |                               |                                                                         |                                                                           | Dangerous                                                                                                                            | Use a survey company with local knowledge and experience                                         |
|               |                                     |             |                |                                                                               |                               |                                                                         |                                                                           | Requires ethics clearance                                                                                                               |                                                                                                |
|               |                                     |             |                |                                                                               |                               |                                                                         |                                                                           | Respondents may think fieldworkers are linked to the police and may not declare true price paid for cigarettes |                                                                                                                                                                                |
|               |                                     |             |                |                                                                               |                               |                                                                         |                                                                           | If weights are not applied, the sample will not be representative                                                            |                                                                                                                                                                                |

Table 1: Summary of published illicit trade papers in South Africa using different methods
methodologies. Under-reporting captures these inconsistencies. If researchers require illicit trade estimates as a percentage of the total market, then there are two unknowns: the level of illicit trade and the level of under-reporting in the survey data.

Self-reported consumption should be equal to or greater than tax-paid consumption in all years, to ensure that the volume of illicit trade is not less than zero, since negative illicit trade is illogical. Researchers should not be concerned if illicit trade is less than zero before self-reported consumption is adjusted to account for under-reporting. Under-reporting estimates have a direct impact on the estimated size of the illicit market and should therefore be carefully considered. The level of under-reporting can be calculated if there is a year when illicit trade was insignificant. Let x be self-reported consumption and y be actual consumption:

\[ Y = \frac{x}{100\% - \text{under-reporting percentage}} \]

If x and y are known, then the percentage of under-reporting can be calculated. For example, if actual consumption (y) is 100 cigarettes, but a smoker reported 70 cigarettes, then this smoker has under-reported his/her true consumption by 30 cigarettes (30%). This estimate can be used to calculate actual consumption for subsequent years (y=x/0.7). If a 30% increase is applied to the 70 units, actual consumption would be underestimated at 91 cigarettes (70×1.3) versus the more accurate number of 100 (70/0.7). An alternative method is to apply an uplift factor to self-reported consumption. Using the same example, the uplift factor would be 1.43 (based on the calculation 1/(100–30)/100).

The latter application is used by Her Majesty’s Revenue and Customs, who apply an uplift factor of 1.46 to self-reported consumption. This implies that 100 self-reported cigarettes are increased to 146 actual cigarettes. The survey therefore captured 68.5% of smokers’ consumption (x=100/146). The assumption is that under-reporting is 31.5% (100%–68.5%).

The same under-reporting estimate can be used for all years. If there is reason to believe that under-reporting is increasing or decreasing, the researcher may consider using different under-reporting estimates for different years. It may be important to periodically validate and, if appropriate, modify under-reporting estimates. While most researchers apply the same under-reporting estimates to the entire population, Szklo et al stratified under-reporting by educational level (<8 years vs ≥8 years).13

If there is more than one survey covering the same period, different under-reporting estimates by survey may be necessary, depending on how well the surveys capture self-reported consumption. Vellios et al assumed under-reporting is consistent over time and used under-reporting estimates of 5% and 10% for the All Media and Products Survey and 15% and 20% for the National Income Dynamics Study (NIDS).7 These percentages ensure that the volume of illicit trade is not less than zero in any year.

By using different levels of under-reporting, authors can provide a range within which the level of illicit trade is likely to fall. Vellios et al, using 2017 NIDS data, estimated that illicit trade comprised between 30% (assuming 15% under-reporting) and 35% (assuming 20% under-reporting) of the total market.7

Neither of the surveys used in Vellios et al were designed specifically to measure smoking behaviour, yet they ask useful smoking-related questions. Before surveying smokers, researchers should investigate existing datasets as variables on smoking may exist.

The ease or difficulty of obtaining data on legal sales varies across countries. Most countries publish legal sales on the basis of sales declarations by cigarette manufacturers for tax purposes. If the revenue service is interested in illicit trade, they may be helpful in accessing data gatekeepers.

If it is not possible to get data directly from government sources, researchers can use data from market research firms such as Euromonitor International14 and GlobalData.15 Paraje used sales information from Euromonitor International since there is no official information on registered sales for Chile, Colombia, and Peru.16 However, market-research data are expensive: the 2019 report on the cigarette market in South Africa is $975 (GlobalData) and $990 (Euromonitor International). The reports cover a variety of topics: historic cigarette sales being one of them.

Comparing sales data from multiple sources provides assurance (or not) as to the accuracy of data. Paraje is the first author to publish illicit trade results for Argentina and Brazil using two sources of legal sales data (government and Euromonitor International).16

For South Africa, data on legal sales were derived from budget review statistics, available online. The National Treasury of South Africa compiles excise revenue from domestic cigarette sales. Since excise taxes are levied as a uniform specific tax, the number of cigarettes sold is calculated by dividing the excise revenue by the excise tax per cigarette. Excise revenue from imported cigarettes may be captured separately from locally produced cigarettes (as is the case in South Africa). In South Africa, the number of cigarettes imported was sourced from the Department of Trade and Industry’s website, as the budget line for imported cigarettes is aggregated with other imported products. Excluding imports results in higher illicit trade estimates since the gap between tax-paid sales and self-reported consumption is wider.

A long-time trend allows researchers to benchmark their results with previous academic studies and explain discrepancies, if any. Vellios et al compared their results to two previous studies, namely Van Walbeek and Blecher.17,18

The advantages of the gap analysis method are that the results are transparent, replicable, and nationally representative. Results can be updated as new data become available. As secondary data are used, this method is relatively inexpensive.

The gap analysis method has a number of disadvantages. First, the results are sensitive to the under-reporting assumptions. Second, government data on legal cigarette sales may be unavailable. Third, this method cannot distinguish between tax avoidance (legal) and tax evasion (illegal). Tax avoidance occurs when smokers legally buy cigarettes in neighbouring countries with a lower tax rate. These smokers will report smoking in surveys (which assumes local purchases), but the cigarettes they bought will not appear in government tax-paid sales data. Fourth, roll-your-own cigarettes might not be included in official statistics, but are reported in surveys. Consequently, the comparison of survey-based consumption (that includes roll-your-own cigarettes) with tax-based sales would overestimate the level of tax evasion/avoidance.2 Fifth, gap analysis does not account for cigarette packs that, having paid excise tax, subsequently leave the country.

Price threshold

The price threshold method identifies a price point that separates legal cigarettes from illegal cigarettes. In the market, the final price of cigarettes is the sum of manufacturing costs, taxes (excise, Value Added Tax (VAT) and possibly other duties), distribution costs (producer, wholesaler, and retailer), and profits. A price threshold is determined, below which it is impossible to sell...
Evidence from the South African tobacco industry suggests that the 14% VAT on excise was R2.00 (total tax of R16.30). In 2017, the excise tax on a pack of 20 cigarettes was R14.30 (or single sticks) did you buy when you bought your cigarettes?’, ‘How many of these packs (or single sticks) did you buy when you bought your cigarettes’?, and ‘How much did it cost you to buy these cigarettes?’

Researchers should investigate what national surveys are planned for the coming years and request the addition of questions. Adding questions to national surveys is ideal, as it may cost little or nothing. This was the case in South Africa, but this may not be the case in other countries. The main advantage is that the results are nationally representative. Using data from national surveys allows researchers to include variables like education and income in the analysis.

Collecting new data allows researchers to tailor the survey to their research question. Since smokers are the only consumers involved in purchasing cigarettes, only smokers (not the general population) should be sampled. Obtaining guidance from a statistician will improve the sampling frame. The rigour of the sampling methodology will depend on budget availability. If budgets are limited, then simple methods may be the only option. Van der Zee et al could not apply a rigorous sampling methodology due to budget constraints and safety issues. Instead, they used a random walk approach in six townships to estimate the proportion of illicit cigarettes consumed in the total market.8 To do this, information on smoking intensity and survey weights are required.

In the planning stages of wave 5, the NIDS team was asked to include the following questions: ‘When you last purchased cigarettes, what size was the packaging’?, ‘How many of these packs (or single sticks) did you buy when you bought your cigarettes?’, and ‘How much did it cost you to buy these cigarettes?’

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quality control (including telephonic back checks), and compiling field reports. A household questionnaire was used to screen for smokers. An individual questionnaire was completed by a randomly selected smoker in those households willing and available to participate. Households were surveyed until a target of 200 smokers per township was reached.

Differences in socioeconomic status and smoking behaviours between individuals living in households willing and available to participate and the true population may bias illicit trade estimates. For instance, individuals who smoke more cigarettes per day (who perhaps smoke more illicit cigarettes) tend to be more often out on the streets and may have a higher chance of selection in the random walk approach.

If different companies are used, the method in subsequent rounds should resemble that of the first to ensure comparability. Van der Zee et al ensured that data in both rounds were collected over a short period (round 1: October—November 2017, round 2: July—August 2018). Data were collected over periods unaffected by any policy changes (such as excise tax increases). Data were not collected over the December/January period to avoid any seasonal variation in cigarette consumption (such as New Year’s resolutions).

To improve the likelihood of people being truthful about their smoking habits, especially in the context of illicit activities, it was important in the South African context to inform participants upfront that the survey was not linked to the police. If respondents who buy illegal cigarettes think that they may be caught, they will refuse to participate or give incorrect information. In countries where people may be embarrassed to disclose that they smoke illicit cigarettes, illicit trade estimates may be severely underestimated. In South Africa, this was not problematic as many smokers are unaware that they are purchasing illicit cigarettes. Those who are aware are probably uninterested as the consequences are negligible.

Weighting data can add additional rigour to survey results. Van der Zee et al did not apply weights because weighting data required robust sampling (which was not possible due to budget constraints) and because the actual population estimates from which the sample was drawn was unknown. To account for this limitation, the authors present the results as an observational study: 34.6% and 36.4% of smokers in the sample purchased illicit cigarettes. The authors do not report illicit trade estimates in townships or in low socioeconomic areas.

Questionnaires and data can be made publicly available, which enables other researchers to replicate the results or to explore other research questions. The questionnaires and data from Van der Zee are publically available.23 A paper that describes data collection, all the variables in the dataset, and other research topics the data can be used for is also publically available.24 26

A major disadvantage of collecting data in low socioeconomic areas in South Africa is crime. This may or may not be similar in other countries. During round 1, fieldworkers entered houses where cocaine was being produced, others were robbed of their personal belongings. One fieldworker, who was born and raised in the area where she was conducting fieldwork, said her biggest fear entering people’s homes was being raped. In some areas, fieldworkers recruited participants on the streets to avoid entering people’s homes. In round 2, the survey company had inside information about crime hotspots from previous fieldwork experience in these areas. The survey company also had better contact and communication with community leaders, who were instrumental in advising against certain areas. Despite this, one fieldworker was robbed of his belongings and his survey tablet, and a team supervisor reported that he narrowly avoided being hijacked.

DISCUSSION

Choosing a method to measure illicit trade is limited by data availability, the existence of security features on cigarette packs, and budget constraints. The optimal practice for researchers studying illicit trade is to cross-validate their estimates using different methods.25

The estimates of South Africa’s illicit market, using different methods, were close. In 2017, illicit trade estimates (percentage of the total market and percentage of smokers who buy illicit cigarettes) ranged from 30% to 36%. Using gap analysis, illicit cigarettes comprised between 30% and 35% of the total market. Using the price threshold method with secondary data, illicit cigarettes accounted for approximately 30% of the market in 2017.26 Primary data were also collected, which focused on low socioeconomic areas. In 2017 and 2018, respectively, 35% and 36% of smokers in the sample indicated that they had purchased illicit cigarettes, based on the prices paid for the product.27

These results are surprisingly close to those of the tobacco industry who surveyed 2058 outlets twice. They estimated that illicit trade as a percentage of the total market was 27% in June 2018 and 33% in September 2018 using a different price threshold.28 They defined illicit trade as any product whose price was less than the excise tax plus the VAT (a total of R17.85 per pack of 20 cigarettes or 90c per single cigarette).

It is important to keep monitoring changes in the illicit market. Researchers should keep track of when new national survey data are released. These data can be used to update the gap analysis and the price threshold method. In addition to monitoring illicit trade, countries should have a sustained surveillance system to track tobacco use, as outlined in Article 20 of the WHO’s Framework Convention on Tobacco Control.

Understanding the causes of illicit trade can be achieved by conducting qualitative research with revenue services. In the case of South Africa, several books have been written by an investigative journalist29 and an ex-government employee.30

Results from academic papers can be used to argue for better tax administration to curb illicit trade. Results can be disseminated through the media, directly emailing relevant government officials (accompanied by a one-page or two-page summarised policy brief), and presenting results to various stakeholders.

The WHO’s Protocol to Eliminate Illicit Trade in Tobacco Products provides best practices for eliminating illicit trade.31 Tackling illicit trade is also addressed in a World Bank report that provides multiple country-specific examples.32

CONCLUSION

While there are several methods available to researchers to measure illicit trade, the choice is country specific. Researchers

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What this paper adds

⇒ The paper provides practitioners with a guide on how to measure illicit trade in countries that do not have tax security features, using South Africa as a case study.
⇒ South Africa provides a good example of how researchers were creative in applying different methods to measure illicit trade.
⇒ The advantages and disadvantages of the gap analysis and price threshold method are discussed.
need to understand the regulatory environment (eg, cigarette packaging laws) and investigate available data sources (and assess data accuracy). In South Africa, a variety of possible methods were used to estimate illicit trade. This allows a level of confidence in the results that would have been lacking if only one method had been used.

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REFERENCES
1 Smith KE, Sawell E, Gilmore AB. What is known about tobacco industry efforts to influence tobacco tax? A systematic review of empirical studies. Tob Control 2013;22:e1–53.
2 Ross H. Understanding and measuring tax avoidance and evasion: a methodological guide. Prepared for the Economics of Tobacco Control Project, School of Economics, University of Cape Town and Tobacconomics, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago; 2015.
3 John RM, Ross H. Illicit cigarette sales in Indian cities: findings from a retail survey. Tob Control 2018;27:684–8.
4 Saenz de Miera Juarez B, Reynales-Shigematsu LM, Stoklosa M, et al. Measuring the illicit cigarette market in Mexico: a cross validation of two methodologies. Tob Control 2021;30:125–31.
5 Stoklosa M, Ross H. Contrasting academic and tobacco industry estimates of illicit cigarette trade: evidence from Warsaw, Poland. Tob Control 2014;23:e30–4.
6 Republic of South Africa. Regulations relating to the labelling, advertising and sale of tobacco products as published in GN 2063 in GS 16111 of 2 December 1994 as amended by GN R1148 in GS 16588 of 4 August 1995: 1995.
7 Vellios N, Ross H, Van Walbeek C. The illicit trade of cigarettes in South Africa: 2002 - 2017. Tob Control 2019;29.
8 Van der Zee K, Van Walbeek C, Magadla S. Illicit/cheap cigarettes in South Africa. Trends Organ Crime 2020;23:242–62.
9 Van der Zee K, Vellios N, Van Walbeek C, et al. The illicit cigarette market in six South African townships. Tob Control 2020;29:s267–74.
10 Dietz PM, Homa D, England LT, et al. Estimates of nondisclosure of cigarette smoking among pregnant and nonpregnant women of reproductive age in the United States. Am J Epidemiol 2011;173:35–9.
11 Pérez-Stable EJ, Marin BV, Marin G, et al. Apparent underreporting of cigarette consumption among Mexican American smokers. Am J Public Health 1990;80:1057–61.
12 Roth MA, Alfisi-Selmi A, Wardle H, et al. Under-reporting of tobacco use among Bangladeshi women in England. J Public Health 2009;31:326–34.
13 Szklo A, Iglesias RM, Carvalho de Souza M, et al. Trends in illicit cigarette use in Brazil estimated from legal sales, 2012-2016. Am J Public Health 2018;108:265–9.
14 Euromonitor international, 2020. Available: https://www.euromonitor.com/search/?txtSearch=cigarette
15 GlobalData, 2020. Available: https://store.globaldata.com/search/?s=cigarette
16 Paraje G. Illicit cigarette trade in five South American countries: a gap analysis for Argentina, Brazil, Chile, Colombia, and Peru. Nicotine Tobacco Research 2019;21:1079–86.
17 Van Walbeek C. Measuring changes in the illicit cigarette market using government revenue data: the example of South Africa. Tob Control 2014;23:e69–74.
18 Blecher E A mountain or a molehill: is the illicit trade in cigarettes undermining tobacco control policy in South Africa? Trends Organ Crime 2010;13:299–315.
19 Liedeman R, Mackay B A SmokeScreen economy: the nature and scale of the township grey market cigarette trade in Delft, 2015. Available: http://livelivelihoods.org.za/wp-content/uploads/2018/05/SA-SmokeScreen-Economy-township-grey-market-cigarette-trade-in-Delft_booklet.pdf
20 Iglesias RM, Szklo AS, Souza MCde, et al. Estimating the size of illicit tobacco consumption in Brazil: findings from the global adult tobacco survey. Tob Control 2017;26:53–9.
21 Maldonado N, Llorente BA, Iglesias RM, et al. Measuring illicit cigarette trade in Colombia. Tob Control 2020;29:s260–6.
22 Biznews. Alec Hogg interviews owner of Amalgamated Tobacco. Meet ‘half pregnant’ Yusuf Kajee – independent tobacco player with strong Zuma connection, 2017. Available: https://rions.fm/e/883933
23 Research Unit on the Economics of Excisable Products. Data on Alcohol and Tobacco in Africa Project. African Cigarette Prices 2016-2019. [dataset]. Version 1.3. Cape Town: Research Unit on the Economics of Excisable Products [producer], 2019. Cape Town: DataFirst [distributor], 2020.
24 Van Loggerenberg J. Tobacco wars. Cape Town, South Africa, Tafelberg: NB Publishers, 2019.
25 Research Unit on the Economics of Excisable Products. South Africa – Township Smoking Study 2017-2018 [dataset]. Version 1. Cape Town: Research Unit on the Economics of Excisable Products (REEP) [producer], 2020. Cape Town: DataFirst [distributor], 2020.
26 Vellios N, Van der Zee K. Dataset on cigarette smokers in six South African townships. Data Brief 2020;32:106260.
27 Ipsos. Research report September, 2018. Available: https://web.archive.org/web/20190311091719/http://www.itobacco.co.za/wp-content/uploads/Ipsos-Tobacco-Market-Study-REPORT.pdf
28 Paun J. The President’s Keepers. NB Publishers, 2017.
29 Van Loggerenberg J, Lackay A. Rogue: The Inside Story of SARS’s Elite Crime-busting Unit. Jonathan Ball Publishers, 2016.
30 World Health Organization. Framework Convention on Tobacco Control. Protocol to eliminate illicit trade in tobacco products. Geneva, Switzerland, 2013.
31 World Bank. Confronting illicit tobacco trade: a global review of country experiences. WBG global tobacco control program, 2019. Available: http://documents.worldbank.org/curated/en/677451548260528135/Confronting-Illlicit-Tobacco-Trade—a-Global-Review-of-Country-Experiences