

**Illicit and Non-Compliant Tobacco in Low- and Middle-Income Countries:
Unpacking the Extent, Structure, and Regulatory Gaps with a Bangladesh Lens**

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Abstract

Introduction

Illicit tobacco trade (ITT) undermines tobacco control by increasing affordability, reducing government revenue, and weakening regulation. Despite bearing a substantial tobacco burden, low- and middle-income countries (LMICs) lack robust evidence on the extent of ITT, particularly for smokeless tobacco (ST). This thesis aimed to assess the extent, structure, and associated factors of ITT and identify strategies for improving tobacco control in Bangladesh and other LMICs.

Methods

Four interrelated studies were conducted using multiple research methods: i) a systematic review and meta-analysis synthesised evidence on the share of illicit tobacco and the methods used in LMICs, ii) a cigarette pack analysis estimated the magnitude, structure and associated factors of illicit cigarette sales in Bangladesh, iii) a cross-country ST pack analysis assessed the extent of illicit ST in Bangladesh, India, and Pakistan, and iv) qualitative interviews with tobacco control stakeholders explored strategies for improving ST regulation and monitoring in Bangladesh.

Results

Illicit smoking tobacco accounted for an estimated 14.4% (95% CI: 10.5–18.9) of tobacco sales and/or consumption in LMICs. Evidence on ST was limited, although available studies suggested a higher illicit share. In Bangladesh, 5.6% (95% CI: 4.3–7.1) of cigarette packs were illicit, mainly due to domestic tax evasion. More than 90% of ST products in Bangladesh and India were non-compliant, while none of the packs in Pakistan complied with WHO FCTC-recommended packaging features. Stakeholders identified market informality, weak enforcement, and limited policy attention as key barriers to effective ST control.

Conclusions

Approximately one in seven smoking tobacco packs in LMICs is potentially illicit. Although the illicit share of ST may be higher, evidence remains limited. In Bangladesh, illicit cigarettes are relatively uncommon, whereas the ST market is dominated by non-compliant and potentially illicit products. Standardised packaging, licensing, and stronger enforcement are needed to improve ST control in Bangladesh.

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List of Abbreviations

ASTRA	Addressing Smokeless Tobacco and Building Research Capacity in South Asia
BAT	British American Tobacco
BBS	Bangladesh Bureau of Statistics
BCIC	Bangladesh Chemical Industries Corporation
BCCP	Bangladesh Center for Communication Programs
BDT	Bangladeshi Taka
BER	Bureau of Economic Research
BIDS	Bangladesh Institute of Development Studies
BMRC	Bangladesh Medical Research Council
BUHSS	Bangladesh University of Health Sciences
BUP	Bangladesh University of Professionals
CASP	Critical Appraisal Skills Programme
CLPA	Center for Law and Policy Affairs
CTFK	Campaign for Tobacco Free Kids
CVD	Cardiovascular Diseases
DALY	Disability Adjusted Life Year
DIU	Dhaka International University
FAO	Food and Agriculture Organization
FCTC	Framework Convention on Tobacco Control
GATS	Global Adult Tobacco Survey
GYTS	Global Youth Tobacco Survey
GCRF	Global Challenges Research Fund
GDP	Gross Domestic Product
HDS	Health Development Surcharge
HIC	High Income Countries
HSRG	Health Sciences Research Governance Committee
HS	Harmonized System
ITP	Illicit Tobacco Trade Protocol
ITT	Illicit Trade in Tobacco
JTI	Japan Tobacco International
LMICs	Low- and Middle-Income Countries
NCI	National Cancer Institute
NCD	Non-Communicable Disease
NIHR	National Institute of Health Research
NTCC	National Tobacco Control Cell
PHW	Pictorial Health Warning
PP	Plain Packaging
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta Analyses
REEP	Research Unit on the Economics of Excisable Products
SED	Stakeholders Engagement Discussion
SD	Supplementary Duty
SME	Small and Medium Industries
SHS	Second Hand Smoke
TAPS	Tobacco Advertisement, Promotion and Sponsorship
TCCP	Tobacco Control Capacity Program
TCRC	Tobacco Control Research Cell
TCRG	Tobacco Control Research Group
TPackSS	Tobacco Pack Surveillance System
THW	Textual Health Warning
USD	United States Dollar
VAT	Value Added Tax
WBB	Work for Better Bangladesh Trust
WHO	World Health Organization
WTO	World Trade Organization

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Author's Declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References. This thesis is prepared following the “Journal Style Thesis” format recommended by the University of York, UK. It has four interpretative research paper chapters alongside a conventional background and conclusion. I have used author's accepted version of the manuscripts for the interpretative research chapters of the thesis. While all the research papers are co-authored with others, I made significant individual contribution to each one of them, and am the first as well as the corresponding author for all of them. Contribution and dissemination details of the work provided below, signed by myself and one of the major contributory coauthors of each research paper:

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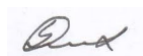
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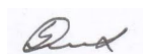
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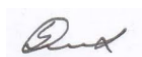
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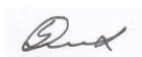
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Conference, Workshop and Webinar Presentation

1. **Conference poster:** A poster was presented at the conference of the “Department of Health Sciences Research Showcase 2023” for Early Career Researchers and PhD students at the University of York, UK.

Poster title: “Estimating the share of illicit cigarettes sold as retail in Bangladesh: The sensitivity and specificity of packaging compliance in detecting tax evasion”, S M Abdullah; Rumana Huque; Nahian Azad Shashi; Md. Tariq Hassan; Mona Kanaan; Kmaran Siddiqi.

2. **Conference presentation:** An oral presentation was made at the conference of the “Department of Health Sciences Research Showcase 2024” for Early Career Researchers and PhD students at the University of York, UK.

Presentation title: “The Extent of Illicit Tobacco Trade in Low and Middle-Income Countries (LMICs): a Systematic Review and Meta-Analysis”, S M Abdullah; Zakariya Siddiqi; Rumana Huque; Mona Kanaan; Kamran Siddiqi

3. **Workshop appearance as a resource person:** I was invited as a resource person to the workshop titled “Understanding the Tobacco Illicit Trade and Reality,” organised by the Bureau of Economic Research (BER), University of Dhaka, and the Bangladesh Network for Tobacco Tax Policy (BNTTP), held in September 2024 in Dhaka, Bangladesh. I have shared my research findings through that workshop with the tobacco control advocates and researchers across the country.

4. **Webinar presentation:** I was invited by the Health Economics Research Network (HERN), in their monthly capacity-building webinar, to share the methodology and study findings of the systematic review I conducted. The webinar took place on 17th December, 2024.

Part I – Background

The first part of the thesis provides the contextual background for research on illicit tobacco trade in Bangladesh. It contains the discussion on tobacco scenario in Bangladesh and significance of illicit tobacco trade research in the country. The research scope and validation of the definition of illicit tobacco and the methodological approaches practised for measuring illicit trade are discussed. Also, it contains the overview of the research contribution, study design and the proposed studies. It comprises four chapters with the contents as follows:

Chapter 1 titled “Bangladesh, Tobacco and Illicit Trade” provides the background of Bangladesh in terms of tobacco prevalence, health, and economic impact of tobacco use, and the evolution of tobacco control policies in the country. The overview of tobacco control initiatives is presented to contextualise the regulatory environment within which illicit tobacco trade occurs and to highlight the relevance of examining illicit trade in Bangladesh. The chapter also discusses different dimensions of existing illicit tobacco trade research and the significance of such research for Bangladesh.

Chapter 2 titled “Research Scope and Definition Validation for Illicit Tobacco Trade in Bangladesh” provides the contextualization of the concept and definition of illicit tobacco trade in Bangladesh. Once it was decided that the research would focus on the illicit trade, a stakeholder consultation was organised to define illicit tobacco trade and specify the scope of this research. Hence, the chapter contains the summary of the stakeholders’ engagement meeting for the validation of the definition for illicit trade in the context of Bangladesh.

Chapter 3 titled “Methodological Approaches for Estimating the Magnitude of Illicit Tobacco Trade” provides an overview of existing methods for measuring illicit trade in practical. Furthermore, it contains a comparative analysis of existing methods with their pros and cons, and establishes the optimal approach for Bangladesh, aiming towards estimating the illicit tobacco.

Chapter 4 is titled “Research Contribution, Data Source, Study Design and Overview of Proposed Studies” provides the knowledge gap and the potential contribution of this research to bridge the gap. While briefly discussing the data source and study design, this chapter also provides a short description of the proposed studies outlined in the thesis.

Chapter 1: Bangladesh, Tobacco and Illicit Trade

1.1 Introduction

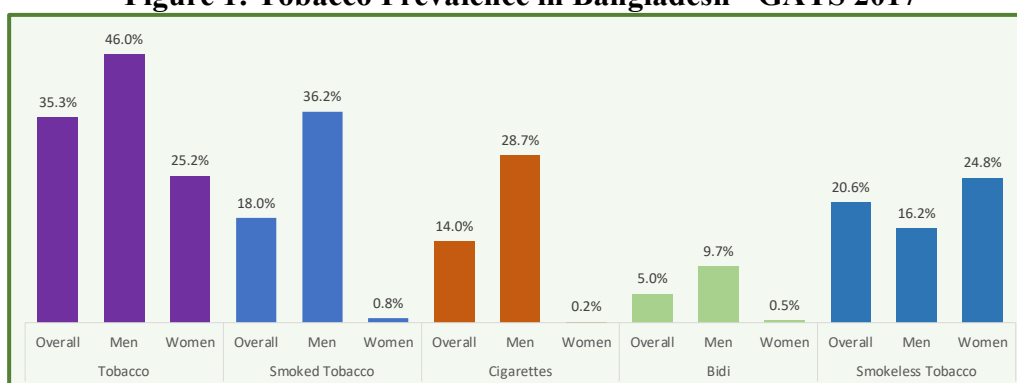
1.1.1 Tobacco and Bangladesh: Global Epidemic to local Burden

Tobacco use remains a significant health and economic burden worldwide. Globally tobacco use accounts for 7 million deaths annually including 1.6 million non-smokers exposed to second-hand smoke.(WHO, 2025) Cardiovascular and chronic respiratory diseases represent the main burden of tobacco use and by 2040, the tobacco related death and disease burden is expected to rise globally.(Chen et al., 2025) The tobacco burden disproportionately falls on the low- and middle-income countries (LMICs) for being home for around 80% of the global tobacco users.(Hebbbar et al., 2022; WHO, 2025) While global smoking prevalence is declining, the disparity in the rate of decline among high- and low-income countries worldwide is shifting the epidemic increasingly towards LMICs.(Dai, Gakidou and Lopez, 2022) Specifically in Asia, smoking is likely to remain a leading cause of preventable death unless there are successful cessation efforts.(Dai, Gakidou and Lopez, 2022)

The tobacco epidemic in South Asia is diverse and unique within global tobacco control efforts, due to the spectrum of commonly used tobacco products in the region.(Gupta, Puntambekar and Assunta, 2022) Tobacco in both combustible (‘smoking’ hereafter) and non-combustible (‘smokeless’ hereafter) form is highly prevalent in South Asian countries.(Xie et al., 2023) There is also a gender perspective of tobacco use; while smoking tobacco is highly prevalent among men, smokeless tobacco (ST) is predominantly high among women in this region. Although ST use is reported in 127 countries, South Asia and South east Asia is the home of over 85% of the global ST users (365 million).(Mehrotra et al., 2019; Coyle et al., 2025; Siddiqi et al., 2020a) Over 85% of the ST burden is estimated to be in South and Southeast Asia, with India, Pakistan, and Bangladesh accounted respectively for 70%, 7%, and 5% of DALYs (Disability Adjusted Life Years).(Siddiqi et al., 2020a) More recently, focusing the economic burden of ST use, given policy stagnancy the lifetime ST attributable treatment cost is estimated to be over USD 1.5, USD 3 billion, and USD 19 billion, respectively in Bangladesh, Pakistan, and India.(Coyle et al., 2025)

In Bangladesh, 35.3% of adults (38 million) use tobacco regularly. (Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) Bangladesh is one of those countries in the world where both smoking and ST are prominent. Additionally, the tobacco consumption has a gender perspective here. According to the Global Adult Tobacco Survey (GATS) 2017, the prevalence of tobacco use is 46% among men and 25.2% among women (Figure 1). (Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) The disaggregation of prevalence according to type of tobacco reveals that ST has a larger prevalence than smoking tobacco (20.6% (22 million adults) against 18.0% (19.2 million adults)). Considering the gender distribution of tobacco consumption, it is evident that ST is more prevalent among women while smoking is prevalent among men. More specifically, prevalence of smoking tobacco among men is 36.2% against 0.8% among women; conversely prevalence of ST is 24.8% among women against 16.2% among men. Around 15 million adults (14.0% overall) smoke cigarettes and another 5.3 million adults (5.0% overall) smoke bidis (locally produced cheap cigarettes). Around 20 million adults (18.7% overall) use betel quid with tobacco and around 3.9 million (3.6% overall) use gul. They are spending, on average, on an average, around 1,078 Bangladeshi Taka (BDT) every month (approximately 13 USD, assuming 1 USD = 83 BDT) for cigarette consumption. (Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) For bidi the monthly average spending was around 342 BDT (approximately 4.1 USD). While tobacco production may generate income, national level evidence for Bangladesh showed that the economic costs from related disease and productivity losses outweigh the sector's revenue generation. (Nargis et al., 2022) Therefore, a holistic approach is required focusing both smoking tobacco and ST, and men as well as women to reduce the overall tobacco prevalence effectively and to reach the national health related targets.

Figure 1: Tobacco Prevalence in Bangladesh - GATS 2017



Source: Global Adult Tobacco Survey (GATS) – 2017

1.1.2 Bangladesh's Tobacco Control Journey

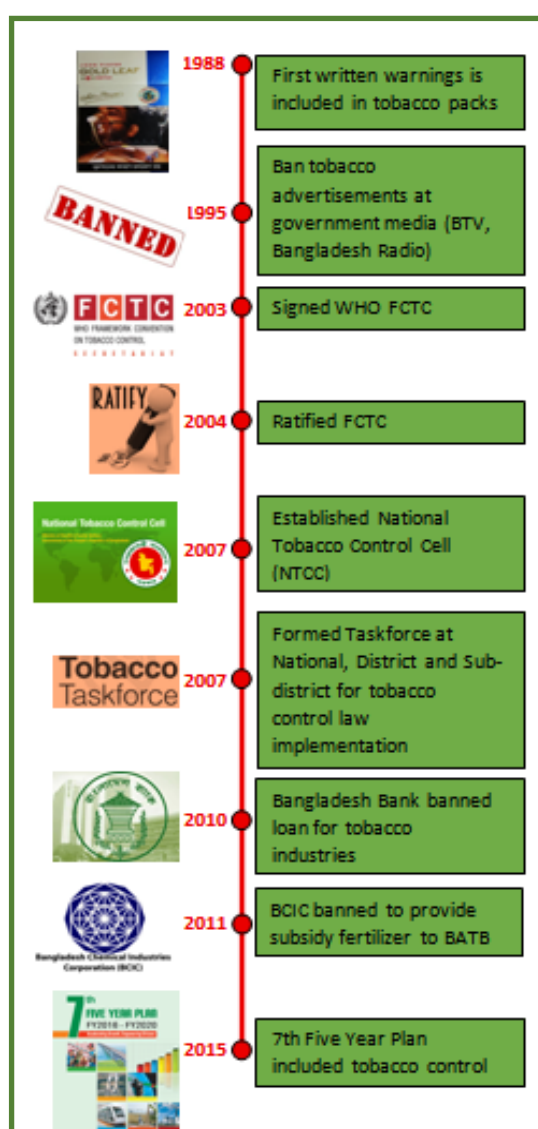
This section briefly traces the evolution of tobacco control policies in Bangladesh to contextualize the regulation of illicit tobacco trade. As a global response to the tobacco epidemic, the Framework Convention on Tobacco Control (FCTC) was initiated in Global Health Assembly during 2003 by the World Health Organization (WHO). The treaty came into force in 2005 and currently a total of 168 countries are signatories. Bangladesh is one of the first signatories of the FCTC in 2003 and ratified the treaty during 2004. Nevertheless, Bangladesh's journey of controlling tobacco started more than a decade before the implementation of the FCTC. As a tobacco control initiative and making people aware about the adverse health implications of tobacco, in Bangladesh Textual Health Warnings (THW) were introduced on tobacco packs back in 1988 for the first time. Another significant event was banning tobacco advertisements in government media (national television and national radio) in 1995. Figure 2 contains the timeline with significant events related to tobacco control in Bangladesh.

Following the ratification of the FCTC in 2004, National Tobacco Control Law was enacted by Bangladesh government during 2005. In the following year, the rules were endorsed to support the enforcement of tobacco control law. This law partially banned "Tobacco Advertisement, Promotion and Sponsorship (TAPS)", introduced health warning on the packs and banned smoking in selected public places and public transport. However, the definition of tobacco was not inclusive of ST. Accordingly, in the year of 2013 the law was amended revising the tobacco definition by including ST. As a commitment under the FCTC and make the tobacco control effort comprehensive during 2007 National Tobacco Control Cell (NTCC) was established. Targeting towards tobacco control law implementation NTCC formed taskforce at national, district and sub-district level.

The central bank of Bangladesh i.e. Bangladesh Bank banned sanctioning of loan to tobacco industries in 2010. In 2011, Bangladesh Chemical Industries Corporation (BCIC) banned the subsidisation of fertilisers to British American Tobacco (BAT) in Bangladesh. During 2015, as a comprehensive target toward achieving health goal, the 7th Five Year plan of Bangladesh considered tobacco control as a priority. Accordingly, NTCC was formalized in 2015 and rules were amended further to enhance the enforcement of tobacco control law. Specifically in the year 2015, sale of tobacco to and by minors was banned, application of deceptive words on packs as brand element was banned, Pictorial Health

Warnings (PHW) on packs covering at least 50% of the main display was introduced, ban on TAPS made comprehensive and advertisement at point of sale was banned and overall penalty for violation of law was increased. As a fiscal stance, a 1% Health Development Surcharge (HDS) was introduced on the retail prices of all tobacco products either manufactured or imported in the fiscal year 2014-15. Government allocated budget for tobacco control activities in the fiscal year 2018-19. Currently, NTCC is working on issuing extensive amendment of existing tobacco control law and requesting the suggestions and reviews from the stakeholders.

Figure 2: Major Initiatives in Bangladesh's Journey for Tobacco Control



1.1.3 Tobacco Control Research in Bangladesh: Illicit Trade in Tobacco (ITT) – An Unfrequented Research Arena

Despite comprehensive tobacco control efforts, tobacco use in Bangladesh remains considerably high, posing severe public health and economic burdens. Among the challenges, the illicit tobacco trade (ITT) stands out as an underexplored but pressing concern. Keeping aside the internal production scenario of tobacco in the country, ITT along with scrawny law enforcement can make the existing comprehensive tobacco control effort vulnerable. Effectiveness of tobacco control initiatives is also tied with the trade regulation of a region. Trade liberalization, particularly at the bilateral level, has stimulated global trade in tobacco and related products in recent years. Reduction in trade barriers might increase the possibility of tobacco marketing and reduce their price causing higher consumption of tobacco.(Chaloupka and Laixuthai, 1996) This effect is especially pronounced in low- and middle-income countries (LMICs), where regulatory capacity is weaker.(Taylor et al., 2000; Bettcher et al., 2003) Similar to licit trade of tobacco, illicit trade expands tobacco accessibility by undercutting prices, threatening progress in tobacco control.

Illicit tobacco generally evades taxes, lacks quality control, and bypasses licence agreements.(Arevalo et al., 2016) ITT not only might increase tobacco consumption but also, simultaneously, erodes fiscal revenue and weakens tobacco control policy. Lencucha and Callard (2011) estimated that cumulative revenue losses from ITT in countries such as Belgium, India, Indonesia, and Vietnam would amount to three times the WHO's budget for 2010–2011.(Lencucha and Callard, 2011) For Indonesia this tax loss during 2011 and 2013 has been estimated to be 4% to 13% of total tobacco excise revenue.(Ahsan et al., 2014) ITT is associated with law enforcement, border control and governance. Tobacco smuggling often overlaps with organized criminal networks, fostering corruption among customs and border officials, especially in contexts with weak institutional capacity.(Kupatadze, 2021) Countries with less transparency, indicating higher corruption and weaker governance, tend to have higher observed ITT.(Ross and Blecher, 2019) Moreover, tobacco companies frequently exploit the lack of reliable data on ITT by propagating misleading estimates to discourage governments from increasing taxes.(Chaloupka, 2014; Ross and Blecher, 2019) Such practices are also evident in Bangladesh, where weak governance and limited surveillance capacity make the tobacco control environment especially vulnerable. Ultimately, ITT reduces tax revenue,

increases tobacco use, sustains premature deaths, and undermines both national and global tobacco control commitments.(Joossens et al., 2014)

The importance of academic research to address a public health problem scientifically is unquestionable. Although tobacco control research in Bangladesh has gained momentum since the late 1990s, the available research evidence remains inadequate to date. Some tobacco control research evidence in Bangladesh has focused on tobacco tax and pricing,(Nargis, Ruthbah and Fong, 2010; Barkat et al., 2012; Nargis et al., 2019a, 2019b; Hossain, Abdullah and Huque, 2022; Nasiruddin et al., 2019) tobacco demand and price elasticity,(Ali, Rahman and Rahman, 2013; Guindon, Perucic and Boisclair, 2003; Barkat et al., 2012; Palipudi et al., 2012; Nargis et al., 2014; Del Carmen, Fuchs and Genoni, 2018; Ahmed et al., 2021, 2022; Huque et al., 2023; Mistry et al., 2021) tobacco control policy,(Khan et al., 2014; Naznin et al., 2021; Mishu et al., 2020; Hoque and Tama, 2021; Huque et al., 2021) tobacco and public health,(Huque et al., 2017, 2016; Driezen et al., 2016; Boeckmann et al., 2018; Nargis et al., 2022; Faruque et al., 2020; Marshall et al., 2020; Siddiqi et al., 2022b) second hand smoke and air quality,(Zafar Ullah et al., 2013; Siddiqi et al., 2015, 2019; Huque et al., 2015; Jackson et al., 2016; Shah et al., 2019; Mdege et al., 2019; Satyanarayana et al., 2021; Jackson et al., 2021; Ferdous et al., 2022) tobacco supply chain,(Siddiqi et al., 2016b; Khan et al., 2020) tobacco production and farming,(Hussain et al., 2020) economic cost of tobacco,(Faruque et al., 2020; Nargis et al., 2022) implementation of Article 5.3 of the FCTC,(Abdullah et al., 2022a; Barry et al., 2022) health warnings and standard packaging of tobacco,(Mutti et al., 2016; Mutti-Packer et al., 2017; Rahman et al., 2019; Mia et al., 2021; Alam, Billah and Hossain) tobacco cessation,(Warsi et al., 2019; Dogar et al., 2020; Elsey et al., 2022) and tobacco control research capacity (Dobbie et al., 2019; Readshaw et al., 2020) are there. Strikingly, although the journey of academic research efforts has passed more than two decades, ITT remains a neglected area of tobacco control research in Bangladesh. Brown et al. (2017) did a study in 14 LMICs including Bangladesh.(Brown et al., 2017) Their methodology included a cross-sectional survey collecting all cigarettes packs available. They found out that the difference in median price between legal and illicit packs as a percentage of the price of legal packs is 455% in Bangladesh. Suggesting that median price of legal cigarettes is lower than illicit cigarettes but the pattern and size of illicit trade of tobacco in Bangladesh remained unknown. Using Euromonitor data it has been claimed that illicit cigarette trade would be about 2% of the total cigarette market in Bangladesh.(Sadiq, Zaidi and Khurshid, 2019) However, the estimate is obsolete and also

the data quality of Euromonitor is not widely accepted in academia as their method usually remain vague and undisclosed.(Blecher et al., 2015) In particular, despite the importance, there is limited independent published evidence measuring the extent of ITT in Bangladesh. (Abdullah et al., 2020) Considering that 80% of the world's 1.3 billion tobacco users live in LMICs,(WHO, 2023) and that ITT is a global research priority, (van Walbeek et al., 2013) addressing this gap in Bangladesh is essential. Generating reliable evidence on ITT will provide policymakers with the tools necessary to strengthen tobacco control initiatives, increase tax revenues, and reduce tobacco consumption.

1.2 Research Dimensions for ITT: Evidence from Existing Literature

Research on ITT products has been documented well before the inception of Illicit Tobacco Trade Protocol (ITP), 2013. Over the last two and half decades, a considerable body of literature has emerged on illicit tobacco trade and consumption addressing its different aspects. Chaloupka (2014) reviewed different papers and discussed the three main issues on illicit trades which are distortion of data by tobacco industry, different ways to measure illicit trade and effectiveness of interventions to solve the problem.(Chaloupka, 2014)

1.2.1 Extent of Illicit Trade

This section reviews key studies examining the extent of illicit tobacco trade using different methods, highlighting the variation in estimates across countries and data sources. Using different methods, considerable research effort has been made to estimate the extent of illicit cigarette consumption. Joossens et al., (2010) argued that low-income countries have the highest percentage of illicit cigarette trade (16.8%).(Joossens et al., 2010) A cross-sectional survey in 18 European Countries revealed that 6.5% of the packs were illicit.(Joossens et al., 2014) Based on data for production, exports and imports, Shafey et al. (2002) calculated per capita cigarette consumption and found that a large volume of cigarettes produced in Brazil that were exported to Paraguay were smuggled back and consumed as tax free contraband.(Shafey et al., 2002) For measuring the illicit cigarette consumption in Vietnam, Nguyen et al. (2014) used two methods.(Nguyen et al., 2014) Firstly, they calculated the difference between legal sales and estimated consumption and secondly, they estimated net smuggling by calculating trade differences in imports recorded by Vietnam and exports by each trading partners. The study found that in 2002, depending on the under-reporting threshold used, illicit consumption was 6% to 20% of legal consumption. Abola et al. (2014) replicated similar methodology for

the Philippines and found that there is a change in illicit trade patterns over time.(Abola et al., 2014) Using data on the import and seizure of legal and illegal tobacco, Ajmal et al. (2015) calculated the rates of smuggled illegal tobacco that has been grown in New Zealand.(Ajmal and Veng, 2015) They found that in the year 2013, 1.8-3.9% of total national tobacco consumption in New Zealand was illicit tobacco consumption. Iglesias et al. (2017) estimated that daily illicit consumption has increased from 16.6% to 31.1% between 2008 and 2013 in Brazil.(Iglesias et al., 2017) Arevalo et al. (2016) analysed and compared labelling characteristics of illegal and legal packs in Guatemala and observed that 95% of street vendors sold illegal cigarettes there.(Arevalo et al., 2016)

1.2.2 Packaging Features and Illicit Trade

Several studies have examined packaging features and the perspectives of vendors and retail sellers to estimate illicit cigarette trade. Wherry et al. (2014) undertook three cross-sectional surveys to study price, brand and pack characteristics of illicit trade of cigarettes in five South African cities.(Wherry et al., 2014) The findings were that 28.6% of packs were labelled illicit due to absence of an excise stamp, and 41% of overall proportion of informal vendors sold illicit cigarettes. Guthrie et al. (2015) studied retailers' views on illicit trade through direct qualitative interview in New Zealand and found that even though they have concern for financial implication of standardised (also known as plain) packaging, many supported government intervention on these issues.(Guthrie et al., 2015) Moodie et al.'s (2018) focus group research found that young women smokers in Scotland did not consider illicit tobacco consumption related to pack design, and nor did they indicate that their behaviour towards counterfeit tobacco purchase would likely change due to standardised packaging.(Moodie et al., 2018) Other research has also reviewed or explored standardised packaging and illicit tobacco.(Scollo et al., 2015; Vincent et al., 2025; Haighton, Taylor and Rutter, 2017)

1.2.3 Revenue Loss Attributed to ITT

The revenue loss due to ITT has been centre of research for some experts around the world. Lencucha and Callard (2011) calculated price per cigarettes, excise tax revenue per cigarettes and excise loss of revenue using Euromonitor International data for 12 countries and found that loss of revenue due to illicit trade is predictably high.(Lencucha and Callard, 2011) For Indonesia, Ahsan et al. (2014) found that illicit trade values ranged

from \$1 million to \$50 million annually, with tax losses accounting for 4% to 13% of tobacco excise revenue in 2011 and 2013.(Ahsan et al., 2014)

Some literature analysed effect of an intervention and overtime trade patterns on illicit cigarette consumption. Joossens and Raw (2012) discussed how taxes are avoided in different ways. Their findings was that over the years there is a change in illicit trade pattern, earlier well known cigarette brands were smuggled but now there are illegal manufacturing that includes counterfeiting.(Joossens and Raw, 2012) With the help of logistic regression for Turkey, Kaplan et al. (2018) found that after 5 months of final tax rise, 12% smokers had an illicit cigarette pack.(Kaplan, Navas-Acien and Cohen, 2018)

1.2.4 Data Distortion and Refuting the Argument from Tobacco Industry

Several earlier studies have examined the extent of cigarette smuggling in developed countries. Merriman et al. (2000) did a review on academic estimates of cigarette smuggling in the United States and Canada.(Merriman, Yurekli and Chaloupka, 2000) While earlier, Joossens and Raw (1995) analysed the aspects of smuggling and cross border shopping of tobacco in Europe.(Joossens and Raw, 1995) They found that, although it is suggested by tobacco industry that increased tax will lead to more illicit trade, but in Europe expensive tobacco products instead of cheaper ones are smuggled; indicating decreasing tax is not the solution for illicit tobacco consumption.

The issue of data inconsistency in the field of ITT research has been the focus of some researchers. Stoklosa and Ross (2014) used data by collecting packs personally and from discarded packs on streets to estimated illicit tobacco trading and compared it with industry data for Poland. The study concluded that tobacco industry data on illicit trade is misleading.(Stoklosa and Ross, 2014) Gilmore et al. (2014) did a data review and comparison. Their findings suggested that “Project Star” overestimates illicit cigarette levels in some European countries.(Gilmore et al., 2014) Blecher et al. (2015) conducted a data analysis and found that data of Euromonitor is inconsistent.(Blecher et al., 2015) Chen et al. (2015), estimated Hong Kong’s total cigarette consumption and legal domestic sales using data from government reports. Consumption of legal duty free by tourists and visitors were also estimated. A two-way sensitivity analysis has been made for under reporting of self-reported smoking consumption and undeclared smoking. Their findings were that in 2012 about 8.2-15.4% of total cigarette consumption was illicit consumption while the industry funded estimation was 35.9%, suggesting industry funded estimate of

illicit cigarette consumption is inflated.(Chen et al., 2015) In Colombia Maldonado et al. (2020) did a street cross-sectional survey and found that 3.5% of consumption is illicit cigarette which is lower than industry estimated data.(Maldonado et al., 2020)

1.2.5 Country Specific Research Need for Understanding ITT

Some literature focused on the research gaps and importance of country specific approach towards illicit trade. Van Walbeek et al. (2013) tried to identify research gaps in study of illicit tobacco consumption and they suggested that different countries have different needs in case of research, as there are differences in stage of the tobacco epidemic in different countries ranking of research priorities appears to be impossible.(van Walbeek et al., 2013) Ross et al. (2015) showed different approaches to control illicit trade in Brazil, Canada, Hungary, Italy, Malaysia, Romania, Spain, Turkey, the United Kingdom and EU and suggested that for different countries implementation for controlling tobacco should be country specific.(Ross et al., 2015) Joossens and Raw (2008) studied cases of smuggling in Italy, Spain and the United Kingdom and concluded that smuggling can be controlled through supply chain which is controlled mainly by the tobacco industries.(Joossens and Raw, 2008)

1.3 Significance of ITT Research in Bangladesh

As the WHO FCTC aims to bring an end to the tobacco epidemic, countries have to eliminate the illicit trade in tobacco products alongside implementing other key measures such as smoke-free public places, pictorial health warnings on tobacco packaging and restrictions on misleading descriptors and other forms of tobacco marketing. Following the WHO FCTC protocol, illicit trade indicates,

“any practice or conduct prohibited by law and which relates to production, shipment receipt, possession, distribution, sale or purchase including any practice or conduct intended to facilitate such activity” (WHO, 2012a)

In practice, illicit tobacco generally avoids tax payments, have less quality control and lack of license agreements.(Arevalo et al., 2016) Conversely, only tax is quite often allegedly linked with ITT by the tobacco industry. However, non-tax covariates such as weak governance, abortive tax administration, lack of market surveillance and monitoring, informal distribution channel of tobacco products are of equal or greater

importance for ITT. Bangladesh has one of the longest land borders with her neighbouring countries (India and Myanmar) in the world. The existing lower border control suggests reduced risk and provides greater incentive to evade tax via cross-border tobacco smuggling. Nevertheless, the price of cigarettes in Bangladesh is lowest in South Asia, and domestically, there is high affordability in lower-priced brands. Additionally, the domestic cultivation and production of tobacco are on the increase. Thus, the incentive is less for cross-border smuggling at least for the smoking tobacco such as cigarette.

Nevertheless, in Bangladesh there is high legal tax on tobacco, especially on cigarettes. Besides, the tax structure is complicated and multi-tiered along with a weak tobacco tax administration. The tobacco control governance is weak and the market surveillance and monitoring is insufficient. All these incentivises the domestic production of cigarette to evade tax by counterfeiting tax stamp (the fiscal instrument used in the cigarette packs as a marker of tax paid product).

Although the domestic tax on ST is not as high as smoking tobacco, it is the most unregulated type of tobacco in Bangladesh. Unlike the smoking tobacco the distribution channel of ST is completely informal. The suppliers are fragmented with diverse type and nature of ST products.(Siddiqi et al., 2016b) Since there is no licensing requirement specific to tobacco production and distribution, ST producers are enormous in number in Bangladesh. Many of them have no formal Value Added Tax (VAT) registration. Although there is regulation, the ST market has weaker surveillance and monitoring compared to smoking due to its informal nature. Accordingly, the domestic producers have the intention to counterfeit the products, non-compliance to tobacco control laws and hence evade taxes. All these can be stimulating for ITT and undermine the national tobacco control effort.

However, there has been no independent published evidence measuring the extent of illicit tobacco trade in Bangladesh. The difference in median price between legal and illicit packs as a percentage of the price of legal packs is 455% in Bangladesh.(Brown et al., 2017) The findings did not mention the extent of illicit packs and their distribution rather focused only on the price difference. Earlier estimates based on Euromonitor data suggested that illicit cigarettes accounted for about 2% of the Bangladeshi market.(Sadiq, Zaidi and Khurshid, 2019) However, these estimates may be outdated, and the transparency and reliability of Euromonitor's data have been questioned.(Blecher et al.,

2015) However, regarding ITT in Bangladesh still now, magnitude of illicit trade in smoking tobacco and ST is unknown. Since the magnitude is absent there has not been any study regarding its determinants and pattern. Correspondingly, the potential revenue loss of the government is also undetermined. Revealing the magnitude and its determinants and patterns is crucial for developing the appropriate policy initiative and designing the intervention to control the unlawful behaviour. Additionally, estimating the magnitude and contextualising it is important for policymakers to prioritise and localise the concern within the tobacco market for Bangladesh.

1.4 Summary of the Chapter

Bangladesh is such a tobacco-burdened country where both smoking and ST are consumed extensively. In response to meeting this high demand the domestic production of tobacco is increasing trend. As a result of extensive use, the tobacco induced diseases and death are increasing significantly in the country. The economy is also adversely affected because of tobacco consumption. The cost-benefit analysis of tobacco use revealed that it has always been a net welfare loss for the country which is also raising.

Given the worse impact and incidence of tobacco use, the tobacco control effort in Bangladesh dates back to late 1980's. The establishment of NTCC following the ratification of the FCTC agreement have provided an institutional structure of the country's tobacco control movement. Several comprehensive policy initiatives has been enacted along with the "National Tobacco Control Law – 2005 (Amended – 2013)" for controlling the tobacco consumption and related business practices. Smoking in public places and advertising of tobacco are banned, health warning labels are mandatory for the packs and tax stamps with specific security features are necessary. Notwithstanding, still the tobacco prevalence and the corresponding burden for the country is considerable.

Similar to the tobacco control initiative, the research effort started over two decades ago. Several researches have been accomplished till the date covering different aspects of tobacco and its use. Nevertheless, still the research effort exploring the tobacco related phenomena in Bangladesh is incomplete as it has lot of untouched areas to establish the evidence. One such rare spotted area is ITT in Bangladesh. Although the low relative price of tobacco compared to the neighbouring countries rules out the possibility of having large magnitude of smuggling, there is scope of tax evasion by domestic manufacturers. There is currently no published evidence to specify the extent of illicit in

the tobacco market (both smoking and smokeless) in Bangladesh, and also the pattern of this activity is unspecified. Thus, an independent research with appropriate method is required to fulfill the knowledge gap.

Chapter 2: Research Scope and Definition Validation for ITT in Bangladesh

2.1 Contextualisation of the Concept and Definition of ITT for Bangladesh

According to GATS 2017, for Bangladesh in the overall tobacco prevalence (35.3%), the prevalence of ST (20.6%) is predominant. (Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) While for smoking tobacco the prevalence is male dominant, for ST it is dominated by females. Regardless of the type of tobacco, the market is driven mostly by domestic production. (Abdullah et al., 2025, 2022b) The relative low price of tobacco products compared to the other countries provides less incentive for tax evasion through cross-border smuggling. In the smoking tobacco market besides only few domestic tobacco industries, large international manufacturing companies such as British American Tobacco (BAT) and Japan Tobacco International (JTI) are constantly operating. The supply chain of this type of tobacco is formal and there is active distributional channel of the large manufacturing companies operating in the market. In contrast, the ST market is operated solely by domestic, small and mostly informal manufacturers. The supply chain of ST is also informal and there is no formal distribution channel exists, except for few large domestic manufacturers who have their own district-wise network of distributors.

The domestic tax incidence for smoking tobacco is moderately high (as per Fiscal Year 2025-26 around 83% irrespective of the price tiers of cigarettes) and there exists well defined fiscal regulation (as a fiscal instrument attachment of “tax stamp” is mandatory) besides the specific packaging rules. This high tax incidence can motivate the manufacturers to evade tax by counterfeiting the products and tax stamps. On the other side, although the tax incidence is also moderately high for ST it is not mandatory for the ST pack to carry the tax marker. However, the other packaging rules (related to health warnings, misleading descriptors, sale statement and price disclosure) are similar to smoking tobacco. Since, ST use is socially accepted, the regulation and surveillance are scarce. All these are likely to incentivise counterfeiting the products and non-compliance of packaging rules for tobacco control. Table 1 summarises the key differences in market structure, regulation, and supply chains between smoking and ST in Bangladesh.

Table 1: Market characteristics of smoking and smokeless tobacco in Bangladesh

Smoking Tobacco	Smokeless Tobacco (ST)
- Male dominant prevalence. - Dominant by domestic production. - Domestic price low – less incentive for smuggling - Large International Manufacturing Companies besides few domestic tobacco industries. - Formal supply chain and distribution channel. - Tax incidence is moderately high. - Domestic production mostly meets the demand. - As a fiscal instrument, “tax stamp” attachment is mandatory. - Well defined fiscal regulation exists.	- Female dominant prevalence. - Dominant by domestic production. - Domestic price low – less incentive for smuggling - Mostly domestic, small and informal manufacturers. - Informal supply chain and distribution channel. - Tax incidence is moderately high. - Domestic production mostly meets the demand. - Socially acceptable. - No fiscal instrument is attached in the pack. - Well defined packaging rules exist. - Less regulated and weak surveillance.

Given the context of Bangladesh, the ITT aspect must not be only limited to scope of tax evasion through cross-border smuggling. Several other illegal practices taking place in the different stages of tobacco supply chain (such as non-compliance of any tobacco control law) also needs to be considered while analyzing the ITT. Domestic production can also evade tax through illicit manufacturing (non-compliance with laws and regulations for governing tobacco manufactures) and counterfeiting (e.g. counterfeiting tax stamps and trademarks). Tax evasion is considered conventionally as the primary purpose of ITT. Nevertheless, since illicit trade can take place at any stage of the tobacco supply chain, ITT covers all illegal activities related to the tobacco trade, not just the circumvention of tobacco taxes.(Ross, 2015)

Accordingly, the definition of ITT can be considered from two aspects, one where the “tax evasion” is considered as the sole purpose, and the other where “tax evasion” is not the sole purpose. The first one, since is only specific to tax evasion, can be regarded as “narrow” in nature. In contrast, the other one represents a “broader” definition that encompasses multiple forms of illicit practices besides tax evasion. Table 2 presents a comparison of narrow and broad definitions of ITT, highlighting their operational approaches and the advantages and limitations for smoking and ST in the context of Bangladesh.

Table 2: Definition comparison for ITT in smoking and smokeless tobacco

Definition of ITT	Approach for operationalisation under tobacco pack examination method	Smoking tobacco		Smokeless tobacco	
		Pros	Cons	Pros	Cons
Definition 1 (Narrow/Specific): ITT indicate any activity that intends to evade tax (partially or completely)	Testing the authenticity of fiscal instrument (tax stamp)	Direct measure of tax evasion	Other illegal activities cannot be addressed	Direct measure of tax evasion	Since tax stamp is not available cannot be operationalised for smokeless tobacco
Definition 2 (Broad/General): ITT indicate any activity that intends to violate any law or legislation of the country besides tax evasion	-Testing the authenticity of fiscal instrument (tax stamp) -Testing the compliance of pack features against tobacco control law	- Can measure tax evasion - Can measure other illegal activities	- Purpose might not be tax evasion rather cost saving. - A pack may be fully compliant but tax might be evaded.	Can measure other illegal activities	A pack may be fully compliant but tax might be evaded.

Considering the context of Bangladesh what would be the most relevant scientific definition of illicit tobacco trade and why?

- **Definition 1:** ITT indicate any activity that intends to evade tax (partially or completely)
- **Definition 2:** ITT indicate any activity that intends to violate any law or legislation of the country besides tax evasion

As the research is expected to focus on ITT in Bangladesh, a stakeholders' consultation was organised to reach a definition of ITT to inform policy and define the scope of research.

2.2 Rationalising the definition through Stakeholders Engagement Discussion (SED)

2.2.1 Summary of the SED on Definition Validation for ITT in Bangladesh

Considering the tobacco market scenario in Bangladesh and targeting towards making the research useful for policy movement, a stakeholders discussion meeting was organized to validate the operational definition of ITT and to identify the most appropriate definition of ITT. A total of nine (n=9) stakeholders, including academicians, health experts, development workers, and policy advocates from various organizations (Work for Better Bangladesh (WBB) Trust, The Union, Bangladesh Center for Communication Programs (BCCP), Tobacco Control Research Cell (TCRC), Campaign for Tobacco Free Kids (CTFK), ARK Foundation, Bureau of Economic Research (BER), University of Dhaka, Dhaka International University (DIU), BRAC University, National Tobacco Control Cell

(NTCC), National Board of Revenue (NBR), Center for Law and Policy Affairs (CLPA) and Bangladesh Cancer Society) attended the event. The list of participants was assembled from publicly available sources and was informed by knowledge of tobacco control policy developments in Bangladesh. Invitations were sent via email, and follow-up calls were made to confirm attendance at the stakeholder engagement event. The participants called for strengthened cooperation among all stakeholders and recommended stronger implementation of policies to address ITT and to achieve tobacco-free Bangladesh. The specific objectives of the stakeholders' event were to discuss the follows:

Objectives of Stakeholders' Discussion:

- Awareness and significance of the problem of ITT in Bangladesh.
- Pattern of illicit practices for smoking and ST in Bangladesh.
- Differentiating among authentic and counterfeit products and non-compliant packaging features as illicit markup for tobacco products.
- Relevant scientific definition for ITT in Bangladesh.

2.2.1.1 Awareness and significance of the problem of ITT in Bangladesh

Unlike other aspects of tobacco control, there is less awareness of ITT among tobacco control stakeholders. In the absence of appropriate and specific research evidence the gravity of the problem is undetermined and tobacco industries exploit this gap frequently to reap the undue policy benefits. This warrants extensive research in the field of ITT in Bangladesh and the communication of the research evidence to the stakeholders to regain awareness.

2.2.1.2 Pattern of illicit practices for smoking and ST in Bangladesh

Though there is no research evidence on the underlying differences in market structure of smoking and ST products, stakeholders noted that the patterns of illicit practices differ between the two due to differences in market structure, regulation, and supply chains. Academics, policy advocates and law enforcement stakeholders argued that although compliance of packaging rules in smoking tobacco is good compared to ST, there is scope of counterfeiting tax stamp and evading tax on domestic production. In some specific periods (few months before and after the fiscal budget announcement by the government), some media releases report on seizures of illegally imported smoking tobacco. However,

those news stories are occasional and mostly stakeholders believe that they are framed and managed by industries to manipulate the policies. It was agreed that there can also exist illicit manufacturing and counterfeiting of smoking tobacco products. On the contrary, for ST products, the media release of seizures of illegally imported products is almost nonexistent; nevertheless, illicit manufacturing and counterfeiting of the ST product are expected to be prominent, through which they can evade tax. Additionally, as there is enormous number of small, informal and unregulated manufacturers operating, the non-compliance of packaging rules is thought to be higher for ST by the stakeholders of tobacco control movement.

2.2.1.3 Differentiating among the authentic and counterfeit product and non-compliant packaging features as illicit markup for tobacco products

Given that there is no track and tracing marker available in the tobacco packs in Bangladesh, it is hard to differentiate among the authentic and counterfeit products, particularly for ST where regulatory oversight is weaker. Since illicit manufacturing and hence counterfeit products are usually sold at low price, the illegal manufacturers target towards saving the production cost. Counterfeit products often fail to replicate mandatory packaging elements (such as affixing appropriate PHW and THW, sale and production disclosure, avoiding deceptive wordings etc.), making packaging non-compliance a practical indicator of illicit products. While tax stamps are mandatory for smoking tobacco products, counterfeit or reused stamps can also be present, complicating tax evasion detection. Thus, the pack markers can be used to examine the compliance of rules and categorising its authenticity. The illegal manufacturers (particularly for ST products) are always in lack of proper business identity so that they can avoid the tax and enforcement authority failed to track them. As the supply chain for ST products is informal and not appropriately integrated and there is no tax marker attached, non-complaint packaging features can be used as illicit markups.

2.2.1.4 Relevant scientific definition for ITT in Bangladesh

The tobacco control stakeholders suggested communicating the illicit trade research information with specificity and caution, since it can potentially cause confusion, and the industry might receive unwanted benefits from the results. It is particularly because the existing awareness among the stakeholders considers only “cross-border” smuggling as illicit. Contemplating the fact that ST have no direct tax marker, it is suggested to keep

the operational definition of ITT as broad. However, since for smoking tobacco there is a tax marker and also as per the rules, the country of origin is mentioned, it is recommended that the domestic production and the imported ones should be analysed separately. While analysing the results, clear distinction must be made between the products which evaded tax locally and those which are imported illegally. Also, for estimating the magnitude of illicit and communicating it with the policy movement activists, illicit product category and its context needs to be established.

Since, board of revenue receives very small amount of money each year as tax revenue from smokeless tobacco, they do not prioritise regulating the market as they do for smoking tobacco. Consequently, rules related to manufacturing, packaging and distribution are predictably the most defied for ST. Although it is difficult to directly conclude about their tax evasion status, it is certain that they are breaching the laws. It is argued accordingly that non-compliance analysis of ST products can help understanding the intensity of illegal practices taking place in the supply chain and establish the significance of tax marker on the ST packs. Apart from hampering revenue generation for the government, illicit ST has the potential to be responsible for causing ample of problems. For instance, since they usually are the low-cost tobacco option their use is extensive among people with low socioeconomic profile. Activities like illicit ST will increase the uptake and use causing a greater health risk to this people which in turn has potential implication for inequality.

2.3 Summary of the Chapter

In Bangladesh, the tobacco market (both smoking and ST) is dominated by domestic production. However, there remains fundamental difference in the business practice and market structure of two types of tobacco. The smoking tobacco market is relatively better regulated and have structured supply chain. Conversely, ST, although having the larger prevalence, are less regulated and have fragmented market with an informal supply chain. Although the packaging rules resembles each other for smoking and ST to a large extent, there is no specific rule for tax marker in the latter type of tobacco. Nevertheless, taking into account the practical context of tobacco in Bangladesh ITT research should be inclusive of ST. It is particularly because the strategy to combat ITT should be comprehensive.

The absence of specific tax marker for ST in law, makes the task of examining the actual tax evasion status of ST products arduous. Besides tax evasion, illicit products can adversely affect tobacco control effort in several other ways. For example, when illicit products do not follow the packaging rules, they fail to create the impact by generating awareness through the warning labels. Stakeholders' consultation therefore directed towards broadening the research scope and suggested adopting a broader operational definition of ITT that includes both tax evasion and violations of tobacco control regulations. This broader definition was considered more appropriate in the Bangladeshi context, particularly for ST where direct fiscal markers are absent. For smoking tobacco since there is clear marker for tax evasion, it's advised to do the analysis for domestic production at disaggregated level. Also expecting that it might inflate the size of illicit extensively, the illicit estimation for ST is suggested to explore separately. Since the market is different and also the practices it was mentioned not to combine the estimates for smoking and ST together and establish a grand estimate. Stakeholders opined to communicate the research results with greater caution and care so that tobacco industry failed to take extra advantage from this noble academic effort.

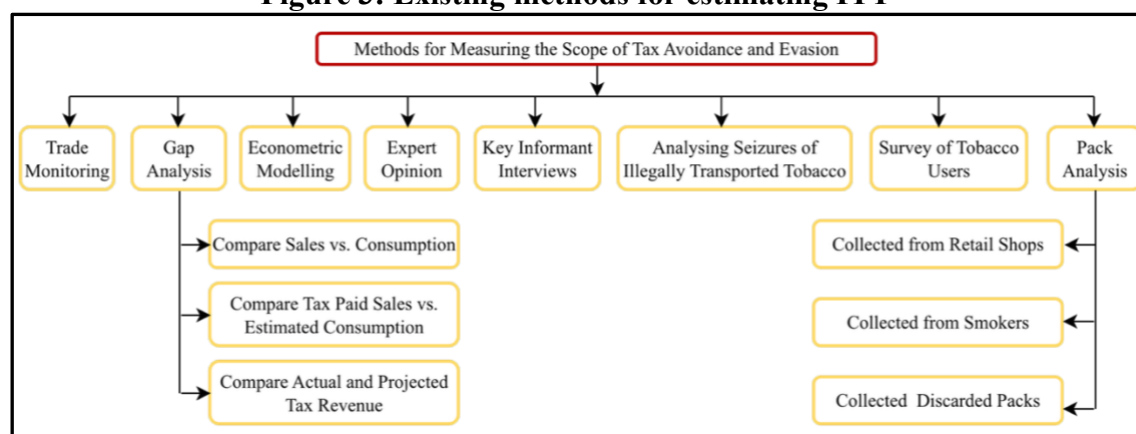
Chapter 3: Methodological Approaches for Estimating the Magnitude of ITT

This chapter reviews existing methods used to estimate the market share of illicit tobacco trade (ITT) and assesses their suitability for Bangladesh. Chapter 6 presents the empirical application of the selected method and the estimation results.

3.1 Overview of Existing Methods for Measuring ITT

Assessing the magnitude of ITT using a multidisciplinary approach has been highlighted as a global tobacco control research priority.(van Walbeek et al., 2013) In the absence of empirical and independent data on the size of ITT, tobacco industry by propagating their own unreliable data, continue to misguide policy makers and discourage governments to increase tobacco taxes.(Chaloupka, 2014) Bangladesh, a signatory to the FCTC, has limited data on the magnitude and impact of ITT in the country making it strenuous to perform further analysis in this regard. Several methods for estimating the extent of illicit trade has been recommended by David Merriman, World Bank Tool kit 7 and Hana Ross, Understanding and Measuring Cigarette Tax Avoidance and Evasion.(Merriman, 2013; Ross, 2015). Also, U.S. National Cancer Institute (NCI) and WHO discussed methods for measuring ITT in the Economics of Tobacco and Tobacco Control monograph.(U.S. National Cancer Institute and World Health Organization, 2016) Among them, some require specialised modelling knowledge based on econometric techniques, while others demand intuition-based calculation. A summary of the approaches, and a comparative analysis of the pros and cons of the methods, is provided in Figure 3. In addition to understanding the methodology of ITT research, this also aids in identifying the appropriate method for measuring ITT within the context of Bangladesh.

Figure 3: Existing methods for estimating ITT

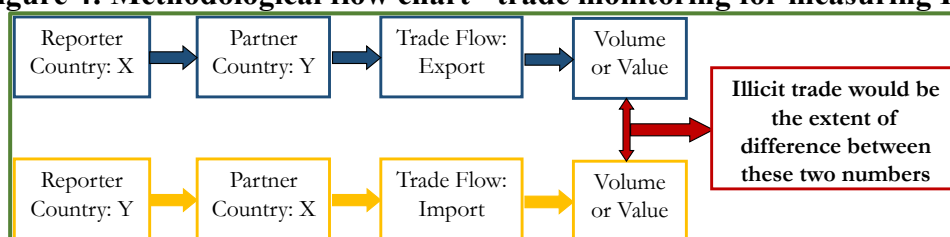


Source: 1. Hana Ross, Understanding and Measuring Cigarette Tax Avoidance and Evasion: A Methodological Guide, 2015, Tobacconomics; 2. David Merriman, Economics of Tobacco Toolkit, 2013; World Bank; 3. U.S National Cancer Institute and World Health Organization, NCI Tobacco Control Monograph 21: The Economics of Tobacco and Tobacco Control, 2016, U.S. NCI and WHO

3.1.1 Method I: Monitoring Trade

Considering some monitoring of export and import data for tobacco products can help in receiving an estimate of ITT in the country level.(Merriman, 2013) In practice, each country records volume and value of exports and imports of tobacco products by country of destination and origin. For ease of understanding assume that country X and Y are bilateral trade partners who exchange tobacco along with other products. Country X's export destination for tobacco is country Y while country Y's import origin for tobacco is country X. Theoretically country X's reported value of export should be equal to country Y's reported value of import for tobacco. Nevertheless, this match has been observed very rarely. The extent of the discrepancy can be thought of as indicative for illicit trade (Figure 4). The method relies on the assumption that the amount of product in trade difference is diverted to illegal markets while in transit. As a potential source of data United Nations Commercial Trade (UN Comtrade), World Trade Organization (WTO) and Food and Agriculture Organization (FAO) statistics are used.

Figure 4: Methodological flow chart - trade monitoring for measuring ITT



Source: 1. Hana Ross, Understanding and Measuring Cigarette Tax Avoidance and Evasion: A Methodological Guide, 2015, Tobacconomics; 2. David Merriman, Economics of Tobacco Toolkit, 2013; World Bank; 3. U.S National Cancer Institute and World Health Organization, NCI Tobacco Control Monograph 21: The Economics of Tobacco and Tobacco Control, 2016, U.S. NCI and WHO

The shortcoming of this method is that it's not designed to address the issue of bootlegging and relies on the assumption that complete discrepancy amount of tobacco products has been smuggled into the destination country. This method is sensitive to the data quality and the approach can become complicated. It is because different countries can use different trade classification system (i.e it can be Harmonized System (HS) coder or any other) and also different countries have different data recording system (some countries record in volume of trade while some others might record the value of trade). Quite often, the recorded trade data do not match correctly within a given month or year, as there remains inertia in the record-keeping system. Most importantly, trade monitoring is not effective for detecting small scale tax evasion, illegal domestic manufacturing and

counterfeit tobacco. Nevertheless, the method is well regarded for generating global estimates of large-scale smuggling in tobacco.

3.1.2 Method II: Comparison of Tobacco Sales and Consumption (Gap Analysis)

Discrepancy in tax paid tobacco sales and total domestic consumption of tobacco can be used to get the extent of ITT. In this process any consumption of tobacco would be characterised as illicit whenever they surpass the amount of legal sale. As a data requirement the researcher needs to have reliable estimate of national tobacco consumption along with total tax paid sales. For estimating the national tobacco consumption different household survey data and tobacco survey data can be exploited. Nevertheless, the issue of under reporting of tobacco consumption in survey should have to be adjusted. Here previous literature (if any) can be employed to get the level of underreporting of tobacco consumption. Also, assuming different levels of under reporting one can see the sensitivity of extent of illicit consumption. The data on total tax paid sales of tobacco can be sourced from revenue board. Also, difference between total domestic production and net export of tobacco would also work as total legal sales of tobacco.(Ahsan et al., 2014) Following Ross (2015) the intuition behind the method can be arithmetically expressed as follows:

$$\text{Size of Cigarette Market} = \text{Legal Consumption} + \text{Illicit Consumption} \text{ --- (1)}$$

$$\text{Size of Smoking Population}$$

$$= \text{Size of Population} * \text{Smoking Prevalence} \text{ --- (2)}$$

$$\text{Size of Cigarette Market}$$

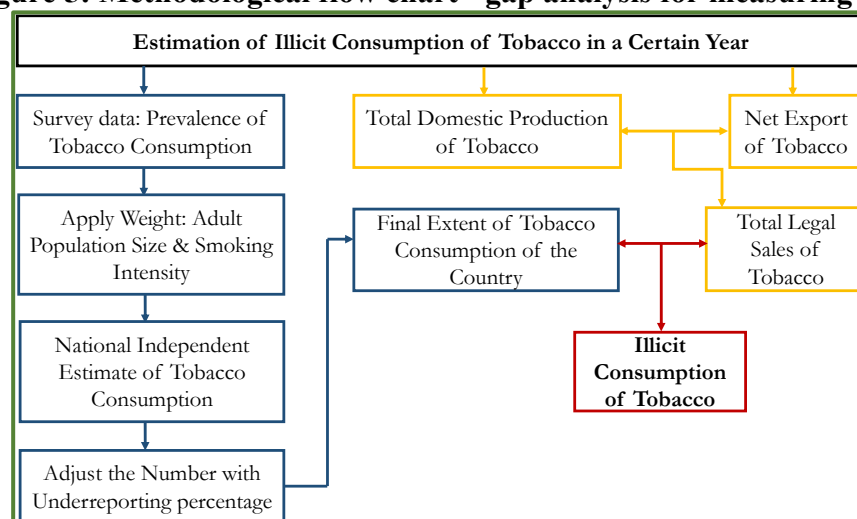
$$= \text{Size of Smoking Population} * \text{Smoking Intensity} \text{ --- (3)}$$

Substitution of relationship (3) to (1) would lead to

$$\text{Illicit Consumption} = \text{Size of Cigarette Market} - \text{Legal Consumption}$$

Thus, application of this method requires information on smoking prevalence, smoking intensity and legal consumption. It can identify the magnitude of deviations from trend and help better understanding of tax changes and in response to that changes in low – tax consumption. Figure 5 contains the conceptual framework involved in the exercise.

Figure 5: Methodological flow chart - gap analysis for measuring ITT



Source: 1. Hana Ross, Understanding and Measuring Cigarette Tax Avoidance and Evasion: A Methodological Guide, 2015, Tobacconomics; 2. David Merriman, Economics of Tobacco Toolkit, 2013; World Bank; 3. U.S National Cancer Institute and World Health Organization, NCI Tobacco Control Monograph 21: The Economics of Tobacco and Tobacco Control, 2016, U.S. NCI and WHO

One major limitation of this approach is that the accuracy of the estimate is largely subject to the accuracy of underreporting of national tobacco consumption which often needs to be assumed. Also, given that time series observation on underreporting is unavailable the percentage of underreporting has to remain consistent across the years. If some tax paid sales are illegally exported there might be downward bias in the estimate. Finally, as it also fails to trace out the source or nature of illicit tobacco products, it cannot identify whether they are counterfeit or contraband. Nevertheless, this approach is transparent and relatively less expensive to implement where unbiased and publicly available data on tax paid sales are available.

3.1.3 Method III: Econometric Modelling

Difficulty of engaging in ITT would vary across countries due to differences in geographical conditions and the effectiveness of border enforcement. Estimation of tobacco demand function while controlling for tobacco bootlegging can help identifying the prime determinants and the magnitude of ITT of a country.(Merriman, Yurekli and Chaloupka, 2000) In bilateral trade primarily bootlegging will take place owing to the relative price difference between origin and destination country. Moreover, level of threat for illegal transportation of tobacco across borders would play as an important determinant. Considering these factors as exogenous, tobacco demand would be mainly determined by the price of tobacco, purchasing power of the users, demographic and other factors. Thus, tobacco demand function in general can be written as:

Tobacco Demand

$= f(\text{Variables related to tobacco demand}, \text{Variables related to Bootlegging})$

Assuming that extent of demand can be proxy by total tax paid sale of tobacco, using the variable names explicitly the function can be written as:

$$TPS = f(P, I, SDIMP, SDEXP)$$

Here, TPS is the Tax Paid Sales, P is the price of tobacco, I is the income of the user, $SDIMP$ and $SDEXP$ are respectively the aggregate incentive for import and export bootlegging. Since there would be some other factors affecting TPS except the listed ones, the above relationship can be thought of as stochastic. Thus the following econometric model can be estimated given the data availability:

$$TPS_{it} = \alpha_i + \beta_t + \gamma_1 P_{it} + \gamma_2 I_{it} + \gamma_3 SDIMP_{it} + \gamma_4 SDEXP_{it} + \varepsilon_{it}$$

Here subscript i indicates country which can vary from 1, 2-----, N and subscript t indicates time that can vary from 1, 2,----, T . The error term ε_{it} includes all the factors affecting TPS_{it} which are unobserved and ignored from the model. Country and time fixed effects have been captured through α_i and β_t respectively. Statistical significance of the variables will help determining the key factors for tobacco demand. Furthermore, through statistical simulation the extent of ITT can be measured with the help of estimated coefficients.

This method is extensively data driven and can be expensive if the data is not readily available. Along with sophisticated econometric expertise it requires high quality macro level time series data on short distance travel record, tobacco price, income and population for the country. Nevertheless, this is the method which takes into account the bootlegging and able to measure it.

3.1.4 Method IV: Modelling the determinants of ITT with Expert opinion

Following Merriman et. al, (2000) this process requires collecting information regarding the extent of illicit tobacco consumption from the experts.(Merriman, Yurekli and Chaloupka, 2000) Most often since time series observation regarding the fact remains unavailable cross section estimates of illicit tobacco consumption has been collected from

the experts of different countries. These expert estimates further used to construct the econometric model to identify the different determinants and their impact. As a convention along with price of tobacco and income of the consumers, transparency is controlled to measure the impact of corruption on the extent of ITT. More specifically the following model is required to be estimated:

Expert Estimates_i

$$= \alpha_1 + \alpha_2 Tobacco\ Price_i + \alpha_3 Per\ Capita\ GDP_i + \alpha_4 Transperegny_i + \varepsilon_i$$

3.1.5 Method V: Key Informant Interview (KII)

Stakeholders who are involved in dealing with tax avoidance or evasion usually have a better theoretical and practical understanding of the nature and scope of such activities. In this method of illicit trade measurement, information regarding the scope of tax evasion is systematically collected from the experts, i.e. key informants. The informant pool includes people from distinct disciplines and backgrounds. Since there is a scope of overestimation or underestimation of the scope of tax evasion by the informants, cross-validation and contrasting estimates are necessary. A standard questionnaire or topic guide is administered for the interview.

Though this method requires the least technical expertise and is fairly simple, the resulting estimates are highly subjective. Additionally, the estimates can also be biased, considering the specific background to which individuals belong. The scope of comparison of estimates across countries resulting from this method is limited because of the underlying differences in culture and politics. Successful implementation of the method requires good networking skills and expertise to complete an informative interview. The data analysis demands intimate knowledge of local context and culture regarding the illicit practices related to tobacco. Henceforth, it is often recommended to be accompanied by an alternative method for validation of the estimates.

3.1.6 Method VI: Analysing Seizures of Illegally Transported Tobacco

Considering all other things remaining constant, if there is variation in the rate of illicit tobacco seizures detected, this might be an indication of changes in the scope of tax evasion. On the basis of local customs and/or police authorities' reports on seizures of

illicit tobacco over the years, this method tries to estimate the scope of tax evasion. However, adopting such data for assessing the tax evasion scope is problematic as they might not be complete, easily accessible and sufficiently accurate. The estimate may not be representative of the illicit market as a whole and particularly underestimates the tax evasion scope, since the data is sensitive to the enforcement effort. It is accepted that the amount of seized cigarettes provides a lower bound of the tax evasion scope and can inform on the composition of the illicit market.(Ross, 2015)

3.1.7 Method VII: Survey of Tobacco Users

Tobacco pack markers (such as the presence/absence of a tax stamp, a health warning, price paid, sale disclosure, use of deceptive words etc.) and their sources (e.g. a duty free store) can work as indicators of tax evasion or avoidance.(Ross, 2015) Tobacco users can be surveyed directly or their packs can be inspected to collect this information. The data analysis will consist of calculating the share of smokers who possessed low-tax cigarettes and the share of low-tax cigarettes consumed by those who possessed them. The process can help estimating the share of users using low tax product and the magnitude of cross border shopping and duty-free purchases.

While surveys provide a direct approach to estimating tax evasion, their validity may be compromised due to reliance on self-reported data. If data is collected from an area where low taxed tobacco products are prevalent the generated estimates might become biased. Additionally, because of social stigma the users might underreport the low tax purchase resulting in underestimation of the extent of tax evasion or avoidance.

3.1.8 Method VIII: Examination of Cigarette Packs (Pack Analysis)

Given the rules and regulations applicable to the area, examination of cigarette packs would help distinguish the low-tax packs from the full-tax ones.(Ross, 2015) Appropriate and authentic tax stamp, health warnings (pictorial and written), price information, duty-free marker and some other features of a pack required by the law can be used as the determinants of distinguishing factors. The marking data is objectively retrieved from the tobacco packs and analyzed accordingly. The potential sources of tobacco packs can be tobacco retailers and littered packs from the streets.

Because of being observational in nature, unlike the self-reported data validity problem is eliminated. It is the direct method for estimating the scope of tax evasion and as it uses the markers, subject to the availability of well-defined law illegal tobacco products are identifiable with minimum assumptions. With further analytical exploration tax evasion possibility of the tobacco products can be linked to the specific pack markers.

Though this method is able to capture the extent of the scope of tax evasion directly, it is time-consuming and expensive. There has to be a sufficient amount of sample for the generalisation of the results. Fiscal instrument needs to be available with tobacco packs and expertise needs to be there for detecting the authenticity of the instrument for distinguish the tax paid products from the unpaid ones. For the littered packs, there remains a difficulty in distinguishing legal tax avoidance and illegal tax evasion.

3.2 Comparison of Method for Estimating ITT and Method Selection for Bangladesh

Table 3 contains features of different methods of measuring ITT along with their estimation validity and estimation accuracy. Table 4 contains the strengths and weakness of different methods and suitability of those in the context of Bangladesh. As it can be seen from the comparative analysis that none of the methods can be considered as “gold standard”. For instance, although the data is available, trade monitoring generates only national level estimate and not suitable as market is dominated by domestic production and pattern and determinant of illicit products will not be revealed. Similarly, gap analysis will also generate national estimate but because of social stigma sensitivity analysis needed to be performed and because of the estimation nature pattern and determinant of illicit products will remain unknown.

Expert opinion and key informant interviews are highly subjective in nature and hence the estimation validity will be at risk of compromise. Because of data restriction econometric modeling and analysis of seizure of illegal tobacco products is not applicable for Bangladesh. Additionally, these approaches will not inform the composition of illicit market. Survey of tobacco users have comparatively acceptable features than others. Nevertheless, the application of this method is restricted because the sale of single stick cigarettes is highly prevalent in Bangladesh. Also, since the data would be self-reported the validity problem will exists. Although, expensive and requires sufficient sample, examination of tobacco packs collected from several sources possess desirable features for measuring ITT. Because of its direct nature and for being observational and objective

the validity issue is less of a concern in this approach. Considering that tax marker is carried by cigarette packs in Bangladesh and also there is well defined packaging regulations, this method is suitable to measure the magnitude of ITT for the country. It would also help to identify the pattern, determinant and composition of illicit market in Bangladesh.

Table 3: ITT estimation methods and their features

Methods	Trace micro level tax evasion scope	Pattern & determinants scope of tax evasion	Trace smuggling	Trace illegal practice in domestic manufacturing	Trace illicit tobacco product	Robustness/Validity of estimation	Presence of bias in estimation
Trade Monitoring	No	No	Yes	No	No	Subject to data quality	Possible, Hard to address
Gap Analysis	Yes	No	No	No	No	Can be compromised	Possible, Required sensitivity analysis
Econometric Modeling	Yes	No	Yes	No	No	Subject to data quality	Possible, required model and method selection
Expert Opinion	No	Yes	No	Yes	No	Can be compromised	Possible, Hard to address
Key Informant Interview	Yes	No	Yes	No	No	Can be compromised	Possible, Required comparison
Seizure of Illegal Tobacco	Yes	No	Yes	No	Yes	Subject to enforcement	Possible, Hard to address
Survey of Tobacco Users	Yes	No	Yes	Yes	No	Can be compromised	Possible, Need to address underreporting
Pack Examination	Yes	Yes	Yes	Yes	Yes	Better, direct and objective	Possible, Required sufficient sample

Table 4: Strengths and weaknesses of ITT estimation methods and suitability for Bangladesh

Methods	Strength	Weakness/Challenges	Suitability for Bangladesh
Trade Monitoring	- Macro Level Estimate - Identify Smuggling Hub	- Limited scope for identifying tax evasion for individual countries - Estimates only large-scale tax evasion - Limited scope to measure non-compliance with local regulations	- Possible to apply but not suitable - Data Quality & Generate only Macro Estimate - Market is dominated by Domestic Production
Gap Analysis	- Simple and replicable method - Given the data availability can be generated quickly	- Limited scope for identifying pattern of tax evasion - Limited scope to measure non-compliance with local regulations - Subject to the availability of survey data - Underreporting may cause bias to the estimate	- Possible to apply but not suitable - For social stigma underreporting would be a problem - Won't be able to identify the composition of illicit market
Econometric Modeling	- Can measure bootlegging and detect tax evasion - Estimate impact of policy change	- Estimation accuracy depends on data quality - Highly data driven - Requires technical skill - Limited scope to measure non-compliance with local regulations	- Not possible to apply due to data limitation. - Won't be able to identify the composition of illicit market
Expert Opinion	- Estimate the impact of corruption	- Subjective assessment and sensitive to individual experience - Requires technical skill - Limited scope to measure non-compliance with local regulations	- Possible to apply but highly subjective in assessment - Limited scope to measure non-compliance with local regulations
Key Informant Interview	- Less requirement of technical skill - Quick and easy assessment of the aspect	- Subjective assessment and sensitive to individual experience - Possibility of bias and less accuracy - Requires good networking skill	- Possible to apply but highly subjective in assessment
Seizure of Illegal Tobacco	- Changes in scope of tax evasion - Structure of Illicit Market	- Possibility of bias estimates and less accuracy - Subject to enforcement level - Limited scope to measure non-compliance with local regulations	- Not possible to apply due to data limitation - Won't be able to identify the composition of illicit market
Survey of Tobacco Users	- Estimates scope of tax evasion	- Self-reported information is needed - Underreporting can cause bias in estimates	- Possible to apply but not suitable - Single stick selling is highly prevalent in Bangladesh, so difficulty of collecting packs from users - As self-reported validity can be compromised
Pack Examination	- Direct measure for estimating the scope of tax evasion, availability of illicit products via legal channel. - Scope to measure non-compliance with local regulations - Since observational, validity is improved	- Can be expensive - Possibility of selection bias - Appropriate marker is required to identify the tax evasion - For discarded packs, difficulty of distinguishing between tax avoidance and tax evasion.	- Possible to apply and selection bias can be addressed with representative sample - Tax marker is carried by packs so can directly measure the scope of tax evasion - Well defined packaging rules exist thus pack markers can be linked to the scope of tax evasion - Would be able to identify the composition of illicit market - For being objective and observational in nature less issue related to validity

Note: Table 3 & 4 are populated and generated following Ross, 2015; Hana Ross, Understanding and Measuring Cigarette Tax Avoidance and Evasion: A Methodological Guide, 2015, Tobacconomics

3.3 Summary of the Chapter

Estimating the magnitude of ITT has always been a strenuous task because of its stealthy nature. Therefore, methodological innovations in the field of illicit trade research have been taking place over the years. There are various methods available, with approaches ranging from pure qualitative to complete quantitative. Each of the methods has their own strengths and weaknesses. Also, all of the methods might not be suitable or applicable to a particular context. Some are heavily data-driven, while others are subjective in nature and require rigorous cross-validation. According to the design, some methods are only able to provide a general estimate for the aspect, ignoring the nature and diversity of the problem. These are helpful to realise the size of the problem, but only from a broad perspective, and often fail to inform policy properly to overcome the hurdle. A comparative analysis of the methods in terms of their features, strengths, weaknesses and suitability in the context of Bangladesh is carried out. As a direct measure of tax evasion with low selection bias, “Pack Analysis” was considered the most suitable approach for Bangladesh to estimate the magnitude of ITT. Since loose selling or single stick selling of cigarettes is prevalent in Bangladesh, the potential source of packs will be the retailers instead of the tobacco users. For cross-validation of the estimates, sample collected from a separate source i.e. littered packs, will be analysed.

Chapter 4: Research Contribution, Data Source, Study Design and Overview of Proposed Studies

4.1 Research Contribution

Research intensity around the world in ITT can be evaluated from two perspectives: one is where most of the research is taking place (LMICs vs. HICs), and the other is which type of tobacco is considered for the research (smoking tobacco vs. ST). It is evident that research in ITT is relatively scarce in LMICs compared to their high-income counterparts. The number becomes even more scarce if South Asian countries are considered only, while, many countries including Bangladesh in South Asia have the unique feature of having high prevalence of both smoking and ST. Though there is limited evidence on ITT in these countries, almost all of them targeted towards smoking tobacco such as cigarettes. Because of being embedded in culture and several misconceptions, ST received social acceptance in this region of the world. Also, it is often the cheapest tobacco option and most unregulated one. Even in some areas ST industries are considered within the structure of the Small and Medium Industries (SME). Ignoring the worse health outcome, the long frequent use of such type of tobacco is working as the risk factor for several catastrophic diseases. Nevertheless, the independent published evidence on illicit ST is almost nonexistent for these countries.

The current research work will explore the different methods that has been applied in ITT research in LMICs and estimate the share of ITT in LMICs. Applying observational method (cigarette pack analysis) it will thrive to generate estimate for the illicit cigarette in Bangladesh. Alongside, it will apply the method for ST and explore the feasibility of using such method. It will generate the evidence for ST in Bangladesh which is very first of its kind. Finally, to address ITT in Bangladesh the research will explore the stakeholders' perspective on improving regulation and monitoring. The research evidence is expected to contribute in the policy movement for better regulation and control of tobacco in Bangladesh and make the country tobacco free.

As mentioned in Section 1.1.2 that Bangladesh formulated her National Tobacco Control Law during the year of 2005 and the last amendment of that law took place during 2013. Since then, lot of development in the arena of market structure, novel tobacco products, content and practices for health warning labels and tax structure ensued. Additionally,

COVID-19 pandemic, have further underscored the need to reduce tobacco consumption and to strengthen the integration of tobacco control within broader policy frameworks. Taking into account all these recent realistic swings, NTCC is working on a new round of tobacco control law amendment for Bangladesh. There is also demand side pressure for this must change and make the law and policy more comprehensive, competent and timely from the tobacco control researchers and advocacy institutions. Such objective will remain untouched if the policy becomes incomplete to address the ITT. An internal demand for ITT research has always been there for the evidence-based tobacco control policy movement from the policymakers and the tobacco control advocates. The research results will inform them to develop strategies for addressing ITT in Bangladesh. For instance, it can inform which tobacco products, geographical area, manufacturing practices etc. needs to be targeted and how. It will also inform what can be done to control the problem for ST which has often remained as a less attracted option but with a larger public health implication. This will also help devising the interventions related to monitoring and surveillance for ensuring track and trace. Hence, the research outputs will help meeting these policy demand and contribute to the intended amendment and making the tobacco control law more comprehensive being inclusive of ITT.

4.2 Data Source and Study Design

The application of the pack analysis requires extensive and quality primary data collection. Under the umbrella of Tobacco Control Capacity Program (TCCP) with support from Global Challenges Research Fund (GCRF), ARK Foundation, Bangladesh in collaboration with the University of York, UK collected empty cigarette packs from retailers and littered packs from streets around Bangladesh.(Dobbie et al., 2019; Abdullah et al., 2020) Additionally, under the research effort, Addressing Smokeless Tobacco and Building Research Capacity in South Asia (ASTRA), with support from the National Institute of Health Research, UK (NIHR), Department of Health Sciences, University of York, UK collected ST packs from Bangladesh, India and Pakistan.(Readshaw et al., 2020) Both the data sources were accessed to conduct the pack analysis for estimating the extent of illicit trade in smoking and ST and identify their structure and associated factors.

Since the PhD research is built on two completed research projects with direct involvement of the PhD researcher it is essential to make the distinction among works that accomplished before PhD and the intended works that comprised the PhD to make

the contribution in the field of tobacco knowledge concerning Bangladesh. Table 5 below outlines the demarcation of research works and study design that was completed with the involvement of PhD researcher before the PhD enrollment and the conducted PhD research works and their data dependency on the research projects.

Although the primary datasets were generated under the TCCP and ASTRA projects, the PhD research extends beyond data access and project participation. The conceptualisation of ITT in the Bangladeshi context, the validation of its operational definition, the comparative methodological assessment of estimation approaches, and the development of the analytical framework for this thesis were undertaken as part of the doctoral research. Additionally, the specific research questions addressed in the thesis, the analytical strategy used to examine the pack data, and the interpretation of findings in relation to illicit trade structure, regulatory gaps, and tobacco control policy were developed independently within the PhD.

Table 5 provides a structured overview of how the research activities relate to the funded projects and the PhD research. Specifically, it identifies which datasets were generated under the TCCP and ASTRA projects, indicates the PhD researcher's engagement, and clarifies how these datasets were subsequently used within the thesis to address the research questions. The table also distinguishes between research tasks undertaken during the funded projects and the analytical work conducted as part of the PhD, including the methodological assessment, secondary data analyses, and qualitative exploration presented in the thesis. This highlights the intellectual contribution of the PhD research while recognising the collaborative data collection.

Table 5: Data source for PhD research and work delineation

Before PhD				During PhD				
Study Design	Work Details	Research Projects		Study Design	Work Details	PhD Research		
		TCCP	ASTRA					
Primary	Project Duration	01 October, 2017 - 31 December, 2021	01 April, 2018 - 31 March, 2022	Secondary	Aim	Inform and influence policy movement for Tobacco Control in light of Illicit Tobacco Trade in Bangladesh		
	Research Themes	Illicit Trade	Sellers Study		Objective	1. Identify the extent of ITT in LMICs		
		Tobacco Taxation	Youth Study			2. Develop the ITT estimate for Smoking and Smokeless Tobacco in Bangladesh		
		Article 5.3/Industry Interference	Economics Study			3. Identify the Structure & associated factors of ITT		
		Smoke Free Policies	Policy Study			4. Improving the regulation to control ITT in Bangladesh		
		Poulation Surveys	Cessation		Research Questions	1. What is the estimate of ITT in LMICs and what are the different methods used for measuring this?		
	COVID - 19 & Tobacco		-			2. What is the extent, structure & associated factors of illicit cigarette trade in Bangladesh?		
	Involvement	Illicit Trade	Selllrs Study			3. What is the feasibility of measuring ITT in ST market in South Asian Countries?		
		Article 5.3	Youth Study			4. How to improve the regulation and monitoring to control ITT in Bangladesh?		
	Protocol Development & Paper	First Author	Coauthor		SEM on ITT Research Scope for Dissertation & ITT Definition Validation	SEM organized to discuss the ITT research scope and identify the relevant scientific definition of ITT for Bangladesh		
	Training and Capacity Development Workshop Participation	- Bangladesh (Participant & Resource Person), -University of York (Participants), - University of Nottingham (Participant), - King's College London (Participant), - University of Capetown (Participant & Resource Person)	- Bangladesh (Participant & Resource Person), -University of York (Participants)		Four Research Papers	During PhD four research papers was developed that consists of the dissertation. They answered the four research questions in lined with the objectives.		
	Stakeholders Mapping	Bangladesh - Developed			Study Design	Secondary Data Analysis		
	Invitation and Coordination	Bangladesh - Coordinated			Finalizing the Analysis Plan	Finalize and Detremine the Aappropriate analysis plan for addressing each of the Research Questions Properly		
	Stackholders Engagement Meeting	Bangladesh - organized			Data Analysis	Depending on the Analysis Plan perform required Statistical Analysis		
	Netwroking with Policy Advocates & Other Stakeholders	Bangladesh - Netwrok Established			Manuscript Draft	Four Manuscripts addressing each of the Research questions and hence objective was developed		
	Institutional Support	ARK Foundation			Policy Materials & Implications	Using the research results derived policy implications will be communcuated through posters/policy brief(s)		
	Ethics Application & Approval	NREC, BMRC (Ref: BMRC/NREC/2016-2019/344; Reg. No: 241 05 08 2019)	NREC, BMRC (Ref: BMRC/NREC/2016-2019/961; Reg. No.: 166 13 11 2018)		Research Dissemination through publications	Journal articles were published. Results can be used to advocacy and sensitized the policymakers		
		HSRG, University of York, UK (HSRGC/2019/346/A)	HSRG, University of York, UK (4-87/NBC-355.19/1695)			Data Source and Research Project Engagement		
	Study and Sampling Design	Designed Completely for Bangladesh	Collaborated & Coordinated with Wider Team		Research Project	TCCP	ASTRA	
	Survey Tool	Developed Completely for Bangladesh	Collaborated & Coordinated with Wider Team		Related Research Theme	Illicit Trade	Sellers Study	
	Survey Team Build up & Training	Built Completely for Bangladesh	Built Completely for Bangladesh		Target Data Component	Cigarette Pack Collection	ST Pack Collection	
	Field Design and Implementation	Designed & Implemented Completely for Bangladesh	Designed & Implemented Completely for Bangladesh		Research Paper 2 & 3	Research Papers 2 used TCCP Data as Secondary	Research Paper 3 Used ASTRA Data as Secondary	
	Data Collection & Management	Collected Completely for Bangladesh	Collected Completely for Bangladesh		Research Paper 1 & 4			
	Database Development	Developed Completely for Bangladesh	Supported the Wider Team		Study Design	Paper 1: Systematic Review and Meta Analysis; Paper 4: Qualitative analysis of the interviews		
	Data Entry and Cleaning	Monitoring and Supervision	Monitoring and Supervision		Data Source and Research Project Engagement	Paper 1 will be a Systematic Review Research Paper while Paper 4 will be primary analysis of the qualitative interviews. Hence, these are independent of the Data Dependence on TCCP and ASTRA.		
	Overall Supervision & Monitoring the Implementation	Directly Supervised & Monitored the Implementation	Direct Supervision and Monitoring for Sellers Study and Coordination for School Study					
Note: HSRG – Health Sciences Research Governance Committee, NREC – National Research Ethics Committee, BMRC – Bangladesh Medical Research Council								

Note: HSRG - Health Sciences Research Governance Committee, NREC - National Research Ethics Committee, BMRC - Bangladesh Medical Research Council

This PhD thesis consists of four intertwined research papers and used multiple methods. The first paper is designed as a systematic review and meta-analysis of ITT in LMICs. The second and third research papers were secondary data-driven, based on TCCP and ASTRA data. The fourth paper was a qualitative exploration of stakeholders' perspectives for strengthening regulation, particularly for non-compliant ST in Bangladesh.

4.3 Overview of Proposed Studies

A brief summary of each of the four studies along with their specific objectives is discussed below:

4.3.1 Study I: Methods followed and Magnitudes Estimated for Illicit Trade in Tobacco in LMICs: A Systematic Review

The thesis aims at better understanding the phenomena of ITT in Bangladesh. Hence, the first study is targeting towards revealing the experience of other LMICs with regards to ITT. The underlying rationality of conducting this research is two. Firstly, there has been a latent demand from the stakeholders about knowing the performance of Bangladesh on ITT control in relation to the countries who are at the same stage of social and economic development. Secondly, besides this cross-country comparison, to have the estimate of ITT for Bangladesh in place, it is imperative to know what are the specific methods other countries were applying to generate the estimate and under what context. Thus, two specific objectives of this study are as follows:

- Identify the specific methods that other LMICs have used to estimate ITT in their context.
- Identify the estimates of ITT for the LMICs.

The proposed study design aimed for a systematic review along with meta-analysis of observational studies. As a review process, the Cochrane guideline was followed. The reporting was made following the guideline by Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA). As an eligibility criterion, study focusing LMICs around the world (including the multi-country studies that covered LMICs) and examined the magnitude of ITT (both in smoking and ST) was considered. English was used as a language restriction for the inclusion. The time duration for the searched literature was from 2012 to 2023. Any study funded by tobacco industry or with undisclosed funding information was analysed separately.

The review exploited electronic databases and reference lists for gathering literature and used them as data source. The potential sources of data and the online databases which were accessed are as follows, MEDLINE, CINAHL, EMBASE, EconLit, Scopus, Web of Science, PubMed, Cochrane Library, Tobacconomics (University of Illinois at Chicago, US), REEP (University of Cape Town, South Africa), and the WHO FCTC Knowledge Hub on Tobacco Taxation and Illicit Trade). Alongside the reference list of the eligible papers was accessed for an additional source of data and a guided search was performed in Google search engine for the other eligible articles published elsewhere. The main key words for the search strategy were, “tobacco (smoking and/or smokeless)”,

“illicit trade”, “Non-compliance Packaging”, “Smuggling”, “Tax evasion”, “Illicit Manufacturing”, “Counterfeit”, “Bootlegging” etc.

Studies were included based on the design and method of measuring ITT (observational, survey, gap analysis, pack examination, expert opinion, econometric modelling, trade monitoring and analysis of seizure illegal products), scope of the work (smoking tobacco, ST or both) and outcome (measured the extent of ITT). For identifying the agreement or disagreement among the reviewers, study selection form and data extraction form were developed. Besides the magnitude of ITT other relevant information such as method used for measuring ITT, study design, place and time, sample size, data collection and analytical method were recorded. Quality assessment through critical appraisal for each of the study was made. Meta-analysis as data synthesis was conducted. The synthesis was made by grouping the studies depending on types of tobacco, methods used for ITT and funding source of the research.

4.3.2 Study II: Magnitude and Structure of Illicit Cigarette sold as Retail in Bangladesh: A Pack Analysis Approach

The second study is trying to analyse the phenomena of ITT in Bangladesh focusing on cigarettes, the most prevalent smoking tobacco in the country. It quantified the extent of illicit cigarettes available in the retail market. Besides the analysis also inform the structure, associated factors and geographical distribution of the extent of illicit cigarettes for the country. In addition to the conventional area-wise comparison and urban-rural distinction it also included the comparison and discussion from border-non-border perspective. The underlying rationality of this study is actually embedded with the study outcome. The resulting estimate of illicit share of cigarettes will help comparing Bangladesh with the other LMICs in terms of tobacco control status. Alongside creating evidence for the debate with tobacco industry, the distribution of the extent of ITT and its structure and associated factors will help informing the areas of intervention for ensuring better control over the problem. Thus, the specific objectives of this study are as follows:

- Estimate the magnitude of illicit cigarettes available in Bangladesh.
- Explore the structure of illicit cigarettes in Bangladesh.
- Identifying the associated factors of illicit cigarettes for Bangladesh.

The study is designed as a secondary data analysis. The data retrieved from the empty cigarette packs collected from the cigarette retailers and from the littered sources was analysed.(Abdullah et al., 2020) Considering the country's tobacco control law and the definition validated through the stakeholders engagement meeting was employed to categorise the packs as illicit. Descriptive analysis carried out for identification of the structure of the illicit. Moreover, the analysis will further explore the illicit cigarette packs by distributing them in terms of administrative areas, low price vs. high price, urban vs. rural, and border vs. non-border categories. The differences across the categories were checked for their statistical significance. Since, cigarette packs are by law bound to carry tax stamps, as a direct measure of tax evasion tax stamp legitimacy data was analysed to identify associated factors of cigarette tax evasion and hence, the illicit cigarettes.

4.3.3 Study III: Estimating the ITT in ST Market: An Exploratory Study from South Asian Countries

Considering the high prevalence of ST in Bangladesh and especially among women the third study explored the illicit tobacco issue for ST. The underlying method of estimation was similar as the one followed for smoking tobacco i.e. cigarettes in the second study. While smoking tobacco has a well-defined supply chain, relatively better regulated and have available fiscal marker (tax stamp) in place to examine directly the tax evasion status, for ST absence of such instrument made the task intricate. Also, the supply chain is informal and fragmented and not well explored yet. Hence, even for measuring the extent of illicit some kind of exploration was required. Accordingly, the study has included the exploration of context in the neighbouring countries i.e. India and Pakistan. The products under ST category are diverse and so are the packaging practices. Although, that is quite challenging to know the actual tax evasion status, compliance of the different ST was examined as there are well defined packaging rules in place. The share of non-compliant products was considered as an indicative of the products being potentially illicit. The specific objectives of this study are as follows:

- Estimate the extent of illicit ST available in Bangladesh.
- Exploring and comparing the situation with neighbouring countries i.e. India and Pakistan.
- Mapping the tobacco control laws for smoking and ST.
- Explore the structure of non-compliance (illicit) ST in Bangladesh, India and Pakistan.

The resulting estimate facilitated a comprehensive analysis of illicit tobacco in Bangladesh, as it was inclusive of all types of tobacco. This would help mobilizing the policymakers to develop a comprehensive tobacco control policy and identify pragmatic strategies general enough to control illicit products both for smoking and ST. Sometimes it is argued that ST generates a negligible portion of revenue from the tobacco source as a whole and hence received less attention from the revenue board or from the policymakers. Nevertheless, it must be realised that the public health implication in terms of tobacco prevalence degradation is more important than the revenue implication. The tobacco prevalence in Bangladesh is driven by both smoking and ST. Consequently, both has to be controlled properly, regardless of the amount of revenue they generate to reach the public health goal of prevalence reduction.

The study used secondary data generated by a ST pack collection study previously implemented in Bangladesh, India and Pakistan.(Khan et al., 2020) Unique packs of different types of ST from the mentioned countries were collected. Several packaging features were retrieved to develop the database. Considering the country specific tobacco control laws the database was explored to examine the extent of compliance. The non-compliance is assumed to be an indication of the product being illicit.

4.3.4 Study IV: Improving the Regulation and Monitoring to Control the Non-compliance and illicit ST in Bangladesh: A Qualitative Study

Despite widespread use of ST and its high disease burden, little information is available regarding the surveillance and market regulation to curb non-compliance and illicit ST in Bangladesh. The purpose of this research is to understand the regulation and monitoring aspects for controlling illicit ST. It would help to design appropriate strategies and control the availability of non-compliant and illicit ST products in the market. This study would create the bridge among the illicit tobacco phenomena in Bangladesh with market regulation. The specific objective of the study are as follows:

- Explore the stakeholders' perspectives on the non-compliance and illicit ST in Bangladesh.
- Explore the barriers and facilitators to improve regulation and monitoring in the ST market to control for non-compliance and illicit.

The study was designed as a primary research and followed a qualitative approach involving exploration of the stakeholders perspectives on non-compliance and illicit ST in Bangladesh. Tobacco control stakeholders representing policymakers, nongovernmental organizations, researchers, international agencies and advocacy networks was the participants for in-depth interviews. A semi-structured interview guide centring around perspectives on non-compliance of ST, policies and enforcement mechanisms, and supply chain control and international collaboration to address non-compliance and illicit ST in Bangladesh was utilized. A framework approach was used for data analysis.

4.4 Summary of the Chapter

The ITT research around the world is skewed towards high income countries and with smoking tobacco. Similar as other LMICs, in Bangladesh the ITT research evidence is scarce and that effort for ST is almost nonexistent. Nevertheless, for a comprehensive tobacco control method, the significance of ST cannot be denied as it is the lowest cost tobacco option for Bangladesh and contributing heavily on her overall prevalence of tobacco. Therefore, the current research is intended to perform four interlinked studies. It aims to perform a systematic review exploring the different methods for estimating ITT in LMICs and the extent of such problem there. Prepensely, for knowing the extent of problem in Bangladesh the research anticipates to estimate the extent of illicit smoking and ST in the country. Also, the extended distribution of the illicit tobacco products is expected to be examined to reveal the structure and associated factors. A qualitative study with the stakeholders perspective on regulation and monitoring was carried out.

Part II – Aims and Objectives

The second part of the thesis encloses the aims and objectives of research. It contains a single chapter i.e. Chapter 5. The title of the chapter is “Aims and Objectives of the Research – Theory of Change Approach”. The chapter postulates the discussion on the ultimate research mission and the research aim that needs to be achieved for accomplishing the mission. It identifies the problem statement for this research in the context of Bangladesh which leads to the identification of specific objectives. The proposed studies along with the specific research questions are elucidated that are necessary to reach the objectives. For conceptualising the illicit trade research and establishing the linkage between the proposed studies and aims and objectives a “Theory of Change” approach is followed. It contains the narrative and as well as graphical presentation of the potential channels through which illicit trade of tobacco creates impact. Additionally, how the practical intervention can be made to control the problem and how research can support the practice has also been presented and discussed thematically. Finally, it contains the discussion on essential pathways through which this research intends to make impact on the policy change.

Chapter 5: Aims and Objectives of the Research - Theory of Change Approach

5.1 Research Mission and Specific Aim

The grand mission of this thesis is to create evidence and support the goal of controlling tobacco prevalence in Bangladesh. This will help minimize the death and disability toll caused by tobacco in the long run. Considering the different aspects of tobacco control, scarcity of research efforts and relative importance of the subject matter, the current research is focused on the ITT in Bangladesh. The specific aim of the research is to generate evidence on ITT to inform the policy movement and influence the policymakers to initiate and act on the appropriate strategies for controlling tobacco. The underlying assumption here is that improved intervention for resisting ITT and better packaging compliance will be in place due to evidence-based tobacco control movement. Control over ITT will in turn limit the availability and affect the price of tobacco. The lower availability, controlled price and compliant packaging will curb the consumption along with uptake of tobacco.

5.2 Problem Statement, Research Objectives, Research Questions and Proposed Studies

Relatively little is known regarding ITT in Bangladesh. Hence, the performance of the country in this regard compared to others is unknown. Additionally, the depth and diversity of the issue has also remained unexplored. Tobacco industry always intend to make benefit out of this lack of research evidence. Similar as in other countries they always negotiate with the policymakers stressing on the association between tobacco tax increase and magnitude of the share of illicit tobacco products. They intimidate the potential tobacco tax related policy movement and hence weaken the tax administration causing unwanted delay in the policy implementation. This practice is a practical threat for making the efficient and better policy in place and reaching the mission of controlling prevalence of tobacco. The following research problem statement is identified:

- There is lack of independent comparison on relative performance of Bangladesh for ITT.
- The research evidence and data on ITT for Bangladesh is poor or scarce.
- The extent, structure, associated factors for ITT in Bangladesh is not known properly and hence not well documented.

- Regulation and monitoring practices to control ITT is not well documented.
- Tobacco industry led misinformation on tobacco tax and ITT misguide and influence the policy movement and hence implementation is delayed.

Accordingly, independent and appropriate evidence on ITT can help to better understand the problem and defend against tobacco industry arguments. The research will thus accomplish the following objectives:

- Specify the method and identify the extent of ITT in the LMICs.
- Estimate the magnitude of ITT for smoking and ST in Bangladesh.
- Reveal the structure and associated factors of illicit tobacco products for Bangladesh.
- Identification of the areas of improvement for regulation and monitoring to control ITT.

With a view to accomplish the objectives and move towards the research aim, the study will give effort to answer the following four research questions:

1. What is the estimate of ITT in LMICs and what are the different methods used for measuring this?
2. What is the extent, structure and associated factors of illicit cigarette trade in Bangladesh?
3. What is the feasibility of measuring ITT in ST market in South Asian Countries?
4. How to improve the regulation and monitoring to control ITT in Bangladesh?

In the above process it is assumed that answering the research questions will provide evidence for serving the objectives in a way that can inform the problem statements ultimately.

For answering the above research questions and hence achieving the objectives and overall aim of the research the following four studies were conducted:

Study I: Methods followed and Magnitudes Estimated for ITT in LMICs: A Systematic Review

Study II: Magnitude and Pattern of Illicit Cigarette sold as Retail in Bangladesh: A Pack Analysis Approach

Study III: Estimating the ITT in ST Market: An Exploratory Study from South Asian Countries

Study IV: Improving the Regulation and Monitoring to Control the Non-compliance and illicit ST in Bangladesh: A Qualitative Study

5.3 Aims and Objectives and Proposed Studies Nexus - Theory of Change Approach

All the proposed research studies are interlinked and contribute to the overarching aim of the research. The following subsections contain the details of the conceptualisation of the proposed studies and their intended impact using a theory of change approach.

5.3.1 Illicit Trade of Tobacco and Potential Channels for Impact

Figure 6 contains the conceptual framework presenting the illicit trade and potential channels through which it can affect health, economy, society and environment. This also reflects why illicit trade should be considered as an important aspect for any country that intends to control the tobacco prevalence. Considering tax evasion and packaging non-compliance as the elements of definition for illicit there are three ways tobacco products can be considered as illicit; first - a product may have evaded tax and at the same time it may be have non-compliant packaging, second – a product may be compliant but evaded tax and third – a product may be non-complaint while paid the tax. Regardless of the specification existence of illicit products has implications for health, economy, society and environment. The channels through which the affect takes place are primarily three; price of tobacco and their availability, fiscal revenue and impact through packaging features.

Illicit tobacco products is known to have lower price (as they evade tax and do not comply with packaging features, their production cost is lower).(Joossens et al., 2010; Ross, 2015) This lower price increases the intensity and uptake of tobacco use resulting in increased demand and hence consumption and prevalence. This further degrades the tobacco related mortality and morbidity and worsens the health scenario of the country. Also, because of the low price and more availability of tobacco products affordability of the poor and young increases, accordingly the prevalence among them rises. Thus, they become more at risk of tobacco induced diseases and unplanned health care cost. This cost is a toll for their income which increases both health and income inequality and

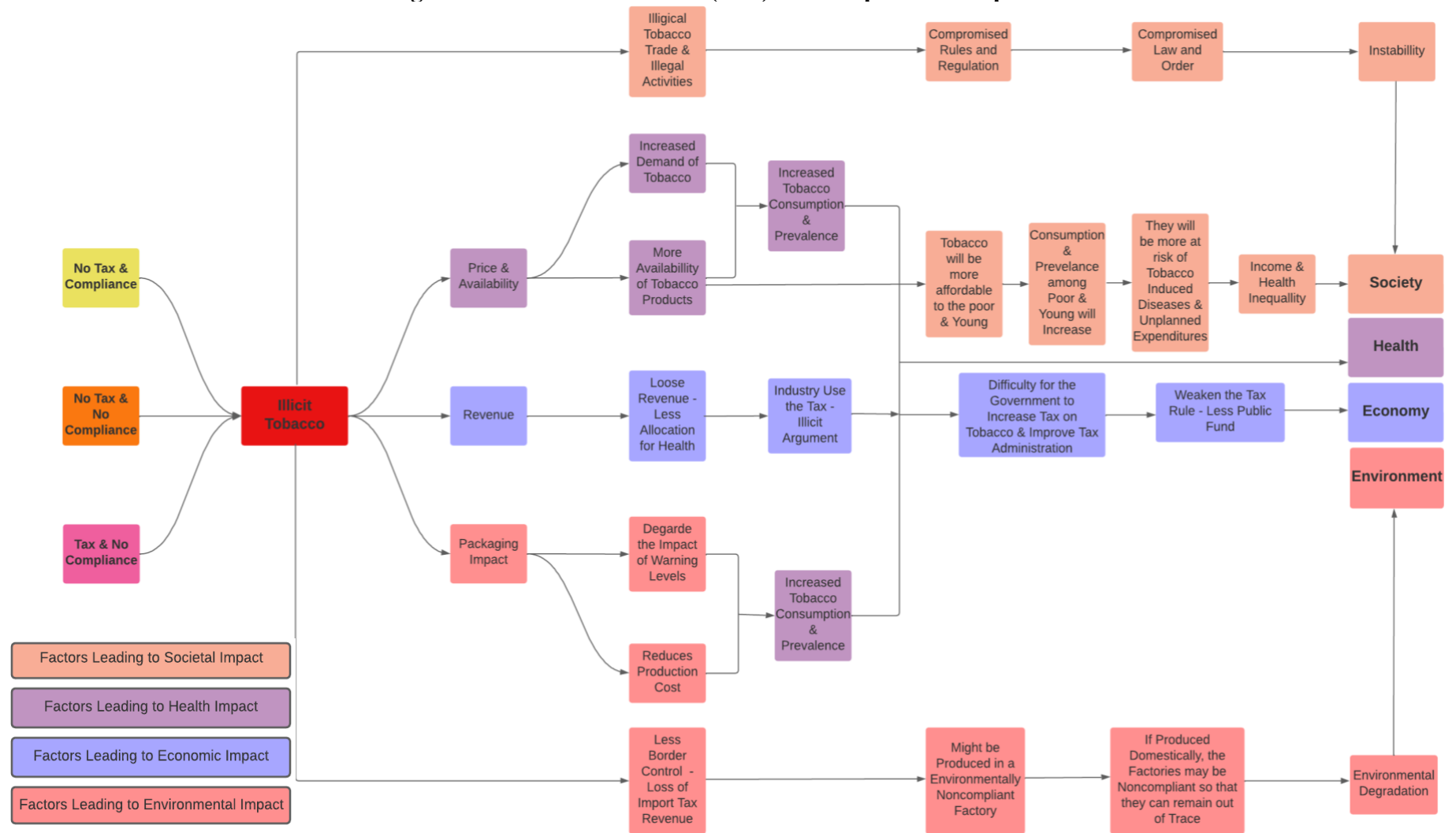
contains a worse impact for the society as a whole. Additionally, illicit tobacco can trigger illegal activities and cause instability in the society by causing threat to the rules and regulation.(Joossens and Raw, 2012; Langley, T. E., Gilmore, A., Gallagher, A., & Arnott, D., 2019; WHO, 2022)

The impact on the economy through revenue loss is quite obvious and direct.(Joossens et al., 2010; Merriman, 2013; WHO, 2022) Illicit tobacco erodes the fiscal revenue for government and affects the allocation for health eventually. Tobacco industry negotiates with the government arguing on the causal effect of increased tobacco tax on illicit trade. Accordingly, the policy makers faces difficulty to increase tobacco tax and improve tax administration. All these result in weakening tax rules and create a downward impact on the public fund and consequently the economy is affected.

The other prominent channel through which illicit tobacco products might weaken the tobacco control effort and hence affect health is weaken the impact of pack markings.(Hammond, 2011) Alongside the tax markers, tobacco packs are supposed to carry health warning labels, sale disclosures (such as area of sale, age restrictions etc.) and quit line numbers. The packs should not carry any misleading descriptors, health claims or any other markings or information that can deceive the current and potential users. Often the illicit tobacco packs do not follow rules for pack markings and consequently have twofold effects. This unlawful practice can help reducing the cost of production which has price implication and consequential for tobacco consumption. Additionally, the tobacco packs with lack of compliant pack features will fail to make the public health impact by creating awareness which they are originally intended to create. Thus, the low awareness will affect the uptake of tobacco use and hence tobacco related illness will rise because of increase in consumption.

Besides these conventional channels through which illicit tobacco use affects health, economy and society, it has important implication for the environment.(Lecours et al., 2012; Novotny et al., 2015) The illicit products are expected to be produced in a place which remains untraceable to the regulators. The establishments thus might not follow the compliance regulations for environment. Moreover, increase consumption of tobacco can also increase the incidence of tobacco farming which cause environmental degradation.

Figure 6: Illicit tobacco trade (ITT) and the potential impact



5.3.2 Controlling Illicit tobacco Trade – Practical Intervention & Support through Research Evidence

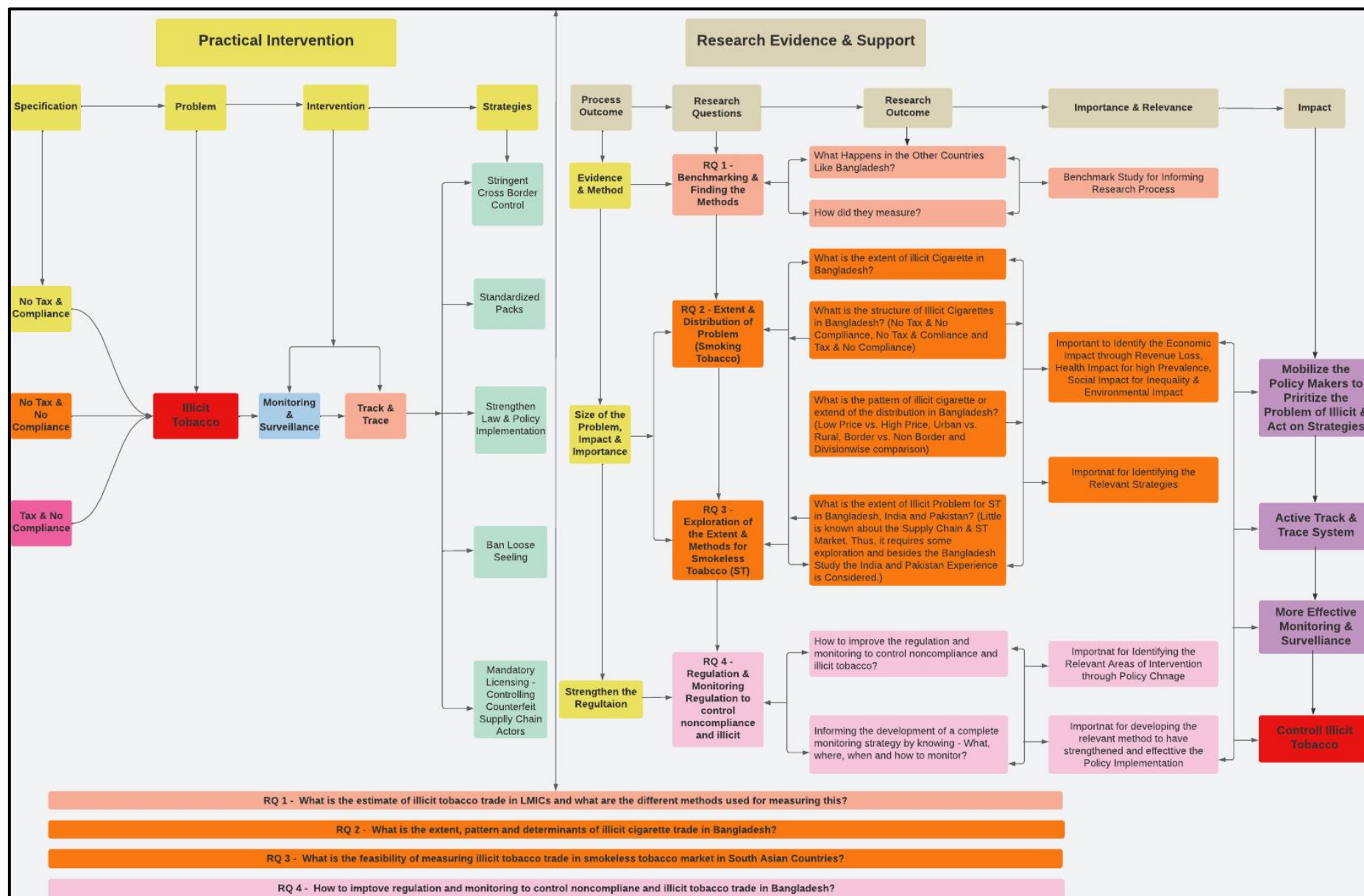
Figure 7 contains the conceptual framework for practical intervention to generate a control over ITT and how the current research can be instrumental for that in the context of Bangladesh. It is well regarded that ITT is more of a governance related phenomena than of tax. Given the specification (i.e. tax and packaging compliance) the problem of illicit tobacco required track and traceability of the products as intervention through monitoring and surveillance. For making the monitoring and surveillance effective and having active track and trace intervention few strategies can be considered. For example, there should be mandatory standardised packaging rules and tax markers for all types of tobacco, loose selling (i.e. single stick cigarette selling) should be banned, mandatory licensing for controlling counterfeit supply chain actors, strengthen rules and policy implementation and above all the cross border controlled should be improved.

The research evidence will inform the strategies in a way that will make the track and trace effective for Bangladesh. As mentioned earlier, the research proposed four separate studies which will address four research questions. The first research question will answer the scenario of ITT focusing in the extent of illicit products and method used for the studies in LMICs. It can be considered as a benchmark work to explore the existing evidences and methods from other countries and inform the current research process. The research outcome of this study would be revealing the illicit trade phenomena of other countries similar to Bangladesh and the particular method of estimation they have used in their context. This will inform the research process with the existing evidence and potential methods of measurement and led to the next stage of identification of the magnitude of problem for Bangladesh and its impact and importance. In this stage the second and third proposed study with answer the corresponding research questions related to illicit tobacco for smoking and ST. Besides estimating the magnitude, the research outcome will inform on the structure of illicit and its extended distribution for smoking tobacco in Bangladesh. While for the smoking tobacco, the illicit trade research scope has a wide horizon for the country because of being at a very preliminary stage and little knowledge about the business structure, the scope of ITT research in ST is limited. Hence, the third question is an exploration in nature. Both these research outcomes are important for the identification of the impact on the economy and health. This will help realise the depth and diversity of the illicit tobacco problem in the process outcome and will be

significant for detecting the relevant strategies. The fourth study is a qualitative study with tobacco control stakeholders. It will answer the research question on how to improve the regulation and monitoring to control non-compliance and illicit tobacco in Bangladesh. It will contribute to select the important areas of policy intervention and also ascertain the appropriate strategies and approaches for strengthening the regulation and its implementation. Thus, as a process outcome, this study will help to develop strategies to improve the implementation and policy regulations in the supply chain.

Ensuring the results are communicated properly, a potential impact of the research evidence will be to help mobilise policymakers to realise the importance of controlling ITT and its implication for health, economy, society and environment. They will prioritise the aspect of ITT and as practical intervention act on the strategies. This can result in an active track and trace system for tobacco control and a vibrant monitoring and surveillance system for the tobacco supply chain. All these will consequently contribute in keeping the ITT under control and reach the target of controlling tobacco prevalence and reducing the death and disability toll due to tobacco.

Figure 7: Practical intervention for controlling ITT and support through research evidence



5.3.3 Nexus of Proposed Research & Policy Impact - Theory of Change Approach

Table 6 contains the potential nexus between the proposed research and the intended policy impact from a “theory of change” perspective. The grand mission of the research is to limit the tobacco prevalence and control the death and disability toll. To accomplish the mission the aim is to inform and influence the policy movement for tobacco control in light of ITT in Bangladesh. It is assumed here that the evidence-based tobacco control movement will be successful in designing better intervention strategies for controlling illicit tobacco. This will reduce the uptake and consumption of tobacco because of control over price and supply. Accordingly, the incidental death and disability owing to tobacco will be condensed. Due to the scarcity of proper research evidence and data on ITT in Bangladesh the relative performance of Bangladesh in this regard remained unknown. Additionally, the extent, pattern, and determinants of the illicit tobacco products remained unrevealed and monitoring and surveillance practices for controlling illicit tobacco is also unknown. This lack of evidence provides the tobacco industry a strong position to negotiate and mislead the policymakers when they target towards tax increase on tobacco products. Thus, the objective of the research is to reveal the evidence of ITT in the LMICs, estimate the extent of that for Bangladesh along with their pattern and determinants and improve the regulation to ensure proper policy practice for controlling the problem. The four interlinked proposed studies will be answering the four interlinked research questions and they will contribute to meet the research objectives to reach to the aim of the research.

As the activities of the theory of change approach show, besides disseminating research evidence, successful communication of research is an important activity for achieving the research aim with the proposed studies. Along with the research progress, the stakeholders mapping, network building with the relevant stakeholders, development of useful policy materials for the movement and deliver those to the stakeholders are activities that will take place. The researchers and policy advocates are considered as internal enablers on the way of reaching aim and accomplishing mission since they share the same philosophy of tobacco control. However, the policy makers and politicians are out of immediate control of the researchers and policy makers and can be thought of external but the most important players to reach the aim. Here an important external factor is tobacco industry who are out of control and an obvious actor with a completely different philosophy regarding tobacco control. They retain a potential threat for the policy implementation.

Table 6: Proposed research and policy impact: theory of change approach

Table 6: Proposed Research and Policy Impact: theory of change approach							
Steps		Narratives				Assumptions	
Mission		Limit the tobacco prevalence and control the death and disability toll				Evidence based tobacco control movement help designing better intervention for controlling ITT, that will control tobacco price and ensure better compliance of packaging features. This will lead to curb consumption and limit the death and disability toll.	
Aim		Inform and influence policy movement for tobacco control in light of ITT in Bangladesh					
Problem Statement		Relative performance of Bangladesh on controlling ITT is unknown	Poor or scarce research evidence and data on ITT in Bangladesh	Extent, structure, associated factors, and regulation practices for ITT in Bangladesh is unknown	Tobacco industry led misinformation on tobacco tax & ITT influence the policy movement	Availability of proper research evidence on ITT help refuting the tobacco industry arguments and strengthen tobacco control movement.	
Objectives		Identify the extent of ITT in LMICs	Develop the ITT estimate for Smoking and Smokeless Tobacco in Bangladesh	Identify the structure and associated factors of ITT	Improving the regulation to control ITT in Bangladesh	Answering the research questions will help achieving the objectives in a way that will inform the problem statements.	
Research Questions		What is the estimate of ITT in LMICs?	What is the extent, structure and associated factors of illicit cigarette trade in Bangladesh?	What is the feasibility of measuring ITT in ST market in South Asian Countries?	How to improve the regulation and monitoring to control ITT in Bangladesh?		
Research Inputs & Activities		Research	Magnitude of ITT in Low- and Middle-Income Countries (LMICs) – A systematic review	Magnitude and structure of illicit cigarette sold as retail in Bangladesh: A pack analysis approach	Estimating the ITT in smokeless tobacco market: An exploratory study	Improving the Regulation and Monitoring to Control the Non-compliance and illicit ST in Bangladesh: A Qualitative Study	The proposed researches will answer the research questions to achieve the objectives and inform the problem statements.
		Dissemination and Research Communication	Mapping of stakeholders	Building relationship with stakeholders	Develop useful materials for policy movement and deliver to the stakeholders		The dissemination and communication will inform the policy advocates and influence the policy movement to reach the aim and accomplish the mission. The researchers and policy advocates are internal enablers in the movement as they believe in the same philosophy. While, policy makers and politicians are external because they are out of immediate control, however the most important to make the change. Tobacco industry is external enablers and a threat in practical on the way of achieving change.
Enablers		Internal	Researchers and Policy Advocates				
		External	Policy Makers, Politicians and Tobacco Industry				
Outcome & Impact		Intermedite (Short Term)	Important evidence on the extent of ITT in LMICs	Important evidence on the extent of ITT in Bangladesh	Structure and associated factors of ITT revealed	Identify the important areas of policy intervention to improve regulation and control ITT	The policy advocates are well sensitized with the communication materials developed from the research evidences and utilizing those during the policy movement
			Policy movement materials developed	Dissemination and communication of the policy movement materials	Policy advocates and other internal enablers are sensitized	Practical utilization of the materials	
		Mid-course (Medium Term)	Effective policy movement	External enablers are communicated and successfully sensitized	Better policy in place	Effective and extensive monitoring and surveillance	The policy advocates successfully communicated the materials to policy makers and politicians and were able to defeat the industry argument depending on evidence. As a result better policy and effective regulation practice is in place.
		Impact (Long Term)	Control of ITT and limit the tobacco prevalence & death and disability toll				

In terms of research outcome, in short run there will be evidence of ITT in LMICs, evidence of ITT and their pattern and determinants for Bangladesh and evidence for important areas of policy intervention to control and monitor ITT for Bangladesh. In terms of practical impact, the policy movement materials will be in place, policy advocates and other enablers will be sensitised through dissemination and communication of the findings and materials and there will be utilization of the policy materials during the movement and negotiation. In the mid-term given that the policy advocates successfully communicated the external enablers with policy materials, they will prioritise the issue, defeat the industry argument and make better policy and instrument available. Effective and extensive monitoring and surveillance will be initiated through proper track and trace approach which will provide a control over illicit trade and also on the tobacco consumption in the long run.

5.4 Summary of the Chapter

With a view to control the tobacco prevalence and reduce the tobacco related illness in Bangladesh, the research directed towards registering substantiation for the ITT. Improved and efficient intervention needs to be initiated for resisting illicit tobacco products which requires appropriate policy design. Research outcome intends to help the policy movement and make the necessary changes so that the policy design becomes more suitable in the context of Bangladesh. Given the fact that the evidence and data of ITT in Bangladesh is limited, pattern, determinants and surveillance and monitoring practices is not well explored and the relative performance of Bangladesh is also unknown in this regard, tobacco industries always frighten for any kind of policy shift arguing that illicit trade might inflate. The current research is, hence answering the research questions with the studies that will meet the objectives of estimating the extent of ITT in Bangladesh, identifying the extent in other LMICs, explore the extended distribution of IT in Bangladesh and identification of appropriate strategies to limit the extent of the problem.

Analysis of conceptual framework for illicit trade disclose that it potentially possesses several detrimental impacts not only in the health and economy but also as a whole to the society and environment. In broad spectrum, on one side it can stimulate consumption of tobacco and adversely affect public health and on the other side can cause fiscal revenue loss for the government and spitefully affect the economy. Since ITT is subject to tobacco governance, the conceptual framework for practical intervention recommends the track and trace through active monitoring and surveillance. The theory of change approach discloses that the planned research outcomes once communicated by the internal enablers (researchers and policy advocates) to external enablers (policy makers and politicians) the visible impact through policy shift can take place. In the long run as a result of track and trace and regular monitoring and surveillance illicit tobacco will be limited and the general aim of prevalence reduction can be attained.

Part III – Substantive Research Chapters

The third part of the thesis contains the substantive research chapters. It encloses the four studies conducted for the PhD. It contains the updated estimate of ITT in LMICs. Also, it includes the share of illicit cigarette and ST in Bangladesh. In light of addressing non-compliance and illicit ST, steps for improving regulation and monitoring are discussed. The part comprises four chapters that answer the four research questions and contribute towards the overall aim of the research. The chapter contents are as follows:

Chapter 6 is titled as “Methods followed and Magnitudes Estimated for Illicit Trade in Tobacco in LMICs”. Following a systematic approach, the evidence was gathered and analysed in this chapter. It also provides a meta-analysis on the share of ITT studies found in LMICs. The meta-analysis was conducted for stratified groups based on the type of tobacco (smoking and ST) and the funding source (independently funded and industry/undisclosed funded). Also, within the stratified groups meta-analysis was performed by defining the sub-groups based on method of estimation for ITT in LMICs. The chapter also contains the risk of bias assessment for quality of estimates in the IT studies in LMICs.

Chapter 7 is titled as “Magnitude and pattern of illicit cigarette sold as retail in Bangladesh: A pack analysis approach”. Following a pack analysis approach, it provides the proportion of tax-evaded and non-compliant cigarette packs and correspondingly estimated the share of illicit cigarettes in Bangladesh. For better understanding of the illicit phenomena, the estimate was analysed with regard to the administrative districts, geographic location (urban–rural), border adjacency (border - non-border), and cigarette price segments. The chapter contains specificity and sensitivity of packaging compliance in detecting cigarette tax evasion. It also contains estimation results of multiple logistic regression to identify the factors associated with cigarette tax evasion.

Chapter 8 is titled as “Estimating the ITT in ST market: An Exploratory Study from South Asian Countries”. It followed a similar approach as in chapter 6 and provides the estimate of the share of non-compliant and hence potentially illicit ST in Bangladesh, India and Pakistan. It’s an exploratory work as regulation for ST differs from smoking tobacco. It provides extended distribution of non-compliant ST across the three countries considering the country-specific tobacco control law.

Chapter 9 is titled as “Improving the regulation and monitoring to control the non-compliance and illicit smokeless tobacco in Bangladesh: a qualitative study”. This chapter contains the findings from a qualitative exploration of stakeholders perspective in Bangladesh to improve regulation for non-compliance and illicit ST. This chapter contains what policy initiatives needs to be taken and practice needs to be implemented to improve the regulation of non-compliance and illicit ST in Bangladesh.

Chapter 6: Study I: Methods followed and Magnitudes Estimated for Illicit Trade in Tobacco in LMIC

Chapter 6 contains the research paper titled “The Extent of Illicit Tobacco Trade in Low and Middle-Income Countries (LMICs) - a Systematic Review and Meta-Analysis,” published in the *Nicotine and Tobacco Research* journal as a systematic review. In addition to the structured abstract and implications, it includes five sections. Section 6.1 presents the introduction and rationale for the study. Section 6.2 outlines the methods, detailing the search strategy, data sources, data extraction, quality assessment, and data analysis approach. The results are found in Section 6.3. Finally, section 6.4 contextualises the results by comparing them with findings from existing studies and section 6.5 contains the conclusion. The citation details of the article are given below,

Abdullah, S.M., Siddiqi, Z., Huque, R., Kanaan, M. and Siddiqi, K., (2025). The extent of illicit tobacco trade in low and middle-income countries (LMICs) - a systematic review and meta-analysis. *Nicotine & tobacco research*, 27(10):1673-1683. Available at: doi:10.1093/ntr/ntaf070.

[Note: Table and figure numbers and their in-text referencing are continuous in this chapter and hence differ from the published article to maintain the overall flow of the thesis.]

The Extent of Illicit Tobacco Trade in Low and Middle-Income Countries (LMICs) - a Systematic Review and Meta-Analysis

Abstract

Introduction

Little is known about the extent of the illicit tobacco trade in low- and middle-income countries (LMICs) where more than 80% of tobacco users now live. We systematically reviewed literature from LMICs to investigate the share of illicit tobacco and the methods studies applied.

Methods

We searched nine electronic databases, three websites, and grey literature published in English from January, 2012 to July, 2023. Studies assessing the extent of illicit tobacco trade within LMICs were included. Two independent reviewers screened titles, abstracts, and full-text manuscripts' and extracted the data from those eligible. Studies were critically appraised using a bespoke framework. We conducted a meta-analysis of the share of illicit tobacco and pooled the results with random effects. Analysis was stratified by type of tobacco and funding source. Based on the estimation methods for illicit tobacco, sub-group analysis was conducted. The review was registered in PROSPERO (CRD42023450354).

Results

Among 48 eligible studies from 39 LMICs, 41 disclosed independent (non-industry) funding sources. Only two studies estimated the share of illicit smokeless tobacco. Studies used three estimation methods: i) pack analysis (n=33), ii) gap analysis (n=13), and iii) trade monitoring (n=2). The pooled share of illicit smoking and smokeless tobacco was 14.4% (95%CI: 10.5-18.9) and 86.9% (95%CI: 51.1-100.0) respectively.

Conclusions

Approximately one in every seven cigarette packs is likely to be illicit in LMICs. The share of illicit smokeless tobacco may be a lot higher, but the estimates were uncertain due to very few studies.

Implications

Since the inception of the WHO FCTC Illicit Tobacco Trade Protocol (ITP) in 2012 this review is the first attempt to systematically investigate the share of illicit tobacco in LMICs. We found that the evidence is lacking in many LMICs, even among ITP signatories. The share of illicit smokeless tobacco appears to be higher than that of smoking tobacco, although the estimates remain uncertain due to the limited number of studies. Given that there is no fiscal marking (e.g. tax stamp) on the packs, studies in LMICs mainly relied on packaging compliance to detect illicit tobacco products. The findings highlight the lack of evidence in LMICs and the importance of robust estimation of the share of illicit tobacco where the evidence is lacking.

6.1 Introduction

Over one in five adults worldwide are tobacco users. Among the 1.3 billion users, more than 80% live in low and middle-income countries (LMICs).(WHO, 2023) Consequently, a high burden of tobacco-related deaths and disabilities is borne in these countries.(Joossens et al., 2010; Action on Smoking and Health, 2019) The illicit tobacco trade evades taxes and keeps these products cheap and accessible, which in turn increases their uptake, especially among youth.(WHO, 2022) Moreover, the illicit tobacco trade undercuts government revenue and threatens security.(WHO, 2022)

Illicit tobacco trade is a global problem. Since the inception of World Health Organization (WHO) Illicit Tobacco Trade Protocol (ITP) in 2012,(WHO, 2012a) 87 countries have either signed and/or ratified the protocol. According to the protocol, illicit tobacco trade is defined as “*any practice or conduct prohibited by law and which relates to production, shipment, receipt, possession, distribution, sale or purchase including any practice or conduct intended to facilitate such activity*”.(WHO, 2012a) The adoption of the ITP aimed to strengthen global coordination to combat illicit tobacco trade; however, illicit markets have continued to evolve in response to regulatory and enforcement efforts. Researchers have observed a shift in illicit tobacco trade patterns; previously, only well-known cigarette brands were smuggled in, but now illegal manufacturing of cigarettes, including counterfeiting, has emerged.(Joossens and Raw, 2012) The cumulative revenue loss of Belgium, Bulgaria, Czech Republic, Ecuador, Estonia, Hungary, India, Indonesia, Malaysia, Philippines, Romania, UK and Vietnam owing to illicit trade was three times more than the budget of WHO during 2010–11.(Lencucha and Callard, 2011) For Indonesia, this loss during 2011-2013 was 4% to 13% of total tobacco excise revenue.(Ahsan et al., 2014) Minimising illicit tobacco trade could generate substantial government revenue and lower tobacco use.(Joossens et al., 2010; Goodchild et al., 2022) Over 3.49 billion illicit cigarettes were seized globally in 2019.(World Customs Organization, 2019) The market share of illicit cigarettes was shown to be higher in LMICs than the overall share in high-income countries (HICs) in two previous studies (12.1% vs. 9.8% and 12.3% vs.10.4%).(Joossens et al., 2010; Goodchild et al., 2022) However, these estimates did not include all forms of tobacco and did not distinguish between the methods and funding sources of the included studies. These studies were not designed as systematic reviews and hence, the quality of estimates was not assessed. Furthermore, due to the dynamic and contextual nature of the illicit tobacco trade, their

estimates need updating regularly.

The WHO Framework Convention on Tobacco Control (WHO FCTC) aimed to standardise global tobacco control policies, offers several comprehensive interventions across all governance levels.(Anderson, Becher and Winkler, 2016) Nevertheless, tobacco control regulation and enforcement differ significantly between LMICs and HICs, with policy stagnancy in most LMICs.(Bump and Reich, 2013) The differences are generally based on varying taxation levels, differing comprehensiveness of advertising bans and packaging laws, and varying degrees of industry influence.(Anderson, Becher and Winkler, 2016; Bump and Reich, 2013; Nagler and Viswanath, 2013) The governance, border control, licensing procedure and other policy enforcement measures may be a little weaker in LMICs than HICs. Moreover, the illicit tobacco trade undermines effective tobacco control in LMICs, undermining regulation efforts even more than HICs.(Ulep, Lavares and Francisco, 2021)

Research in illicit tobacco trade is skewed to the HICs, while the overall share of illicit tobacco is larger for LMICs.(Joossens et al., 2010; Goodchild et al., 2022) We performed a scoping search and found to date no systematic review on illicit tobacco trade in LMICs. Thus, we systematically reviewed the literature on illicit tobacco in the context of LMICs to explore the prevalence of illicit tobacco and the various methods used in the studies to estimate its extent. We specified the review questions using PerSPECTiF [Perspective (Per), Setting (S), Phenomena (P), Environment (E), Comparator (C), Timing (Ti), and Findings (F)] framework (Appendix 1: Chapter 6-Supplementary Tables: Table S1, pp 188).(Booth et al., 2019) The review questions were: What is the share of illicit tobacco sales and/or consumption in LMICs? And what methods were used by the studies in LMICs to estimate the share of illicit tobacco?

6.2 Methods

6.2.1 Search strategy and selection criteria

This systematic review is registered in PROSPERO (CRD42023450354) (Abdullah, Siddiqi and Khan, 2023) and it was conducted following PRISMA guidelines.(Page et al., 2021) Using a comprehensive search strategy (developed with inputs from the information specialist in the Department of Health Sciences, University of York, UK), we performed the search with a blend of free text and Medical Subject Heading (MeSH) phrases related to the areas of smoking or smokeless tobacco and illicit trade (Appendix

1: Chapter 6-Supplementary File, Search Strategy, pp 162-184). The main keywords included “illicit”, “smoking tobacco”, “smokeless tobacco”, “sales”, “consumption”, “tax evasion”, “counterfeit”, “smuggle”, “bootleg”, and “packaging compliance”. We searched nine electronic databases (MEDLINE, CINAHL, EMBASE, EconLit, PSYCInfo, Scopus, Web of Science, PubMed, and Cochrane Library), and the websites and registers of three organisations: Tobacconomics (University of Illinois at Chicago, US), Research Unit on the Economics of Excisable Products (REEP) (University of Cape Town, South Africa), and the WHO FCTC Knowledge Hub on Tobacco Taxation. We accessed the reference lists of eligible papers and performed a guided search in Google Scholar (the first 50 search results were considered) to assess the eligible studies published elsewhere. ProQuest Dissertations & Theses and DART-Europe E-theses Portal were searched for grey literature. The search was conducted in July 2023.

We included studies conducted in LMICs and published between January, 2012 and July, 2023. The search timeline coincided with the enactment of ITP in 2012.(WHO, 2012a) We used the World Bank’s income classification in 2022-23 for country selection (Appendix 1: Chapter 6-Supplementary Tables: Table S2, pp 188).(World Bank, 2023) Studies published in languages other than English were excluded.

There were two separate stages for study screening: titles and abstract, and full-text screening. Two independent reviewers (S M Abdullah (SMA) and Zakariya Siddiqi (ZS)) conducted the screening using a screening form (Appendix 1: Chapter 6-Supplementary File, Title and Abstract Screening Form, Full Text Screening Form, pp 184-185) based on the inclusion/exclusion criteria (Appendix 1: Chapter 6-Supplementary Tables: Table S3, pp 189). Discrepancies were resolved through discussion and with the intervention of the third reviewer (Sheraz Khan (SK)). We conducted the de-duplication of records in EndNote 20.(The EndNote Team) Ineligible studies were removed by manual searching. As a review management tool for screening and data extraction, we used Covidence.(Veritas Health Innovation, 2023)

6.2.2 Data extraction and quality assessment

We adapted the Cochrane Effective Practice and Organization Care (EPOC, 2017) data extraction tool.(EPOC) It provides an extraction framework suitable for interventional and observational studies with heterogeneous design. EPOC is modified for studies

assessing the effect of policy and public health interventions, making it suitable for illicit tobacco, which encompasses fiscal, regulatory, and enforcement measures. Before its implementation, we piloted the data extraction form using five included studies (Appendix 1: Chapter 6-Supplementary File, Data Extraction Form, pp 186). Subsequently, we modified the form to include a column for data sources. Besides the estimates, the form included columns for the methods used for measuring illicit tobacco trade, including study design, place and time, sample size, data collection and the methods for analysis, and funding sources. A list of potential outcome domains for different data items and their probable effect measure is given in the Appendix 1: Chapter 6-Supplementary Tables (Table S4, pp 190). Illicit tobacco research can include multi-country estimates within a single study, as well as multiple estimates for individual countries. For the meta-analysis, we utilised the country-specific estimates of illicit tobacco. Since studies may report estimates using various methods, all estimates were documented and synthesised into different sub-groups based on the estimation methods. Two reviewers (SMA and ZS) extracted the data independently. For validity and consistency, we cross-matched the following domains: study design, study sample, method(s) of measurement, outcome(s) measured, and findings. Disputes were settled through discussion and with the involvement of a third reviewer (SK).

We assessed the quality of illicit tobacco trade estimates using a novel tool. Ross (2015) suggested a domain-based approach and proposed 20 characteristics for assessing the quality of estimates related to tobacco tax evasion and hence, illicit tobacco. (Ross, 2015) We used this approach and combined it with the scale in Crombie's Item (I) (Crombie, 1996) ["yes" (score = 1) - meets the characteristics, "no" (score = 0) do not meet the characteristics, "unclear" (score = 0.5), and "not applicable" (no score assigned)]. For consistency and validation, two reviewers (SMA and ZS) appraised independently, involving a third reviewer (SK) for dispute settlement. The critical appraisal form (Appendix 1: Chapter 6-Supplementary File, Critical Appraisal Form, pp 187) mapped characteristics of studies over the seven domains: peer-reviewed, funding, replicability and theory relevance, generalisability and criteria selection, definition and identification of illicit products, result and cross-validation of illicit estimate, and limitation acknowledgment. The proportion of characteristics in each domain was considered as weight. Score for each domain is calculated by multiplying the domain-specific weight with the number of characteristics included in that domain. We calculated the total score for a study by summing up the individual score over the seven domains (Appendix 1:

Chapter 6-Supplementary File, Critical Appraisal Form, pp 187). After standardising the score to a scale of ten, the maximum score a study could obtain was 36, with the lowest zero. Studies were categorised in terms of risk to the quality of estimates as, i) Low risk (≥ 22), ii) Moderate risk (between 22-11), and iii) Serious risk (≤ 11). Thus, studies meeting less than 30% of the criteria were deemed methodologically weak, rendering their estimates unreliable.(Steele, Bialocerkowski and Grimmer, 2003; Geytenbeek, 2002; Nazar et al., 2021) We also used the Cochrane Risk of Bias Assessment Tool: for Non-Randomized Studies of Interventions (ROBINS - I) for the visual presentation of the quality assessment.(Sterne et al., 2016)

6.2.3 Data analysis

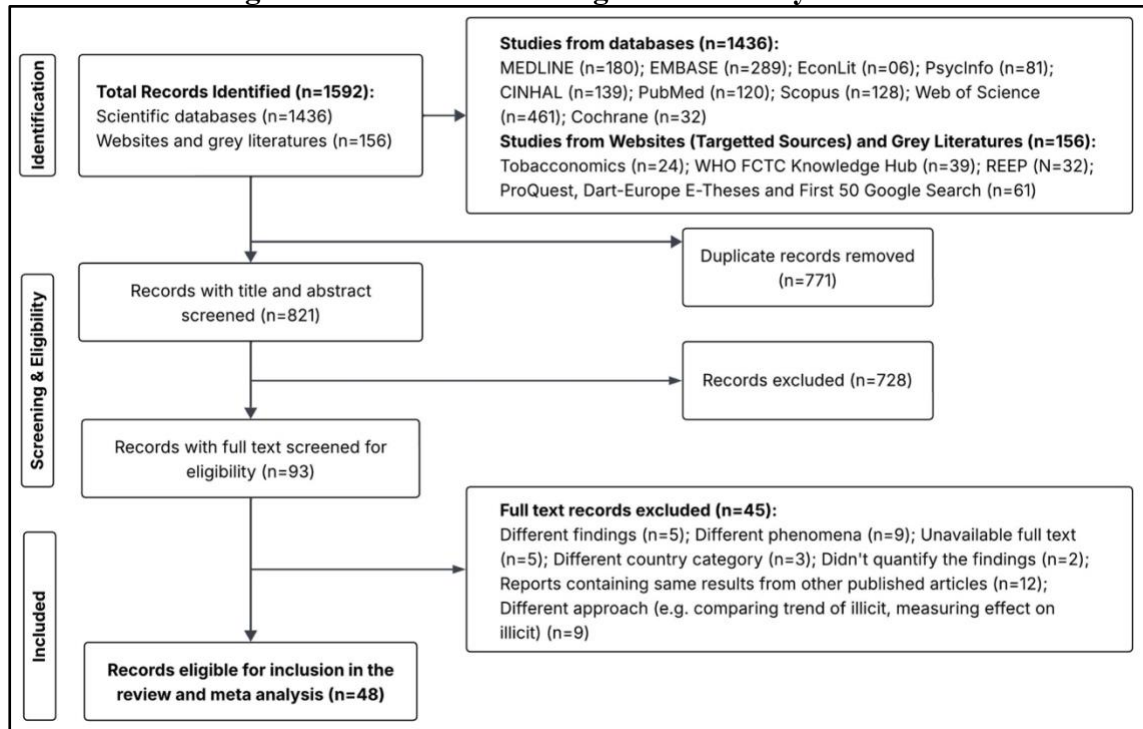
We conducted a quantitative synthesis and meta-analysis of the illicit tobacco estimates with 95% confidence intervals (CI) and pooled the results with random effects. Share of illicit tobacco is expected to vary across the type of tobacco, and method for estimation. It can be diverse because of non-comparable proportional data in different studies. Moreover, the observational studies (smokers survey, retailers survey, and pack analysis) can have large sample sizes, generating tighter CI for the share of illicit tobacco. All these could inflate I^2 value in the meta-analysis of studies with the share of illicit tobacco. Accordingly, to minimise the effect of heterogeneity and to make informative inferences from meta-analysis, we applied the random effects model and estimated 95% prediction intervals (PI). Unlike the fixed effects model, the random effects model uses more balanced weighting regardless of study size and allows the effect size to vary across studies, thereby incorporating between-study variance to provide a more realistic estimate of the share of illicit. To explore heterogeneity, we performed subgroup analysis based on the method of estimation. We stratified the analysis by type of tobacco (smoking or smokeless) and funding source of the studies (independently funded or industry funded/undisclosed) for sensitivity. The overall pooled estimate and the estimate of the share of illicit tobacco for each sub-group were presented using the forest plot. The potential publication bias was assessed visually using the funnel plot. We tested the significance of funnel asymmetry by Egger test and Begg test.(Egger et al., 1997; Begg and Mazumdar, 1994) All statistical analysis was carried out using STATA V.18.(StataCorp, 2023)

6.3 Results

6.3.1 Selection process and characteristics of included studies

We identified 1,592 studies (1,436 from database searches and 156 from the websites and grey literature). After the removal of duplicates (771), we considered 821 studies for title and abstract screening. We excluded 728 studies at this stage for being ineligible. Of the remaining 93, full-texts were retrieved and 48 studies were found eligible for the review and meta-analysis (Figure 8). Of these 48 studies, six were reports, (Tobacconomics, 2023; Kartika et al., 2019; Morais, Colombage and Wickramasinghe, 2018; FTI Consulting, 2019; International Tax and Investment Centre and Oxford Economics, 2016; Oxford Economics, 2020) and 42 were journal articles (Appendix 1: Chapter 6-Supplementary Tables: Table S5, pp 191-193). (Vladisavljevic et al., 2022; van der Zee et al., 2020; van der Zee, van Walbeek and Magadla, 2020; Szklo et al., 2022; Szklo and Drope, 2023; Szklo et al., 2018; Singh et al., 2023; Shakya et al., 2023; Ross et al., 2020; Pizarro et al., 2022; Pavananunt, 2011; Nguyen et al., 2019; Nguyen and Nguyen, 2020; Maldonado et al., 2018; Machado et al., 2021; Little et al., 2020, 2021; Lavares et al., 2022; Koya, Branston and Gallagher, 2022; Khan et al., 2021; Kasri et al., 2021; Kaplan, Navas-Acien and Cohen, 2018; Joossens et al., 2014; John and Ross, 2018; Iglesias et al., 2017; Heydari et al., 2016; Heydari and Joossens, 2022; Guindon et al., 2014; Goodchild et al., 2020; Dauchy and Ross, 2022; Chisha, Janneh and Ross, 2020; Bui, Ross and Mohamed Nor, 2022; Ahsan et al., 2014; Abdullah et al., 2022b; Welding et al., 2021; Vellios, van Walbeek and Ross, 2020; Saenz de Miera Juarez et al., 2021; Nguyen et al., 2014; Nguyen, Giang and Pham, 2020; Maldonado et al., 2020; Gallien and Occhiali, 2023; Abola et al., 2014) There were seven multi-country studies (five articles (Vladisavljevic et al., 2022; Joossens et al., 2014; Guindon et al., 2014; Abdullah et al., 2022b; Welding et al., 2021) and two reports (International Tax and Investment Centre and Oxford Economics, 2016; Oxford Economics, 2020)). Seven studies (FTI Consulting, 2019; International Tax and Investment Centre and Oxford Economics, 2016; Oxford Economics, 2020; Heydari et al., 2016; Heydari and Joossens, 2022; Morais, Colombage and Wickramasinghe, 2018; Machado et al., 2021) were either funded by the tobacco industry (three studies) (FTI Consulting, 2019; International Tax and Investment Centre and Oxford Economics, 2016; Oxford Economics, 2020) or the funding information was undisclosed by the authors (four studies); (Heydari et al., 2016; Heydari and Joossens, 2022; Morais, Colombage and Wickramasinghe, 2018; Machado et al., 2021) the rest were funded independently.

Figure 8: PRISMA flow diagram and study selection



The included studies were conducted in 39 countries (Appendix 1: Chapter 6-Supplementary Figures: Figure S1, pp 205): 28 in Asia (Bangladesh,(Guindon et al., 2014; Abdullah et al., 2022b) Cambodia,(International Tax and Investment Centre and Oxford Economics, 2016) China,(Guindon et al., 2014) Georgia,(Little et al., 2020, 2021) India,(Goodchild et al., 2020; Welding et al., 2021; Abdullah et al., 2022b; John and Ross, 2018), Indonesia,(International Tax and Investment Centre and Oxford Economics, 2016; Ahsan et al., 2014; Kartika et al., 2019; Kasri et al., 2021) Iran,(Heydari et al., 2016; Heydari and Joossens, 2022) Jordan,(Oxford Economics, 2020) Lebanon,(Oxford Economics, 2020) Malaysia,(International Tax and Investment Centre and Oxford Economics, 2016; Guindon et al., 2014; Koya, Branston and Gallagher, 2022; Bui, Ross and Mohamed Nor, 2022) Mauritius,(Guindon et al., 2014) Mongolia,(Ross et al., 2020) Myanmar,(International Tax and Investment Centre and Oxford Economics, 2016) Nepal,(Shakya et al., 2023) Pakistan,(Khan et al., 2021; Abdullah et al., 2022b; International Tax and Investment Centre and Oxford Economics, 2016) Philippines,(International Tax and Investment Centre and Oxford Economics, 2016; Lavares et al., 2022; Abola et al., 2014) Sri Lanka,(Morais, Colombage and Wickramasinghe, 2018) Thailand,(Pavananunt, 2011; International Tax and Investment Centre and Oxford Economics, 2016; Guindon et al., 2014) Turkey,(Kaplan, Navas-Acien and Cohen, 2018) and Vietnam(Nguyen, Giang and Pham, 2020; Nguyen et al., 2014; Nguyen and Nguyen, 2020; Nguyen et al., 2019)), eight in Africa (Egypt,(Oxford

Economics, 2020) Ethiopia,(Dauchy and Ross, 2022) Gambia,(Chisha, Janneh and Ross, 2020) Ghana,(Singh et al., 2023) Sierra Leone,(Gallien and Occhiali, 2023) and South Africa(van der Zee, van Walbeek and Magadla, 2020; van der Zee et al., 2020; Vellios, van Walbeek and Ross, 2020)), three in Europe (Albania,(Vladisavljevic et al., 2022; Joossens et al., 2014) Bosnia and Herzegovina,(Vladisavljevic et al., 2022) Bulgaria,(Joossens et al., 2014) Montenegro,(Vladisavljevic et al., 2022; Tobacconomics, 2023) North Macedonia,(Vladisavljevic et al., 2022) Romania,(Joossens et al., 2014) Serbia,(Vladisavljevic et al., 2022) and Kosovo(Vladisavljevic et al., 2022)), ten in Latin America (Argentina,(Pizarro et al., 2022) Brazil,(Szklo et al., 2022; Szklo and Drope, 2023; Szklo et al., 2018; Iglesias et al., 2017; Machado et al., 2021) Colombia,(Maldonado et al., 2018, 2020) and Mexico(Guindon et al., 2014; Saenz de Miera Juarez et al., 2021)), and one in Oceania (Papua New Guinea(FTI Consulting, 2019)).

Only one study focused solely on smokeless tobacco(Abdullah et al., 2022b) and one on both smoking and smokeless tobacco;(Welding et al., 2021) the rest estimated cigarette illicit trade. Welding and colleagues considered bidi (cheap smoking tobacco) besides cigarettes for India.(Welding et al., 2021) Study from Papua New Guinea discussed Brus (smoking tobacco made from traditionally dried raw tobacco leaf) along with cigarettes.(FTI Consulting, 2019) Hand-rolled tobacco besides manufactured cigarettes was studied by Vladisavljevic and colleagues in Western Balkan Countries (Albania, Bosnia and Herzegovina, Kosovo, Montenegro, North Macedonia, and Serbia).(Vladisavljevic et al., 2022)

6.3.2 Methods applied to estimate the share of illicit tobacco

Three methods were used to estimate the share of illicit tobacco: i) pack analysis (33 studies)(Vladisavljevic et al., 2022; van der Zee, van Walbeek and Magadla, 2020; van der Zee et al., 2020; Szklo et al., 2022; Szklo and Drope, 2023; Singh et al., 2023; Shakya et al., 2023; Ross et al., 2020; Pizarro et al., 2022; Nguyen et al., 2019; Nguyen and Nguyen, 2020; Maldonado et al., 2018; Little et al., 2020, 2021; Khan et al., 2021; Kaplan, Navas-Acien and Cohen, 2018; Joossens et al., 2014; John and Ross, 2018; Iglesias et al., 2017; Guindon et al., 2014; Dauchy and Ross, 2022; Chisha, Janneh and Ross, 2020; Abdullah et al., 2022b; Kartika et al., 2019; Tobacconomics, 2023; Welding et al., 2021; Saenz de Miera Juarez et al., 2021; Maldonado et al., 2020; Machado et al., 2021; Heydari

et al., 2016; Heydari and Joossens, 2022; Morais, Colombage and Wickramasinghe, 2018; FTI Consulting, 2019) -analysing the tobacco pack features collected from different sources e.g. smokers, retailers, littered and waste recycle stores, ii) gap analysis (13 studies)(Szklo et al., 2018; Lavares et al., 2022; Koya, Branston and Gallagher, 2022; Kasri et al., 2021; Bui, Ross and Mohamed Nor, 2022; Ahsan et al., 2014; Goodchild et al., 2020; Vellios, van Walbeek and Ross, 2020; Gallien and Occhiali, 2023; Nguyen et al., 2014; Nguyen, Giang and Pham, 2020; International Tax and Investment Centre and Oxford Economics, 2016; Oxford Economics, 2020) -comparing the legal tax paid sales with estimated total consumption, and iii) trade monitoring (two studies)(Pavananunt, 2011; Abola et al., 2014) -comparing the bilateral exports and imports of the country.(Ross, 2015)

Table S6 (Appendix 1: Chapter 6-Supplementary Tables, pp 194-202) lists the studies with independent funding. Of these 40 studies, 27 used pack analysis. Twenty-one studies(Vladislavljevic et al., 2022; van der Zee, van Walbeek and Magadla, 2020; van der Zee et al., 2020; Szklo et al., 2022; Szklo and Drope, 2023; Nguyen et al., 2019; Nguyen and Nguyen, 2020; Maldonado et al., 2018; Little et al., 2021, 2020; Khan et al., 2021; Kaplan, Navas-Acien and Cohen, 2018; Joossens et al., 2014; Iglesias et al., 2017; Guindon et al., 2014; Dauchy and Ross, 2022; Chisha, Janneh and Ross, 2020; Kartika et al., 2019; Tobacconomics, 2023; Saenz de Miera Juarez et al., 2021; Maldonado et al., 2020) surveyed smokers face-to-face and either asked them to show their last purchased cigarette pack and directly recorded their packaging features or recorded the smokers-reported packaging features. Four studies(Singh et al., 2023; Shakya et al., 2023; Welding et al., 2021; John and Ross, 2018) collected empty cigarette packs from retailers or purchased packs from point-of-sale vendors while nine others(Szklo et al., 2022; Shakya et al., 2023; Ross et al., 2020; Pizarro et al., 2022; Khan et al., 2021; John and Ross, 2018; Dauchy and Ross, 2022; Tobacconomics, 2023; Saenz de Miera Juarez et al., 2021) collected discarded cigarette packs from sources such as street litter, waste recycle bins, household solid waste, and waste recycle stores. Seven studies(Szklo et al., 2022; Shakya et al., 2023; Khan et al., 2021; John and Ross, 2018; Dauchy and Ross, 2022; Tobacconomics, 2023; Saenz de Miera Juarez et al., 2021) analysed pack information using packs from multiple sources (collected pack information (empty packs) from smokers or retailers and packs from discarded sources). Eleven studies(Szklo et al., 2022; Singh et al., 2023; Shakya et al., 2023; Ross et al., 2020; Pizarro et al., 2022; Khan et al., 2021; John and Ross, 2018; Dauchy and Ross, 2022; Tobacconomics, 2023; Welding et

al., 2021; Saenz de Miera Juarez et al., 2021) collected cigarette packs and examined their features while fifteen (Vladisavljevic et al., 2022; Szklo et al., 2022; Nguyen et al., 2019; Nguyen and Nguyen, 2020; Maldonado et al., 2018; Little et al., 2021, 2020; Khan et al., 2021; Kaplan, Navas-Acien and Cohen, 2018; Joossens et al., 2014; Guindon et al., 2014; Chisha, Janneh and Ross, 2020; Kartika et al., 2019; Tobacconomics, 2023; Maldonado et al., 2020) observed or photographed the last purchased packs from the smokers. Smokers-reported packaging information was analysed in twelve studies. (Vladisavljevic et al., 2022; van der Zee, van Walbeek and Magadla, 2020; van der Zee et al., 2020; Szklo et al., 2022; Szklo and Drope, 2023; Maldonado et al., 2018; Joossens et al., 2014; Iglesias et al., 2017; Guindon et al., 2014; Chisha, Janneh and Ross, 2020; Saenz de Miera Juarez et al., 2021; Maldonado et al., 2020)

Twenty-two studies used pack compliance related to the health warning (graphical and textual – size, content, colour, and design) legitimacy, brand legitimacy, country of origin, price disclosure, under age or country of sale disclosure or duty-free sign as a hallmark of illicit. Fourteen studies scrutinised tax stamp or excise sticker compliance to detect illicit. (Vladisavljevic et al., 2022; Singh et al., 2023; Shakya et al., 2023; Ross et al., 2020; Pizarro et al., 2022; Nguyen et al., 2019; Nguyen and Nguyen, 2020; Little et al., 2020, 2021; Kaplan, Navas-Acien and Cohen, 2018; Joossens et al., 2014; Guindon et al., 2014; Kartika et al., 2019; Tobacconomics, 2023) Ten studies used price threshold (Vladisavljevic et al., 2022; van der Zee et al., 2020; van der Zee, van Walbeek and Magadla, 2020; Szklo et al., 2022; Szklo and Drope, 2023; Maldonado et al., 2018, 2020; Joossens et al., 2014; Iglesias et al., 2017; Chisha, Janneh and Ross, 2020) approach and four used place of purchase (Vladisavljevic et al., 2022; Joossens et al., 2014; Nguyen and Nguyen, 2020; Tobacconomics, 2023) to detect the illicit products. We found only two studies estimating the share of illicit smokeless tobacco. (Abdullah et al., 2022b; Welding et al., 2021) Both of them were independently funded, applied pack analysis (collected packs from retailers) method and used packaging compliance to categorise the product as illicit.

Among the seven tobacco industry-funded (or undisclosed funding information) studies (Appendix 1: Chapter 6-Supplementary Tables: Table S7, pp 203-204), five applied pack analysis method; (FTI Consulting, 2019; Morais, Colombage and Wickramasinghe, 2018; Machado et al., 2021; Heydari et al., 2016; Heydari and Joossens, 2022) two (Morais, Colombage and Wickramasinghe, 2018; Machado et al., 2021) collected packs (from

littered sources) and examined their features while another two (Heydari et al., 2016; Heydari and Joossens, 2022) observed the packs (available with smokers) and one study (FTI Consulting, 2019) did not discuss the method adequately. Three studies (Heydari et al., 2016; Heydari and Joossens, 2022; Machado et al., 2021) used packaging compliance to identify illicit packs while none of them scrutinised the tax stamp legitimacy or used price threshold for the purpose.

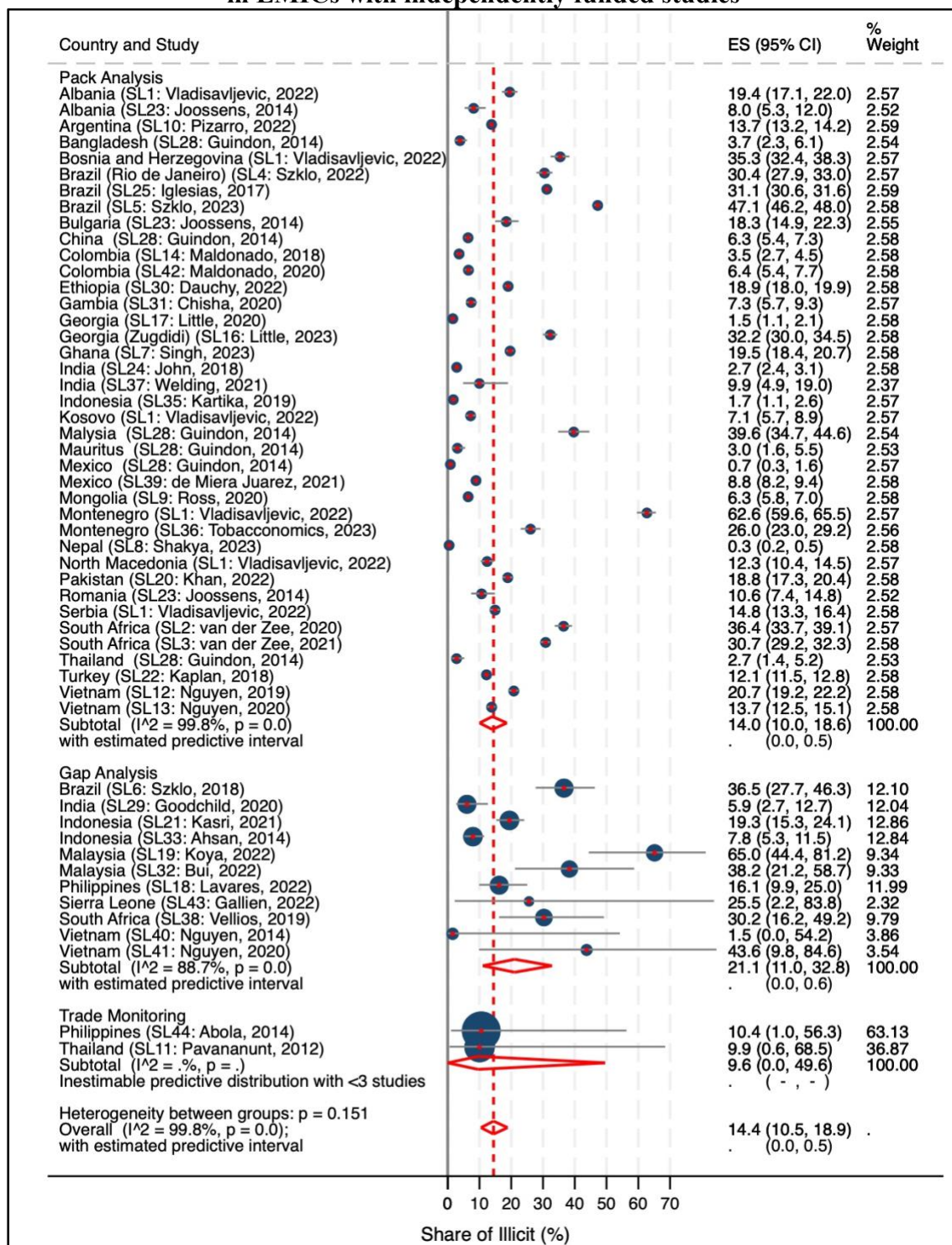
Among the eleven independently funded smoking tobacco studies that used gap analysis to estimate the share of illicit, (Szklo et al., 2018; Kasri et al., 2021; Bui, Ross and Mohamed Nor, 2022; Ahsan et al., 2014; Goodchild et al., 2020; Vellios, van Walbeek and Ross, 2020; Nguyen et al., 2014; Nguyen, Giang and Pham, 2020; Lavares et al., 2022; Koya, Branston and Gallagher, 2022; Gallien and Occhiali, 2023) eight (Szklo et al., 2018; Kasri et al., 2021; Bui, Ross and Mohamed Nor, 2022; Ahsan et al., 2014; Goodchild et al., 2020; Vellios, van Walbeek and Ross, 2020; Nguyen et al., 2014; Nguyen, Giang and Pham, 2020) compared the legal cigarette sales and the estimated total cigarette consumption. Lavares and colleagues used the gap between annual total estimated cigarette consumption and annual legal consumption for Philippines to estimate the share of illicit tobacco. (Lavares et al., 2022) For Sierra Leone, Gallien and Occhiali used gap between annual total consumption and total legal import. (Gallien and Occhiali, 2023) Koya and colleagues in Malaysia applied gap between actual excise tax payment and due tax payment estimated with total consumption. (Koya, Branston and Gallagher, 2022) All gap analysis studies utilised routine data to gather information on smoking prevalence, smoking intensity, tobacco tax revenue and consumption, sales, population and cigarette trade. There were only two industry-funded studies that applied gap analysis. (International Tax and Investment Centre and Oxford Economics, 2016; Oxford Economics, 2020) They used domestic sales and consumption data to estimate the gap and measure the extent of illicit tobacco. However, the method and assumptions were not adequately described.

We found trade monitoring as the least applied method for estimating the illicit tobacco share. Abola and colleagues in Philippines and Pavananunt in Thailand applied this method. (Pavananunt, 2011; Abola et al., 2014) Trade discrepancy was measured using the gap between the reported import and export of tobacco. Both studies were independently funded.

6.3.3 Estimate of the share of illicit tobacco – Meta-analysis

Figure 9 shows the forest plot for independently funded studies. The pooled estimate for the share of illicit smoking tobacco was 14.4% (95%CI: 10.5-18.9). Due to diverse methods of estimation, noticeable heterogeneity was present (Overall $I^2=99.8$). Accordingly, we conducted sub-group analysis and found the pooled estimates with pack analysis studies (29 countries) as 14.0% (95%CI: 10.0-18.6; 95%PI: 0.0-50.0), with gap analysis (eight countries) as 21.1% (95%CI: 11.0-32.8; 95%PI: 0.0-60.0) and with trade monitoring method (two countries) as 9.6% (95%CI: 0.0-49.6; PI could not be estimated for the insufficient number of studies).

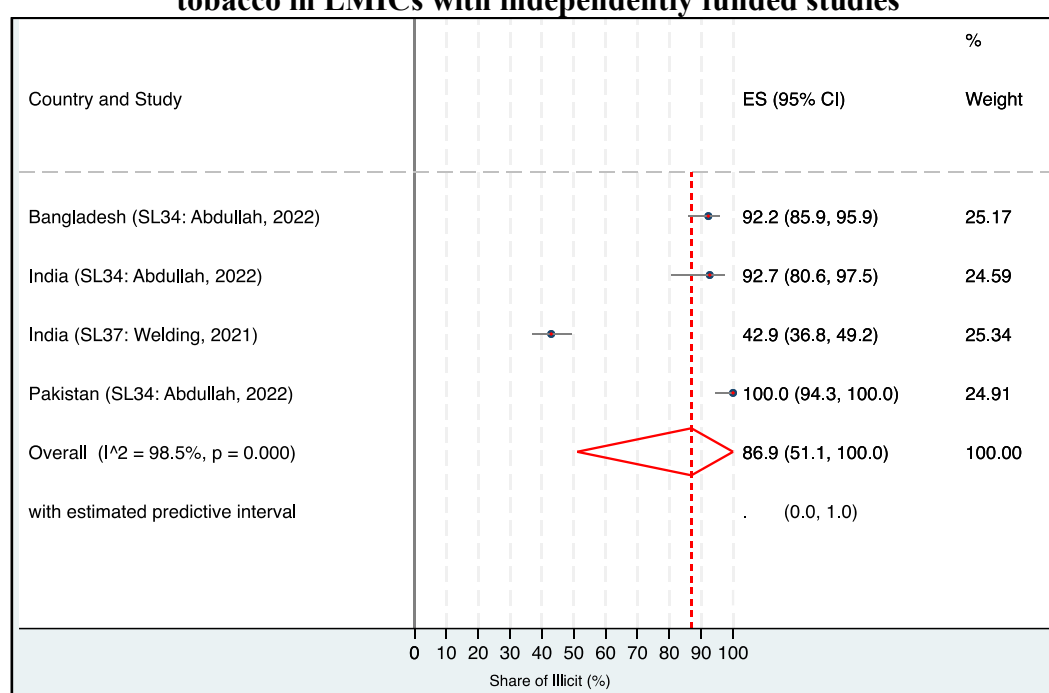
Figure 9: Random effects model showing the proportion of illicit smoking tobacco in LMICs with independently funded studies



For sensitivity, we conducted the meta-analysis for smokeless tobacco (Figure 10) and undisclosed or industry-funded studies (Appendix 1: Chapter 6-Supplementary Figures: Figure S2, pp 205) separately. The pooled estimate of the share of illicit smokeless tobacco was 86.9% (95%CI: 51.1-100.0; 95%PI: 0.0-100.0). We estimated the pooled estimate for smoking tobacco in undisclosed or industry-funded studies as 13.9%

(95%CI: 9.0-19.5; 95%PI: 0.0-40.0). It was 15.6% (95%CI: 9.1-23.4; 95%PI: 0.0-60.0) with the studies applying pack analysis and 14.7% (95%CI: 4.8-27.8; 95%PI: 0.0-70.0) with those applying gap analysis (Appendix 1: Chapter 6-Supplementary Figures: Figure S2, pp 205). The insignificance of small study effects in the meta-analysis was confirmed by Egger test [Independently funded studies: $z=1.45$ ($p=0.146$); Undisclosed or Industry-funded studies: $z=1.16$ ($p=0.245$)] and Begg's test [Independently funded studies: $z=1.41$ ($p=0.159$); Undisclosed or Industry-funded studies: $z=0.45$ ($p=0.651$)]. Funnel plots confirming these are given in (Appendix 1: Chapter 6-Supplementary Figures: Figure S3, pp 206).

Figure 10: Random effects model showing the proportion of illicit smokeless tobacco in LMICs with independently funded studies



6.3.4 Risk of bias and quality of estimates

After assessing the estimates of illicit tobacco for the risk of bias, the average score was 18.2, with a maximum of 30.25 and a minimum of 8.0 (Appendix 1: Chapter 6-Supplementary Tables: Table S6 and S7 pp 194-204). Estimate of the share of illicit tobacco in 29 studies (60.0%; average score 17.74) had moderate, 11 studies (23.0%; average score 25.1) had low, (Tobacconomics, 2023; van der Zee et al., 2020; van der Zee, van Walbeek and Magadla, 2020; Szklo and Drope, 2023; Pizarro et al., 2022; Ahsan et al., 2014; Nguyen and Nguyen, 2020; Iglesias et al., 2017; Guindon et al., 2014; Chisha, Janneh and Ross, 2020; Saenz de Miera Juarez et al., 2021) and eight studies (17.0%;

average score 10.2) had serious risk of bias (Appendix 1: Chapter 6-Supplementary Figures: Figure S4, pp 206).(Morais, Colombage and Wickramasinghe, 2018; FTI Consulting, 2019; International Tax and Investment Centre and Oxford Economics, 2016; Oxford Economics, 2020; Pavananunt, 2011; Machado et al., 2021; John and Ross, 2018; Heydari et al., 2016) Of these eight studies, six were either industry-funded or had undisclosed funding (average score 10.04). (Morais, Colombage and Wickramasinghe, 2018; FTI Consulting, 2019; International Tax and Investment Centre and Oxford Economics, 2016; Oxford Economics, 2020; Pavananunt, 2011; Machado et al., 2021; John and Ross, 2018; Heydari et al., 2016)

All 11 studies with low risk of bias applied pack analysis. Seventeen studies used this method with a moderate risk of bias, while five studies exhibited a high risk. Among 13 studies with gap analysis, 11 had a moderate risk of bias. Among the two studies that applied trade monitoring, one had moderate, and the other had serious risk of bias in their quality of estimate of illicit tobacco. Risks mainly pertained to the domains, replicability and theory relevance, generalisation and criteria selection, definition and identification of illicit, and results and cross-validation of illicit (Figure 11).

Figure 11: Risk of bias assessments for individual studies

	Risk of bias domains							
	D1	D2	D3	D4	D5	D6	D7	ver
SL1: Vladislavjevic, 2022	+	+	-	+	+	+	+	+
SL2: van der Zee, 2020a	+	+	-	-	+	+	+	+
SL3: van der Zee, 2020b	+	+	-	+	+	+	+	+
SL4: Szklo, 2022	+	+	-	-	+	+	+	+
SL5: Szklo, 2023	+	+	-	-	+	+	+	+
SL6: Szklo, 2018	+	+	+	-	+	+	+	+
SL7: Singh, 2023	+	+	+	-	+	+	+	+
SL8: Shakya, 2023	+	+	+	-	+	+	+	+
SL9: Ross, 2023	+	+	-	-	+	+	+	+
SL10: Pizzaro, 2022	+	+	+	+	+	+	+	+
SL11: Pavananunt, 2012	+	+	+	+	+	+	+	+
SL12: Nguyen, 2019	+	+	-	+	+	+	+	+
SL13: Nguyen, 2020a	+	+	+	+	+	+	+	+
SL14: Maldonado, 2018	+	+	+	-	-	+	+	+
SL15: Machado, 2021	+	+	+	-	+	+	+	+
SL16: Little, 2023	+	+	+	-	+	+	+	+
SL17: Little, 2020	+	+	+	-	+	+	+	+
SL18: Lavares, 2022	+	+	+	-	+	+	+	+
SL19: Koya, 2022	+	+	-	+	+	+	+	+
SL20: Khan, 2022	+	+	-	-	+	+	+	+
SL21: Kasri, 2021	+	+	-	+	+	+	+	+
SL22: Kaplan, 2018	+	+	+	-	+	+	+	+
SL23: Joossens, 2014	+	+	-	-	+	+	+	+
SL24: John, 2018	+	+	+	+	+	+	+	+
SL25: Iglesias, 2017	+	+	+	+	+	+	+	+
SL26: Heydari, 2016	+	+	+	+	+	+	+	+
SL27: Heydari, 2022	+	+	-	+	+	+	+	+
SL28: Guindon, 2014	+	+	-	+	+	+	+	+
SL29: Goodchild, 2020	+	+	-	+	+	+	+	+
SL30: Dauchy, 2022	+	+	-	+	+	+	+	+
SL31: Chisha, 2020	+	+	+	+	+	+	+	+
SL32: Bui, 2022	+	+	+	-	+	+	+	+
SL33: Ahsan, 2014	+	+	-	+	+	+	+	+
SL34: Abdullah, 2022	+	+	-	-	+	+	+	+
SL35: Kartika, 2019	+	+	-	+	+	+	+	+
SL36: Tobacconomics, 2023	+	+	+	-	-	+	+	+
SL37: Welding, 2021	+	+	-	+	+	+	+	+
SL38: Vellios, 2019	+	+	-	+	+	+	+	+
SL39: de Miera Juarez, 2021	+	+	-	+	+	+	+	+
SL40: Nguyen, 2014	+	+	+	-	-	+	+	+
SL41: Nguyen, 2020b	+	+	-	-	-	+	+	+
SL42: Maldonado, 2020	+	+	+	-	+	+	+	+
SL43: Gallien, 2022	+	+	+	+	+	+	+	+
SL44: Abola, 2014	+	+	+	+	+	+	+	+
SL45: Morais, 2018	+	+	+	+	+	+	+	+
SL46: FTI Consulting, 2019	+	+	+	+	+	+	+	+
SL47: Oxford Economics, 2020	+	+	+	+	+	+	+	+
SL48: International Tax and Investment Center and Oxford Economics, 2016	+	+	+	+	+	+	+	+

Domains: D1: Peer Reviewed; D2: Funding; D3: Replicability & Theory Relevance; D4: Generalizability & Criteria Selection; D5: Definition & identification of Illicit; D6: Results & Cross Validation of Illicit; D7: Limitation Acknowledgement.

Judgement:
 Serious
 Moderate
 Low

6.4 Discussion

We found that the extent of the estimates of the share of illicit tobacco for 39 LMICs from 48 studies differed greatly between countries. Furthermore, it differed by estimation method, tobacco type, and funding source. The pooled estimate of the share of illicit smoking tobacco was 14.4% (95%CI: 10.5-18.9) while that for smokeless tobacco was

86.9% (95%CI: 51.1-100.0). The estimate with the pack analysis method was lower (14.0%; 95%CI: 10.0-18.6) than the gap analysis (21.1%; 95%CI: 11.0-32.8). While most of the independently funded studies applied pack analysis (designed as either a cross-sectional survey of smokers/retailers or observational studies), the undisclosed or industry-funded studies applied gap analysis. These studies estimated a relatively larger share of illicit with pack analysis method than the independently funded studies (15.6% vs. 14.0%).

The share of illicit tobacco varied from less than 1% to over 60% between LMICs. We found an extremely high share of illicit tobacco in some LMICs: using pack analysis 62.6% in Montenegro, 47.1% in Brazil, 36.4% in South Africa, 35.3% in Bosnia and Herzegovina and 32.2% in Georgia; using gap analysis 65% in Malaysia, 44.6% in Vietnam, 25.9% in Sierra Leone, 19.3% in Indonesia, and 16.1% in Philippines. Earlier Joossens and colleagues also found high share of illicit tobacco in most of these LMICs.(Joossens et al., 2010) Although their results are not directly comparable due to differences in methodologies adopted, our pooled estimate (14.4%) is close to the previous pooled LMIC estimates by Goodchild and colleagues (12.3%) and Joossens and colleagues (12.1%).(Joossens et al., 2010; Goodchild et al., 2022) Goodchild and colleagues estimated the pooled share for HICs as 10.4%.(Goodchild et al., 2022) Estimated higher share of illicit tobacco in LMICs reinstated the possible unequal burden of tobacco-related diseases and revenue loss for them compared to HICs. The tax administration capacity and governance level are important determinants of illicit tobacco.(Paraje, Stoklosa and Blecher, 2022; Huque et al., 2024b) Weaker tobacco control law enforcement and tax administration and lower governance levels could be the reasons for underlying differences in the share of illicit tobacco in LMICs and HICs.(Ulep, Lavares and Francisco, 2021) LMICs encounter multiple challenges in implementing tobacco control interventions.(Sreeramareddy, 2024) These include informal tobacco markets, where retailing is unregulated and tobacco control enforcement is poorly coordinated.(Gallien, Occhiali and Ross, 2023) Additionally, weak tax policies and a lack of digital tracking systems adds to the challenges. Significant interference from the tobacco industry in policymaking is compounded by a lack of awareness and political will to tackle the illicit tobacco issue.(Gilmore et al., 2015; Sreeramareddy, 2024) Some of the HICs where illicit tobacco is more effectively regulated, include Australia, Austria, Finland, France, Greece, Hungary, Italy, and New Zealand.(ATO; Ajmal and Veng, 2015; Joossens et al., 2014) They employ an advanced tracking and tracing system, strictly

enforce border control, and impose heavy penalties for illicit trade. LMICs experiencing significant illicit tobacco may adopt strategies from HICs, contextualising them appropriately to decrease the prevalence.

We found that the illicit tobacco research evidence is skewed towards smoking tobacco and focused mainly on cigarettes. However, the illicit trade of novel tobacco such as e-cigarettes is an emerging problem.(Paraje, Stoklosa and Blecher, 2022) Although the use of smokeless tobacco is reported in 127 countries around the world,(Siddiqi et al., 2022a) only two of the included studies covering Bangladesh, India, and Pakistan reported the share of illicit for smokeless tobacco. The pooled estimate of the share of illicit smokeless tobacco was more than six times than that of smoking tobacco. India, Pakistan, and Bangladesh accounted respectively for 70%, 7%, and 5% of DALYs (Disability Adjusted Life Years) lost in the overall smokeless tobacco disease burden in South and Southeast Asia.(Siddiqi et al., 2020a) Such high prevalence of illicit smokeless tobacco has adverse implications for the disease burden of these countries.

The ITP was targeted improving coordinated national efforts to curb the illicit tobacco trade problem. Among the 87 current signatories of ITP, 43 fall within the category of LMIC. Of these, we found that only 11 countries (Brazil, China, Colombia, Ghana, India, Mongolia, Montenegro, Pakistan, Serbia, and South Africa) have independently funded evidence on the share of illicit tobacco since the inception of ITP. Thus, the majority of LMIC signatories lack evidence for the estimated share of illicit tobacco. More LMICs should sign and ratify the ITP. Research indicates that implementing track and trace systems and the Global Information-Sharing Focal Point (GSP) is vital for securing the tobacco supply chain.(Paraje, Stoklosa and Blecher, 2022; Gilmore, Gallagher and Rowell, 2019; Solutions SB, 2019) Besides these global tools, establishing an effective system to control illicit tobacco would require international collaboration among LMICs.

Tax stamp examination is the direct measure of tobacco tax evasion and illicit tobacco.(Kurti et al., 2017) Nevertheless, given the unavailability of proper track and trace or fiscal marking (e.g. tax stamp), studies mostly relied on indirect measures (e.g. compliance of packaging features or comparing the purchase price with either estimated or legislated threshold price of tobacco). Of the included 27 independently funded smoking tobacco studies, only 14 scrutinised the tax stamp, and 16 applied tax and/or price information of tobacco along with the pack features as the criteria for detecting illicit

and hence tax evaded tobacco. Thus, although in many LMICs an attempt to estimate the share of illicit tobacco is present, robust estimation of this share is lacking. Representative survey data on tobacco-related information and disaggregated bilateral tobacco trade information are lacking for many LMICs. This inherent data challenge resulted in lower number of illicit tobacco studies with gap analysis and trade monitoring method.

The study has several strengths. Our detailed and exhaustive search strategy found 23 independently funded new illicit tobacco studies in 25 LMICs since 2018. Estimation of illicit cigarette consumption in LMICs by Goodchild and colleagues used evidence from 16 LMICs from 2010 to 2018.(Goodchild et al., 2022) However, they did not include six independently funded studies(Guindon et al., 2014; Iglesias et al., 2017; John and Ross, 2018; Nguyen et al., 2014; Abola et al., 2014; Pavananunt, 2011) published within the period from ten LMICs (Bangladesh, China, Malaysia, Mauritius, Mexico, Thailand, Brazil, India, Vietnam, and Philippines). Unlike the earlier research, we stratified the analysis depending on the type of tobacco and method of estimation for illicit. Additionally, we analysed the undisclosed or industry-funded studies separately whose estimates might be interest-driven and often overestimate the share of illicit tobacco to impede tobacco tax increases.

The application of English as a language restriction is a limitation, nevertheless, we found a good number of studies with a geographical variation. Evidence with a low risk of bias was scarce. However, we did not use the quality ranking of the studies as an exclusion criterion and the findings were free from small study bias. Significant variations in the share of illicit tobacco across studies resulted in higher heterogeneity in the meta-analysis. Additionally, differing definitions of illicit tobacco and various estimation methods may impact the true extent of illicit tobacco. Therefore, the comparability of the included studies and the generalizability of the pooled estimate are limited. Although a subgroup analysis with PI using a random effects model was performed, the results should be interpreted with caution.

6.5 Conclusion

In conclusion, we provided the latest estimates of the share of illicit smoking tobacco in LMICs (14.4%) and highlighted the lack of such estimates in many LMICs. We found only a couple of estimates for smokeless tobacco which were high. Besides illicit cigarette trade, future research needs to consider novel tobacco products and smokeless tobacco.

Results show that the studies rely mostly on context-specific packaging compliance to categorise tobacco product as illicit. Evidence of scrutinising the tax stamp is limited and thus the assessment for true illicit share might not be robust. Regardless of the type of tobacco LMICs require robust administration of tobacco taxes and implementation of the provisions of ITP (e.g. track and trace system and tax stamp) to combat illicit trade.

Chapter 7: Study II: Magnitude and Structure of Illicit Cigarettes Sold as Retail in Bangladesh: A Pack Analysis Approach

Chapter 7 contains the research paper titled “Magnitude, structure and associated factors of illicit cigarette sales in Bangladesh: A pack analysis,” published in the Tobacco Control journal as original research. In addition to the structured abstract, contribution, and implications, it includes five sections. Section 7.1 presents the introduction, rationale and aim of the study. Section 7.2 outlines the methods, detailing the data, measurements, and statistical analysis. The results are found in Section 7.3 detailing the findings from the descriptive approach and the analytical approach. Finally, section 7.4 contains the discussion for the findings and section 7.5 concludes. The citation details of the article are given below,

Abdullah, S.M., Huque, R., Shashi, N.A., Hassan, M.T., Kanaan, M. and Siddiqi, K., (2025). Magnitude, structure and associated factors of illicit cigarette sales in Bangladesh: a pack analysis. *Tobacco Control*. Published Online First: 30 May 2025. Available at: doi: 10.1136/tc-2024-059131

[Note: Table and figure numbers and their in-text referencing are continuous in this chapter and hence differ from the published article to maintain the overall flow of the thesis.]

Magnitude, structure and associated factors of illicit cigarette sales in Bangladesh: A pack analysis

Abstract

Introduction

Bangladesh's cigarette smoking prevalence remained unchanged (around 14%) between 2009 and 2017. Through tax evasion and regulatory non-compliance, illicit trade might have contributed to the status quo. Little is known about the magnitude of illicit cigarettes in Bangladesh.

Methods

We analysed empty cigarette packs collected from retailers and street litter in eight districts in Bangladesh between December 2019 and January 2020. We examined tax stamps on packs to assess tax evasion and printed health warnings, retail prices, sales declarations, misleading descriptors, and duty-free signs to determine packaging law compliance. All but tax-paid and compliant packs were considered illicit. We examined associations between tax evasion and price or non-price factors. Sensitivity and specificity of packaging compliance were measured if used as a proxy for tax evasion.

Results

Among 24,363 packs (23,207 from shops and 1,156 from litter) examined from the sampled districts in Bangladesh, 5.32% (95%CI: 5.04-5.60) evaded taxes, while only 0.77% (95%CI: 0.4-1.4) were non-compliant with packaging laws, totalling 5.62% (95%CI: 4.3-7.1) illicit share. This neither differed statistically significantly between packs collected from shops (5.47%; 95%CI: 4.2-7.0) and those from litter (8.13%; 95%CI: 5.7-11.1) nor between urban (5.15%; 95%CI: 3.5-7.3) and rural (6.16%; 95%CI: 4.2-8.7) areas. Low-price cigarettes (OR: 3.48; 95%CI: 2.10-5.75) and those sold in unconventional shops (i.e, retail outlets not primarily dedicated to cigarette sales) (OR: 1.99; 95%CI: 1.12-3.54), were more likely to be tax evaded than high-price cigarettes and those sold in formal shops, respectively. Packaging non-compliance was not a sensitive marker for detecting tax-evaded cigarettes.

Conclusion

Bangladesh has a low share of illicit cigarette packs. While surveillance of the illicit cigarette trade is essential, the government should continue to enhance cigarette taxes without concern for its effect on the illicit trade.

What is already known on this topic

- Illicit cigarette and tax evasion research is limited in Bangladesh. Research in other LMICs often used packaging compliance as an indirect measure of tax evasion. Specific factors contributing to tax evasion in Bangladesh remain unexplored. The specificity and sensitivity of packaging compliance in detecting cigarette tax evasion require exploration.

What this study adds

- Using the largest dataset of cigarette packs and objectively applying selected illicit criteria, we provided an updated estimate of illicit cigarette packs in Bangladesh.
- Tax evasion was more likely in the low-price segment and unconventional shops, emphasising the necessity of obligatory licensing of retailers and focused market monitoring.
- Assessment of the preciseness of packaging compliance in detecting evasion underscored the importance of explicit tax markers on packs.

How this study might affect research, practice or policy

- Cigarette packs in Bangladesh are mostly compliant with packaging and labelling requirements. The government can further increase cigarette tax without concern for its effect on illicit cigarettes.
- Within the legal enforcement mechanism, enhanced regulatory oversight of informal cigarette retailers and cigarettes in the low-price segment would be critical for keeping the share of illicit cigarettes low.

7.1 Introduction

Bangladesh is the eighth largest tobacco-consuming country globally.(Hussain et al., 2020) While tobacco consumption consists of both smoking and smokeless forms, cigarettes have remained the most popular form of smoking in Bangladesh; the cigarette smoking consumption remained constant around 14% between 2009 and 2017.(Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) Of the 15 million cigarette-smoking adult population, around 98% are men (male prevalence 28.7%).(Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) Accordingly, among men in Bangladesh, 25% of all deaths aged 25-69 years are attributable to smoking.(Alam et al., 2013) Furthermore, 61,000 children suffered from diseases attributable to passive smoking in 2018 in the country.(Nargis et al., 2022) Alarmingly, a nationwide survey found that over 40% of students aged 13-15 years are around second-hand smoke in public places.(Global Youth Tobacco Survey, 2013) In some areas, 95% of primary school children were positive for recent second-hand smoking exposure.(Shah et al., 2019) Controlling the prevalence of smoking and hence the exposure to passive smoking is crucial for curbing the death and disability toll.

Since ratifying the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC) in 2004, Bangladesh has implemented fiscal and regulatory measures to curb cigarette use.(WHO, 2003) However, research in other settings shows that the illicit sale of cigarettes, often through tax evasion and non-compliance with packaging laws, impedes tobacco control efforts,(Ulep, Lavares and Francisco, 2021; Joossens and Raw, 1998; Joossens et al., 2009; Ross et al., 2016; WHO, 2012b) which might have also been the case in Bangladesh. Understanding the magnitude and structure of the illicit cigarette trade is critical to designing more effective policies and preventive interventions. In Bangladesh, legitimate cigarette packs should display health warning labels (pictorial and textual), retail prices, and sales declarations (printing “sales only allowed in Bangladesh”), avoid misleading descriptors and duty-free signs, and carry an official tax stamp indicating tax payment.(Tobacco Control Law, 2013; Smoking and Tobacco Products Usage (Control) Rule, 2015) Tax evasion of cigarettes can be related to price and non-price factors.(Pizarro et al., 2022; Vladisavljevic et al., 2022; Barker et al., 2016; Singh et al., 2023; van der Zee et al., 2020; Maldonado et al., 2020; Merriman, 2010) Evidence from other countries shows that cigarette tax evasion varies across administrative regions,(Barker et al., 2016; Singh et al., 2023; van der Zee et al., 2020) urban-rural geographic areas,(Barker et al., 2016) border proximity,(Vladisavljevic et al.,

2022; Singh et al., 2023; Merriman, 2010) and pack sizes.(Pizarro et al., 2022; Singh et al., 2023; Vladisavljevic et al., 2022; van der Zee et al., 2020) Many such studies have used packaging non-compliance as a proxy to estimate cigarette tax compliance.(John and Ross, 2018; Khan et al., 2021; Shakya et al., 2023; Singh et al., 2023) Despite having a significant smoking population, evidence on illicit cigarettes in Bangladesh is limited. Exploiting the year 2010 International Tobacco Control (ITC) Wave II data, Guindon and colleagues found that 3.7% of cigarette packs in Bangladesh evaded taxes.(Guindon et al., 2014) Sadiq and colleagues relied on tobacco industry estimates and reported a 1.8% market share for illicit cigarettes in 2016-17.(Sadiq, Zaidi and Khurshid, 2019) Furthermore, Brown and colleagues estimated a median price disparity of 455% between illicit and licit cigarette packs in Bangladesh.(Brown et al., 2017)

Recent independent estimates of the share of illicit cigarettes are scarce in Bangladesh.(Abdullah et al., 2020) Moreover, previous studies in Bangladesh have not estimated the proportions of cigarette packs with invalid or absent tax stamps (a direct indicator of tax evasion) and those not compliant with the packaging laws, which may or may not have evaded taxes. We aimed to address this gap by estimating the magnitude of illicit cigarette packs sold in retail markets and analysing its composition concerning tax-evasion and packaging non-compliance. We examined the association of price and non-price factors with cigarette tax evasion. Also, we explored the sensitivity and specificity of packs' compliance with packaging laws if used as a proxy for tax evasion. The findings will provide the magnitude and structure of illicit cigarettes in selected districts in Bangladesh and inform policy initiatives to combat the issue.

7.2 Methods

7.2.1 Data and sample

We analysed the cross-sectional survey data obtained from a pack observational study conducted in Bangladesh under the Tobacco Control Capacity Programme (TCCP).(Abdullah et al., 2020; Dobbie et al., 2019) Bangladesh comprises 8 divisions (Barishal, Chittagong, Dhaka, Khulna, Mymensingh, Rangpur, Rajshahi, and Sylhet; highest administrative unit) and 64 districts (second highest administrative unit). Except Dhaka and Barishal, all divisions share international borders with India or Myanmar. The study randomly selected eight districts (Comilla, Chapainawabganj, Dhaka, Maulavibazar, Mymensingh, Patuakhali, Satkhira, and Thakurgaon) for cigarette pack

collection. Together, they account for 22% of the total population and 15.12% of the country's total area.(Bangladesh Bureau of Statistics, 2023). Table S8 (Appendix 2: Chapter 7-Supplementary Tables, pp 209) compares the socio-demographics of these districts with the national average, revealing marginal differences. Districts were categorised as either 'border' or 'non-border' based on their proximity to international land border. Border districts were defined as those that share a land border with India or Myanmar, while non-border districts were selected from divisions where no district has international land border. Within these districts, 80 postcodes were randomly selected as Primary Sampling Units (PSUs), evenly divided across eight districts with equal urban-rural stratification. The study protocol detailing the sampling design has been published elsewhere.(Abdullah et al., 2020)

Cigarette packs were collected in December 2019 and January 2020 from two sources: retail shops (1,339 retailers) and street litter (Appendix 2: Chapter 7-Supplementary Tables: Table S9, pp 209). In Bangladesh, cigarettes are commonly sold as single sticks rather than full packs, leading to fewer discarded packs among consumers and necessitates collecting empty packs from retailers. In practice, for each PSU the enumerators selected a centre point or landmark (e.g. a bus station, a government building, or a marketplace). Within half kilometre distance from the centre point, all cigarette retailing shops (e.g. ordinary/departmental stores, groceries, tea stalls, only tobacco shop, cart, and others) on both sides of the streets were requested to hand over the empty cigarette packs generated from one business day of retailing. Table S10 (Appendix 2: Chapter 7-Supplementary Tables, pp 209) categorises the packs among retail shop types. Littered packs were collected from the streets around the cigarette retailing shops and from other streets with public gatherings.(Abdullah et al., 2020)

7.2.2 Measures

7.2.2.1 Packaging and tax compliance of cigarette packs and operational definition of illicit

Table S11 (Appendix 2: Chapter 7-Supplementary Tables, pp 210-211) summarises cigarette packs' tax and packaging compliance based on Bangladesh's tobacco control laws. We considered a pack non-compliant if it lacked or had non-compliant pictorial or textual health warnings, retail price (MRP), or sales statements or if it displayed misleading descriptors or duty-free signs. While it makes cigarette packs illegal,

packaging non-compliance does not automatically indicate tax evasion status (TES). As research considered the absence of tax stamps as a good indicator for TES, (Ross, 2015) we considered the packs with no or invalid tax stamps to have evaded tax. Each tax stamp was examined under ultraviolet light (UV) to verify the presence of the official watermark or luminescent security features. Tax stamps were invalid if they lacked the legitimate watermark or luminescent content that glows under UV light. We conceptualised the illicit phenomena by merging two aspects: tax evasion (paid vs. evaded) and packaging compliance (compliant vs. non-compliant). Legal cigarette packs were identified by valid tax stamps and compliant packaging. If either of these two were absent, the pack was considered illicit. Packs containing a tax stamp only could be counterfeit, and those with compliant packaging but no tax stamp could be tax evaded.

7.2.2.2 Outcome and exposures

In the descriptive analysis, we considered the illicit status of cigarette packs (illicit vs. licit) as the outcome, whereas TES (paid vs. evaded) served as the outcome in the analytical approach. Bangladesh has a segmented cigarette price structure. (Ahmed et al., 2019) Based on MRP in Bangladeshi Taka (BDT), cigarette packs were categorised into four segments [Fiscal Year 2019-20: premium (MRP>123 BDT), medium (MRP>93 BDT), high (MRP>63 BDT), and low (MRP>37 BDT)]. Three different taxes are levied on cigarettes: Value Added Tax (VAT), Supplementary Duty (SD), and Health Development Surcharge (HDS). Regardless of the price segment, VAT and HDS are imposed equally at rates of 15% and 1%, respectively. In 2019-20, for cigarettes in the low-price segment, the SD rate was 55%, while the other segments had an SD rate of 65%. Thus, the total tax share in price (or tax incidence defined as the sum of VAT, SD, and HDS) for low price segments was 71%, whereas for the other segments it was 81%. (Campaign for Tobacco-Free Kids, The Union, Vital Strategies, WHO and Tobacconomics., 2021) We considered price segments and tax share in price as price-related exposures. Along with districts, location (urban and rural) and proximity to Myanmar or Indian border (border and non-border areas), we used several other non-price exposures such as pack size (20 sticks pack and others), shop type (Ordinary/Departmental store, Grocery, Tea Stall, Only Tobacco Shop, Cart, and Others), pack source (retail shops and littered), and packaging compliance (compliant and non-compliant). Table S12 (Appendix 2: Chapter 7-Supplementary Tables, pp 211) details variable definitions and their roles.

7.2.3 Statistical Analysis

7.2.3.1 Descriptive approach: Sample description and structure of illicit cigarette packs

The descriptive analysis provided the proportional distribution of packs with their tax and packaging compliance. Accordingly, the distribution of the structure of illicit is generated. Stratifying the analysis by pack source, we described the sample and presented the overall proportion of illicit cigarette packs over price and non-price exposures. We also estimated and presented the overall proportion of illicit cigarettes by administrative district. We used robust standard errors and presented the estimates of proportions with a 95% confidence interval (CI). Differences between groups were considered statistically significant when the 95% CI of the estimated proportions did not overlap.

7.2.3.2 Analytical approach: Tax evasion of cigarette packs and the associated factors

We estimated five logistic regressions to analyse binary outcome (TES) and examine how different exposures affect adjusted odds ratios (AOR). Statistical specification of the multiple logistic regression is provided in Appendix 2 (Chapter 7-Supplementary File, pp 206-208). Model 1 included only the geographical variables (districts, location, and border proximity) as exposures. Model 2 augmented Model 1 with price and pack-related variables (price segment, pack size, and pack source). In Model 3, pack compliance was added as an additional exposure to Model 2. Replacing price segment with tax share in the price of the cigarette pack in Models 4 and 5, we re-estimated the parameters. In all models, we grouped districts a priori based on the regional concentration of illicit cigarette production and high tobacco prevalence to enhance model interpretability and reduce complexity while capturing overarching patterns. Statistical analysis was performed using STATA V18.0.(StataCorp, 2023) AOR estimates were presented with 95% CI. Clustered robust standard errors with PSUs as clusters were employed to address clustering effects. The Hosmer–Lemeshow test was employed to assess goodness of fit, while Wald test evaluated overall significance.(Hosmer and Lemeshow, 1980) Diagnostic ability of the models was assessed using the area under Receiver Operating Characteristic (ROC) curve. Bayesian Information Criterion (BIC) was reported for model selection. We conducted a subgroup analysis restricting the sample to packs collected from retail shops. All five models were re-estimated for this restricted sample while controlling for shop type to assess whether certain retail outlets were more likely to sell tax-evaded cigarettes.

We also estimated the specificity and sensitivity of pack compliance in detecting TES. Table S13 (Appendix 2: Chapter 7-Supplementary Tables, pp 212) contains the (2x2) contingency structure for the analysis. Sensitivity (true tax evasion rate) was defined as the probability of detecting a tax-evaded cigarette pack when the pack was indeed evaded. Specificity (true tax-paid rate) was measured as the probability of detecting tax-paid pack when the pack was certainly tax-paid.

7.3 Results

7.3.1 Descriptive approach

7.3.1.1 Pack collection summary and sample description

We analysed 24,363 empty cigarette packs; 23,207 packs from shops, and 1,156 from street litter (Appendix 2: Chapter 7-Supplementary Tables: Table S9 pp 209). The low number of packs from the littered source is due to the high prevalence of loose or single sticks selling (about 81%) in Bangladesh. (Huque et al., 2023) Administrative districts and source-wise pack distribution are provided in Figure S5 (Appendix 2: Chapter 7-Supplementary Figures, pp 215). Regardless of the collection source, the highest and lowest number of packs were collected from Patuakhali (3,658; 15.01%) and Mymensingh (2,326; 9.55%), respectively. Table 7 shows packs distributed across their features. Almost all the cigarette packs (99.67%; 95%CI: 99.4-99.8) originated from Bangladesh, with 71.0% falling under low and medium price segments. Nearly all had legitimate pictorial and textual health warnings. Around 99.36% (95%CI: 98.7-99.7) of the packs featured sale statements printed without misleading descriptors. For the tax marker, around 99.55% (95%CI: 99.3-99.7) of the cigarette packs had affixed tax stamps. We found that 4.89% (95%CI: 3.7-6.3) of the packs had invalid tax stamps. Those collected from shops had 4.80% (95%CI: 3.6-6.2) and those from litter had 6.81% (95%CI: 4.7-9.4) packs with invalid tax stamps.

Table 7: Proportional distribution of cigarette packs over their packaging features and collection source

Pack Features	Pack Collection Source		Total (N = 24,363) n (%) [95%CI]
	Retail Shop (N = 23,207) n (%) [95%CI]	Littered (N = 1,156) n (%) [95%CI]	
Pack Size (Sticks)			
5	9 (0.04) [0.0-0.2]	-	9 (0.04) [0.0-0.2]
10	7,950 (34.26) [26.3 - 42.9]	418 (36.16) [27.1 - 46.0]	8,368 (34.35) [26.5 - 42.9]
12	535 (2.31) [1.6 - 3.3]	21 (1.82) [0.9 - 3.3]	556 (2.28) [1.5 - 3.2]
16	19 (0.08) [0.0 - 0.2]	1 (0.09) [0.0 - 0.5]	20 (0.08) [0.0 - 0.2]
20	14,694 (63.32) [54.4 - 71.6]	716 (61.94) [52.2 - 71.0]	15410 (63.25) [54.4 - 71.5]
Retail Price (MRP) Printed on Pack (Yes)	23,138 (99.70) [99.4 - 99.9]	1,152 (99.65) [98.9 - 99.9]	24,290 (99.70) [99.4 - 99.9]
Retail Price (MRP) Segment			
Premium (MRP 123 BDT or Higher)	5,972 (25.82) [23.1 - 28.7]	268 (23.26) [19.1 - 27.8]	6,240 (25.70) [23.0 - 28.5]
High (MRP 93 BDT or Higher)	740 (3.20) [2.6 - 3.9]	61 (5.30) [3.7 - 7.3]	801 (3.30) [2.7 - 4.0]
Medium (MRP 63 BDT or Higher)	2,202 (9.52) [7.8 - 11.5]	125 (10.85) [8.0 - 14.2]	2,327 (9.58) [7.9 - 11.5]
Low (MRP 37 BDT or Higher)	14,217 (61.46) [58.6 - 64.3]	698 (60.59) [55.6 - 65.5]	14,915 (61.42) [58.5 - 64.2]
Name and Address of Manufacturer (Yes)	8,735 (37.64) [34.6 - 40.8]	434 (37.54) [33.0 - 42.3]	9,169 (37.76) [34.6 - 40.7]
Country of Origin			
Bangladesh	23,131 (99.67) [99.4 - 99.9]	1152 (99.65) [98.9 - 99.9]	24,283 (99.67) [99.4 - 99.8]
Others	76 (0.33) [0.1 - 0.6]	4 (0.35) [0.1 - 1.1]	80 (0.33) [0.2 - 0.6]
Pictorial Health Warning (PHW)			
PHW Status (Any Size) (Yes)	23,138 (99.70) [99.4 - 99.9]	1,152 (99.65) [98.9 - 99.9]	24,290 (99.70) [99.4 - 99.9]
PHW Covers 50% of the PDA (Yes)	23,131 (99.67) [99.4 - 99.9]	1,152 (99.65) [98.9 - 99.9]	24,283 (99.67) [99.4 - 99.8]
Colourful PHW (Yes)	23,137 (99.69) [99.4 - 99.9]	1,152 (99.65) [98.9 - 99.9]	24,289 (99.70) [99.4 - 99.9]
Proper Quality of PHW (Yes)	23,105 (99.56) [99.2 - 99.8]	1,147 (99.22) [98.4 - 99.7]	24,252 (99.54) [99.2 - 99.8]
PHW Appears Both Side of the Pack (Yes)	23,138 (99.70) [99.4 - 99.9]	1,152 (99.65) [98.9 - 99.9]	24,290 (99.70) [99.4 - 99.9]
PHW Getting Covered Tax Stamp (No)	23,206 (99.99) [99.9 - 100.0]	1,156 (100.0) [100.0 - 100.0]	24,362 (99.99) [99.0 - 100.0]
PHW Recommended by NTCC (Yes)	23,131 (99.67) [99.4 - 99.9]	1,152 (99.65) [98.9 - 99.9]	24,283 (99.67) [99.4 - 99.8]
Textual Health Warning (THW)			
THW Status (Yes)	23,198 (99.96) [99.9 - 100.0]	1,155 (99.91) [99.5 - 100.0]	24,353 (99.96) [99.9 - 100.0]
THW written in Bengali (Yes)	23,130 (99.67) [99.4 - 99.9]	1,152 (99.65) [98.9 - 99.9]	24,282 (99.67) [99.5 - 99.9]
THW Printed in White on Black Background (Yes)	23,138 (99.70) [99.4 - 99.9]	1,152 (99.65) [98.9 - 99.9]	24,290 (99.70) [99.4 - 99.9]
PHW to THW Ratio 6:1 (Yes)	23,131 (99.67) [99.4 - 99.9]	1,152 (99.65) [98.9 - 99.9]	24,283 (99.67) [99.4 - 99.8]
Sale Statement Printed & No Misleading Descriptors (Yes)	23,056 (99.35) [98.7 - 99.7]	1,150 (99.48) [98.8 - 99.8]	24,206 (99.36) [98.7 - 99.7]
Contains Duty Free Sign (Yes)	3 (0.01) [0.0 - 0.1]	-	3 (0.1) [0.0 - 0.1]
Tax Stamps			
Affixed Tax Stamp (Yes)	23,107 (99.57) [99.3 - 99.8]	1,146 (99.13) [98.1 - 99.7]	24,253 (99.55) [99.3 - 99.7]
Authenticity of Tax Stamps			
Valid	20,562 (88.99) [86.9 - 90.9]	925 (80.72) [76.9 - 84.2]	21,487 (88.60) [86.5 - 90.5]
Invalid	1,108 (4.80) [3.6 - 6.2]	78 (6.81) [4.7 - 9.4]	1,186 (4.89) [3.7 - 6.3]
Removed	1,437 (6.22) [4.6 - 8.1]	143 (12.48) [9.3 - 16.2]	1,580 (6.51) [4.9 - 8.4]

Note: The proportions under MRP segment used 23,131 for shops and 1,152 for littered (packs originated in Bangladesh) as the denominator. Because the price segment for the packs originated in other countries is not disclosed explicitly in the packs. Proportions under “Authenticity of Tax Stamps” used 23,107 for shops and 1,146 for littered (number of packs that affixed tax stamps) as the denominator. Tax stamps were considered “invalid” if they didn’t contain the legitimate watermark or luminescent content that glows under ultraviolet (UV) light. Tax stamps were labelled “removed” if the tax stamp were removed or destroyed while retailers or consumers opened the pack. Robust standard errors were applied (with post code as the clusters) and exact confidence interval was used.

7.3.1.2 Tax evasion, packaging non-compliance and illicit cigarette packs

The overall share of tax-evaded cigarette packs was 5.32% (95%CI: 5.04-5.60), while that of non-compliant packs was 0.77% (95%CI: 0.4-1.4). Table S14 (Appendix 2: Chapter 7-Supplementary Tables, pp 212) contains the distribution of non-compliant packs over categories stratified by pack sources. There were 7.60% (95%CI: 5.2-10.7)

tax-evaded packs in the litter, compared to 5.20% (95%CI: 4.0-6.7) in the shops. Nevertheless, the difference between these proportions was not statistically significant. There was also insufficient evidence that the share of non-compliant packs in shops (0.80%; 95%CI: 0.1-1.4) and litter (1.00%; 95%CI: 0.4-1.8) differed. Table 8 shows the share of illicit cigarette packs and their structural distribution concerning tax evasion and packaging non-compliance.

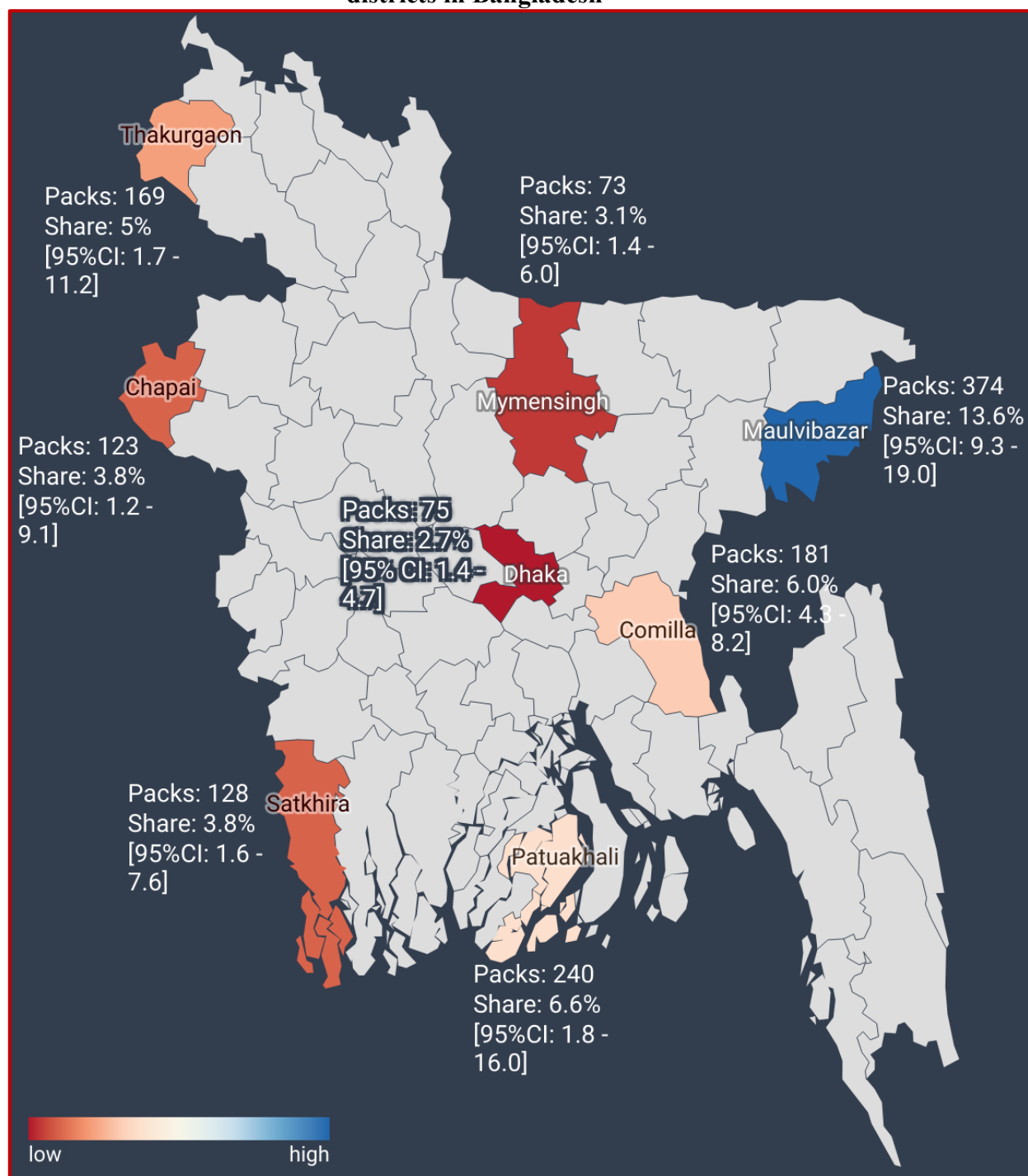
Table 8: Share of illicit cigarette packs and its structural distribution

Pack Category	Pack Source						Total (N = 24,263)		
	Retail Shop (N = 23,207)			Littered (N = 1,156)					
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Compliant & Tax Evaded	1093	4.71	[3.5 - 6.1]	83	7.18	[5.0 - 9.9]	1176	4.85	[3.6 - 6.3]
Non-Compliant & Tax Evaded	115	0.50	[0.3 - 0.8]	5	0.43	[0.1 - 1.2]	120	0.49	[0.3 - 0.8]
Non-Compliant & Tax Paid	61	0.26	[0.0 - 0.8]	6	0.52	[0.2 - 1.2]	67	0.28	[0.1 - 0.8]
Total share of Illicit	1269	5.47	[4.2 - 7.0]	94	8.13	[5.7 - 11.1]	1363	5.62	[4.3 - 7.1]

We estimated the combined share of illicit cigarette packs as 5.62% (95%CI: 4.3-7.1). The proportion of illicit did not differ statistically significantly by pack source (shops: 5.47%; 95%CI: 4.2-7.0; litter: 8.13%; 95%CI: 5.2-11.1). We found the structure of the share of illicit packs consistent regardless of their source.

Regarding districts, Maulvibazar had the highest share of illicit cigarette packs (13.63%; 95%CI: 9.3-19.0), followed by Patuakhali (6.56%; 95%CI: 1.8-16.0) and Comilla (6.05%; 95%CI: 4.3-8.2) (Figure 12). Dhaka had the lowest share of illicit cigarette packs (2.73%; 95%CI: 1.4-4.7). In urban and rural areas, it was 5.15% (95%CI: 3.5-7.3) and 6.16% (95%CI: 4.2-8.7), respectively (Appendix 2: Chapter 7-Supplementary Tables: Table S15, pp 212). Although not significant, districts next to the international border had a higher share (6.79%; 95%CI: 4.5-9.7) than other districts (5.06%; 95%CI: 3.5-7.0). We found in shops, the share of illicit cigarette packs is higher in rural and border areas than in urban and non-border areas (Appendix 2: Chapter 7-Supplementary Tables: Table S15, pp 212). However, the differences were not statistically significant. The share of illicit in the low-price segment was almost three times significantly higher (6.70%; 95%CI: 5.0-8.8) than that in the premium segment (2.36%; 95%CI: 1.5-3.5).

Figure 12: Number of illicit cigarette packs and their share by administrative districts in Bangladesh



Note: Administrative districts with a share of illicit as 5% or less were categorised as “low”, and those with above 5% were categorised as “high”.

7.3.2 Analytical Approach

7.3.2.1 Cigarette tax evasion and associated factors

Table 9 shows the AOR estimation using multivariate tax evasion models. In Model 1, which solely considered administrative and geographical factors, the odds of tax evasion of cigarettes were 2.64 (95%CI: 1.71-4.08) times higher in Maulvibazar, Patuakhali, and Comilla than in the other districts included in the sample. The odds for border and urban areas were 1.82 (95%CI: 0.68-4.88) and 1.13 (95%CI: 0.42-3.05) times higher than non-border and rural areas, respectively. Administrative districts emerged as a statistically significant predictor of tax evasion concerning cigarette packs, while the geographical characteristics (i.e. urban-rural or border-non-border) did not. After adjusting for the price and pack-related factors in Model 2, pack size was statistically insignificant, while pack source emerged as a significant predictor of TES. Tax evasion was 1.52 (95%CI: 1.09-2.13) times more likely in littered cigarette packs than those in shops. Cigarette packs in the low-price segment had 3.35 (95%CI: 2.07-5.43) times higher odds of tax evasion than those in the premium segment. After adjusting for pack compliance in Model 3, odds of tax evasion in Maulvibazar, Patuakhali, and Comilla were estimated to be 2.50 (95%CI: 1.69-3.68) times higher than in Dhaka, Thakurgaon, Nawabganj, Satkhira, and Mymensingh. Low price segment showed 3.48 (95%CI: 2.10-5.75) times higher tax evasion odds than the premium segment, while non-compliant packs had 16.31 (95%CI: 5.09-52.24) times higher odds than compliant packs.

Models 4 and 5 used tax share in price as exposure instead of price segment. In Model 4, cigarette packs with a low tax share in price had 2.40 (95%CI: 1.63-3.56) times higher odds of tax evasion than those with a high tax share. While controlling for pack compliance in Model 5, the odds of tax evasion for cigarette packs with a low tax share in price were 2.43 (95%CI: 1.63-3.63) times higher than those with a high tax share. All five models had overall significance established by the significance of Wald test. Nevertheless, the first three models satisfied the Hosmer-Lemeshow test (high p-value) for goodness of fit implying that the models were complete and specified correctly. In terms of information criterion, Model 3 had the lowest BIC value. Also, it had the highest area under the ROC curve with a value of 0.70. Thus, the specification and the estimation of odds ratios in Model 3 can be considered as the most parsimonious.

To ascertain the association between cigarette tax evasion and type of retail shops, we estimated all models restricting the pack sample with the retail shops and controlling for shop type (Appendix 2: Chapter 7-Supplementary Tables: Table S16, pp 213). The magnitude of the odds did not fluctuate widely. Compared to the departmental stores, the odds of tax-evaded cigarette packs in only tobacco shops and in shops unconventional for cigarette retailing (labelled as “others”) were around 1.50 (95%CI: 0.99-2.27) and 1.99 (95%CI: 1.12-3.54) times higher respectively. Additionally, we estimated the models ignoring packs with removed tax stamps in the sample (Appendix 2: Chapter 7-Supplementary Tables: Table S17, pp 214). The coefficients' magnitude and significance remained stable.

Table 9: Estimation of adjusted odds ratios (AOR) for tax evasion of cigarette packs using multiple logistic regression models

Variables (Dependent: Tax evasion Status)		Model 1				Model 2				Model 3				Model 4				Model - 5			
		AOR	P> Z	95% CI		AOR	P> Z	95% CI		AOR	P> Z	95% CI		AOR	P> Z	95% CI		AOR	P> Z	95% CI	
District (Ref: Dhaka, Thakurgaon, Nawabganj, Satkhira, Mymensingh)	Maulvibazar, Patuakhali and Comilla	2.64***	0.00	1.71	4.08	2.46***	0.00	1.67	3.63	2.50***	0.00	1.69	3.68	2.51***	0.00	1.70	3.69	2.54***	0.00	1.73	3.75
Location (Ref: Rural)	Urban	1.13	0.81	0.42	3.05	1.10	0.85	0.41	2.92	1.06	0.91	0.40	2.82	1.10	0.84	0.41	2.96	1.06	0.91	0.39	2.86
Border (Ref: Non-Border Area)	Border Area	1.82	0.23	0.68	4.88	1.64	0.31	0.63	4.28	1.63	0.32	0.63	4.26	1.69	0.29	0.64	4.44	1.68	0.29	0.64	4.42
Pack Size (Ref: Less than 20 Sticks Pack)	20 Sticks Pack	-	-	-	-	1.16	0.39	0.82	1.65	1.23	0.24	0.87	1.74	1.12	0.54	0.79	1.57	1.17	0.37	0.83	1.65
Price Segment (Ref: Premium)	High	-	-	-	-	2.21**	0.03	1.08	4.53	2.37**	0.02	1.14	4.92	-	-	-	-	-	-	-	-
	Medium	-	-	-	-	2.12***	0.00	1.30	3.46	2.24***	0.00	1.34	3.74	-	-	-	-	-	-	-	-
	Low	-	-	-	-	3.35***	0.00	2.07	5.43	3.48***	0.00	2.10	5.75	-	-	-	-	-	-	-	-
Pack Source (Ref: Shop)	Littered	-	-	-	-	1.52**	0.01	1.09	2.13	1.52**	0.01	1.09	2.13	1.54**	0.01	1.10	2.14	1.53**	0.01	1.10	2.14
Pack Status (Ref: Compliant)	Non-Compliant	-	-	-	-	-	-	-	-	16.31***	0.00	5.09	52.24	-	-	-	-	15.08***	0.00	4.69	48.52
Tax Incidence (Share) (Ref: High Tax (81%))	Low Tax (71%)	-	-	-	-	-	-	-	-	-	-	-	-	2.40***	0.00	1.63	3.56	2.43***	0.00	1.63	3.63
Intercept	Constant	0.03***	0.00	0.01	0.07	0.01***	0.00	0.00	0.02	0.01***	0.00	0.00	0.02	0.01***	0.00	0.01	0.03	0.01***	0.00	0.00	0.03
Number of Observations		24363				24283				24283				24283				24283			
Wald χ^2 (P - Value)		29.02*** (0.000)				77.95*** (0.000)				94.27*** (0.000)				65.40*** (0.000)				83.87*** (0.000)			
Number of Covariate Patterns		6				93				108				48				62			
Hosmer - Lemeshow χ^2 (P - Value)		0.09 (0.769)				0.53 (0.468)				0.88 (0.348)				4.21** (0.040)				5.22** (0.022)			
Area Under ROC Curve		0.64				0.68				0.70				0.67				0.69			
BIC		9843.86				9235.94				9120.266				9251.121				9140.4			

Note: Clustered robust standard errors with PSU as the cluster were used to estimate the odds ratios. Wald χ^2 statistic tests the overall significance of the models and Hosmer – Lemeshow χ^2 tests the goodness of fit for the models. BIC shows the Bayesian Information Criterion for model selection. Numbers for the area under the Receiver Operating Characteristic (ROC) curve measure the diagnostic ability of the models.

7.3.2.2 Sensitivity and specificity of pack compliance in detecting TES

Table 10 shows the sensitivity and specificity of packaging compliance if used as a proxy for tax-evaded cigarette packs. The probability of detecting true tax-evaded cigarette packs using compliance status was 9.26% (95%CI: 8.9-9.6), while the probability of detecting true tax-paid cigarette packs was 99.71% (95%CI: 99.6-99.8). Table S18 and S19 (Appendix 2: Chapter 7-Supplementary Tables, pp 215) contains the specificity and sensitivity analysis stratifying the packs by collection source.

Table 10: Specificity and sensitivity of packaging compliance in detecting cigarette tax evasion

TES of pack (using tax stamp legitimacy – true tax payment status)			
Pack compliance status (using packaging features -screening tool)		Tax evaded	Tax paid
	Non-compliant	A: Non-compliant & tax evaded - True positive (n=120)	B: Non-compliant & tax paid - False positive (n=67)
	Complaint	C: Compliant & tax evaded - False negative (n=1176)	D: Complaint & tax paid - True negative (n=23000)
Sensitivity & Specificity [95% CI]		Sensitivity = $A/(A+C) = 9.26\%$ [8.9-9.6]	Specificity = $D/(B+D) = 99.71\%$ [99.6-99.8%]

7.4 Discussion

We analysed unique pack data from Bangladesh to provide estimates and present the structure of illicit cigarettes. Furthermore, we examined the underlying factors of cigarette tax evasion. Findings showed a low proportion of illicit cigarettes among the sample of packs collected in Bangladesh; the illicit packs in our sample were mainly due to inland tax evasion rather than due to packaging non-compliance. Cigarette packs with non-compliant packaging are illicit for violating government tobacco regulations.(John and Ross, 2018; Singh et al., 2023; Abdullah et al., 2020, 2022b) The proportion varied across the sampled districts and price segments. Although it varied across the sampled urban-rural and border-non-border locations, the differences were not statistically significant. We observed a statistically significant association between the likelihood of cigarette tax evasion and districts, price segment, and shop type.

For other settings, it was argued that data on cigarette tax evasion is not widely accessible or transparent.(Vladisavljevic et al., 2022) Similarly, Bangladesh’s National Board of Revenue (NBR) does not record such statistics.(Sadiq, Zaidi and Khurshid, 2019) Using ITC data and self-reported packaging information, Guindon and colleagues estimated the share of tax-evaded cigarette packs for Bangladesh to be low but increasing [0.4% (Wave I-2009) and 3.7% (Wave II-2010)].(Guindon et al., 2014) We estimated the share of tax-

evaded cigarette packs for the sampled districts in Bangladesh as 5.32% (95%CI: 5.04-5.60) and that of illicit as 5.62% (95%CI: 4.3-7.1). Compared with other South Asian countries, Bangladesh has a higher share of illicit cigarettes than India (2.7%) and Nepal (0.3%) but lower than Pakistan (17.8%) and Sri Lanka (10.8%).(John and Ross, 2018; Shakya et al., 2023; Khan et al., 2021; Morais, Colombaro and Wickramasinghe, 2018) However, these cross-country comparisons should be interpreted cautiously because estimates are derived from studies using different sampling strategies, data sources, and measurement approaches. The share is also lower compared to some other Asian (Malaysia, Vietnam, Turkey, Iran, Indonesia, and Mongolia),(Liber et al., 2015; Anh and Hoang, 2019; Kaplan, Navas-Acien and Cohen, 2018; Heydari, 2018; Ahsan et al., 2014; Ross et al., 2020) African (South Africa, Ghana, Nigeria, Kenya and Gambia),(Singh et al., 2023; Vellios, van Walbeek and Ross, 2020; Ross, 2017; Chisha, Janneh and Ross, 2020; Adeniran, Ekeruche and Castradori, 2020) and Latin and South American (Argentina, Brazil, Uruguay, Chile, Mexico, and Colombia) countries.(Pizarro et al., 2022; Maldonado et al., 2020; Szklo et al., 2022; Abascal and Ramos-Carbajales, 2019; Paraje, Araya and Drope, 2020; Saenz de Miera Juarez et al., 2021)

We found that only 0.77% (95%CI: 0.4-1.4) of cigarette packs in selected districts of Bangladesh were non-compliant, and merely 0.33% (95%CI: 0.2-0.6) originated from other countries. Thus, most illicit cigarettes in Bangladesh were manufactured domestically, primarily resulting from tax evasion rather than packaging non-compliance. Illicit trade and packaging non-compliance are often associated with high-priced cigarettes.(Prieger, 2022; Barker et al., 2016) However, in the sampled districts in Bangladesh, the proportion of illicit cigarette packs in the low-price segment was three times higher than in the premium segment, with tax evasion odds being three and half times greater. Since low-price segment cigarettes dominate the market in Bangladesh, evasion in this segment offers higher returns, as observed in India and Argentina.(Pizarro et al., 2022) The likelihood of illicit among economy packs in Argentina was over 200 times than the premium packs.(Pizarro et al., 2022)

We found significant differences in the share of illicit cigarette packs among the administrative districts in Bangladesh. Maulvibazar, a northeastern district, had the highest share of illicit cigarettes (13.63%; 95%CI: 9.3-19.0), consistent with earlier findings of tobacco tax evasion in northern districts.(Sadiq, Zaidi and Khurshid, 2019) Patuakhali and Comilla also had a higher share of illicit than the national average. It may

stem from inconsistent enforcement of tobacco control laws and relatively high tobacco prevalence. Maulvibazar and Patuakhali, in the Sylhet and Barishal divisions, have the second and third-highest tobacco prevalence in Bangladesh, respectively (47.7% and 40.4%).(Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) Comilla, in the Chittagong division, also has a higher prevalence than others (28.2%).(Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) The share of illicit cigarettes and odds of tax evasion were similar in both border and non-border areas of Bangladesh, perhaps because cross-border smuggling offers low financial incentives. A 20-stick cigarette pack from the most sold brand costs \$1.12 in Bangladesh, compared to \$2.54 in neighbouring India (the nearest neighbouring country with the largest land border), making smuggling less profitable.(WHO, 2021)

We found that cigarette tax evasion is about twice as common in unconventional retailers (e.g., bakeries, fruit retailers, cosmetics and stationery shops, newspaper shops, saloons, and variety stores) as in ordinary or departmental stores. These retailers rely on informal distribution and may operate with less oversight, making it easier to avoid monitoring and evade taxes. Furthermore, research in other settings showed that informal retailing contributes to the distribution of illicit cigarettes, creating easy access to informal distribution and facilitating underage sales.(Stead et al., 2013; Gallien, Occhiali and Ross, 2023; Singh et al., 2023)

Although small in magnitude, the sale of illicit cigarettes in shops highlights weak institutional capacity to regulate legal channels. We found that pack compliance accurately detects over 99% of tax-paid cigarette packs but only 9% of tax-evaded ones, suggesting a need for a robust tax track and trace system. Despite being an early signatory of the FCTC, Bangladesh has not signed and ratified the illicit tobacco trade protocol, which mandates a proper tracking system for supply chain monitoring.(WHO, 2012a) Although introduced in 2002, Bangladesh's cigarette tax stamps remained non-digital and require enhanced security features for zero reproducibility.

Independent and consistent data on the share of illicit cigarettes in Bangladesh is lacking. Applying a rigorous method, we provided an independent and replicable estimate of the magnitude of illicit cigarette packs in Bangladesh. Often, illicit tobacco studies fail to distinguish between legal tax avoidance and illegal tax evasion.(Guindon et al., 2014; Khan et al., 2021; Shakya et al., 2023) Nevertheless, since our findings are based on tax

stamp legitimacy, such limitation probability is low. Similar approach was followed in Argentina recently to explain illicit cigarette trade.(Pizarro et al., 2022) Additionally, the sampling captured urban-rural and border–non-border geographical aspects, yielding robust estimates with internal validity, further endorsed by littered pack estimates.

Despite the various strengths, the study findings have a few limitations. Although our sample included border and non-border districts, the generalisability of our findings is still limited to the sampled districts within the data collection time period. The estimates based on the packs collected from the retailers might have underestimated illicit cigarette sales e.g. if the retailers only handed over the tax-paid and compliant packs. On the other hand, the estimates based on the littered packs were unlikely to have this limitation. However, we acknowledge that the sample size of the littered packs was significantly smaller than the packs collected from the retailers. Estimates of the illicit cigarette sales might also differ if a stick-based approach were used, particularly in Bangladesh, where cigarettes are commonly sold as single sticks, as pack-based methods may not fully capture illicit consumption occurring through single stick sales. Mobile vendors selling cigarettes remained out of the scope in the sample. We could not assess foreign packs' true tax payment status as they had no tax stamps. However, the effect of this limitation on the findings would be minimum as the share of foreign packs was only 0.33% in the sample. Since we have a single data point, the scope of determining potential seasonality related to cigarette tax evasion was limited.

7.5 Conclusion

We have found a low share of illicit or tax-evaded cigarette packs in Bangladesh. Also, cigarette packs mostly follow recommended features and are compliant. Despite the low share, continuous policy initiatives and their enforcement should be there to limit the share and keep it at a minimum. The low-price segment of the cigarette market should be prioritised while surveillance as it has a higher share of tax-evaded cigarette packs than other segments. Given the association between shop type and cigarette tax evasion, unique licensing should be obligatory for retailing cigarettes. Strengthening institutional capacity and monitoring within legal enforcement is essential for improved surveillance coverage.

Chapter 8: Study III: Estimating the illicit tobacco trade in Smokeless Tobacco Market: An Exploratory Study from South Asian Countries

Chapter 8 contains the research paper titled “Non-compliant packaging and illicit smokeless tobacco in Bangladesh, India and Pakistan: Findings of a Pack Analysis,” published in the Tobacco Control journal as original research. In addition to the structured abstract, contribution, and implications, it includes five sections. Section 8.1 presents the introduction, rationale and aim of the study. Section 8.2 contains the methodology, detailing the study design, sampling, pack collection, operational definition of illicit products and statistical analysis. The results are found in Section 8.3 detailing the findings from the sample description and ST packaging non-compliance across the study countries. Finally, section 8.4 contains the discussion for the findings and section 8.5 concludes. The citation details of the article are given below,

Abdullah, S.M., Huque, R., Siddiqi, K., Kanaan, M., Huque, S., Ullah, S., Garg, S., Singh, M.M., Deshmukh, C., Borle, A.L. and Iqbal, R., (2024). Non-compliant packaging and illicit smokeless tobacco in Bangladesh, India and Pakistan: findings of a pack analysis. *Tobacco control*, 33(3):333-340. Available at: doi: 10.1136/tc-2021-057228

[Note: Table and figure numbers and their in-text referencing are continuous in this chapter and hence differ from the published article to maintain the overall flow of the thesis.]

Non-compliant packaging and illicit smokeless tobacco in Bangladesh, India, and Pakistan: Findings of a Pack Analysis

Abstract

Introduction

Illicit smokeless tobacco (ST) trade has seldom been documented despite ST use in at least 127 countries across the world. Based on non-compliance with packaging regulations, we report the proportion of illicit ST products from samples on sale in Bangladesh, India, and Pakistan where 85% of global ST users reside.

Methods

We purchased unique ST products from tobacco sellers in two purposively selected administrative areas (division/district) in each of the three countries. The criteria to determine illicit ST products were based on country-specific legal requirements for ST packaging and labelling. These requirements included: “Market Retail Price (MRP) Disclosure”, “Sale Statement Disclosure”, “Pictorial Health Warning (PHW) Pertinence”, “Appropriate Textual Health Warning (THW)” and “Using Misleading Descriptors (MD)”. Non-compliance with even one of the legal requirements was considered to render the ST product illicit.

Results

Almost all ST products bought in Bangladesh and India were non-compliant with the local packaging requirements and hence potentially illicit; all products in Pakistan lacked WHO Framework Convention on Tobacco Control (WHO FCTC) recommended packaging features. The most common feature missing was health warnings: 84% packs in Bangladesh, 93% in India, and 100% in Pakistan either didn’t have PHWs or their sizes were too small. In Bangladesh, 61% packs carried MD. In India and Pakistan the proportions of such packs were 32% and 42%, respectively.

Conclusions

Weak and poorly enforced ST control policies may be slowing the progress of tobacco control in South Asia. Standardized regulations are required for packaging and labelling ST. Improving compliance and reducing sale of cheap illicit products may require business licensing and market surveillance.

What this paper adds**What is already known on this topic?**

- Studies on illicit tobacco trade focus exclusively on cigarettes and are conducted mostly on high and upper middle-income countries. Illicit trade of ST products has seldom been a focus despite documented ST use in at least 127 countries across the world with over 350 million users.

What this study adds?

- In the three countries where 85% of ST users reside, the majority of ST products are non-compliant with packaging regulations and hence potentially illicit.

How this study might affect research, practice and policy?

- In Bangladesh, India and Pakistan, there is a need to implement and enforce effective standardised regulations for ST products.

8.1 Introduction

Tobacco use leads to over 8 million deaths each year globally.(WHO, 2019) Tobacco products and their use vary across different geographic regions. Besides smoked forms (e.g., cigarette, bidi, waterpipe, cigar), smokeless tobacco (ST) products such as zarda, gul, khaini, sada pata (sun-dried tobacco leaf), naswar, and gutka are also popular, particularly in Bangladesh, India and Pakistan - where 85% of the global ST users reside.(National Cancer Institute and Centers for Disease Control and Prevention, 2014) According to the latest Global Adult Tobacco Survey (GATS) in Bangladesh (2017), India (2017), and Pakistan (2014), the prevalence of ST use among adults were 21%,(Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019; Zhao et al., 2021) 21.4%,(Tata Institute of Social Sciences and Ministry of Health and Family Welfare, Government of India, 2018; Zhao et al., 2021) and 8.6% respectively(Naz et al., 2018). The excessive ST use in these countries and its associated health risks require stringent measures for effective tobacco control.(Mutti-Packer et al., 2017) However, ST control has not been a priority policy focus till date.(Readshaw et al., 2020) Low price, easy affordability and accessibility, social and cultural acceptance, misconception about its medicinal value, exposure at a young age, and a lack of regulatory framework contribute to high prevalence of ST in these countries.(Siddiqi et al., 2016b; Anwar et al., 2005; Kakde, Bhopal and Jones, 2012)

Despite being signatories to the WHO Framework Convention for Tobacco Control (FCTC), the three countries differ in terms of regulations for ST products. The tobacco control laws in Pakistan are not comprehensive and exclude ST from most provisions. In India, the law requires pictorial health warning labels to cover 85% of the principal display area of ST packs while in Bangladesh such requirement is only to cover 50%. Both countries require the warnings to rotate but the time-intervals are different. Printing misleading descriptors such as “light” and “low tar” on ST packs is prohibited by law in India and Bangladesh. In Bangladesh the textual health warning must be printed in Bengali, in India it can be printed in English or in an Indian language or both. Additionally, there are bans on some ST products e.g., gutka and pan masala are banned in India. Despite the ban, pan masala and gutka ingredients are on sale in separate small pouches and consumers can mix the ingredients to consume the products. In Bangladesh no ST products are banned, while in Pakistan the manufacture of gutka is banned in Sindh, one of the country’s four provinces.

Tax evasion - termed loosely as illicit trade in this paper - can increase tobacco's affordability by undercutting its price. In this study, illicit trade primarily refers to tax evasion inferred from non-compliance with packaging regulations, which served as a proxy measure in the absence of fiscal markers such as tax stamps on smokeless tobacco products. Illicit trade increases tobacco consumption and erodes governments' revenue, thus undermining tobacco control efforts.(Joossens et al., 2014; John and Ross, 2018) Most studies on illicit tobacco trade focus exclusively on cigarettes and are conducted mostly in high and upper middle-income countries.(van Walbeek et al., 2013; van Walbeek, 2014; Joossens et al., 2014; Stoklosa and Ross, 2014; Joossens and Raw, 2008; Wherry et al., 2014; Kaplan, Navas-Acien and Cohen, 2018; Blecher et al., 2015; Guthrie et al., 2015; Maldonado et al., 2018; Paraje, 2019; Lencucha and Callard, 2011; Iglesias et al., 2017; Arevalo et al., 2016; Ross et al., 2015; Gilmore et al., 2014) Illicit trade of ST products has seldom been a focus despite documented ST use in at least 127 countries across the world with over 350 million users.(Siddiqi et al., 2020a) Apart from a handful of single country reports on packaging compliance, advertising, and promotion,(Iacobelli et al., 2020; Mullapudi et al., 2019; Rahman et al., 2019; Cohen et al., 2016; Arora et al., 2012; Ahmad et al., 2020) multi-country studies comparing the nature and share of illicit ST sales are non-existent. The absence of any trace and track system or even tax stamps on ST products makes it impossible to estimate the share of illicit ST trade accurately.

This manuscript reports the extent of illicit ST products on sale defined on the basis of non-compliance with packaging laws in Bangladesh, India, and Pakistan. In the absence of tax stamps, non-compliance with ST packaging and labelling requirements were used as a proxy for tax evasion.(Stoklosa, Paraje and Blecher, 2020; Arevalo et al., 2016; Ross, 2015) In previous studies, estimating illicit cigarette trade, when packs did not comply with packaging laws it was assumed that legal taxes have also not been paid.(Arevalo et al., 2016; Scollo, Bayly and Wakefield, 2015; Ross, 2015) Where ST-specific regulations were absent, we estimated the proportion of products that would be non-compliant if the regulations were in place following the WHO FCTC guidelines.

8.2 Methodology

8.2.1 Study Design

The analysis presented in this paper is part of a broader mixed-methods study consisting of ST point-of-sale (POS) mapping and surveys, in-depth interviews with ST supply chain actors, and ST products compliance with existing laws.(Khan et al., 2020)

8.2.2 Study Period and Settings

The study was conducted in two purposively selected administrative areas (division/district) in each of the three countries: Dhaka and Rangpur districts in Bangladesh; North–East and North–West districts of Delhi in India; and Karachi and Peshawar in Pakistan. These were selected due to the high level of consumption and diversity of ST products in these areas. The data collection was completed between June 2019 and December 2020.

8.2.3 Sampling

Within each participating district, one rural and one urban subdistrict was selected purposely. Country-specific definitions as per administrative documents and census reports were used to categorize the study subdistricts into urban and rural. In each of the subdistricts, three smaller areas (Union Council (UC) or Thana) – Primary Sampling Unit (PSU)-were randomly selected. Two enumeration blocks (villages or neighbourhood areas) – Secondary Sampling Unit (SSU)-were randomly selected within each PSU. All ST POS vendors (general/departmental stores, petrol pump/gas station stores, beer/liquor stores, grocery stores, betel quid shops, exclusive tobacco shops, discount shops, mobile vendors/carts, stationary carts) in each SSU were geo-mapped to construct a sampling frame. In case of geo mapping mobile vendors/carts, the first contact place of the enumerators was considered as their location.(Khan et al., 2020) Assuming 20% non-compliance in tobacco shops,(Bhuiyan et al., 2014; Patel et al., 2013; Society of Alternative Media and Research Coalition for Tobacco Control-Pakistan, 2017) 7% absolute precision, 5% confidence coefficient and 15% non response, the optimum number of POS vendors in each country was estimated and rounded to be 290. As there were 6 enumeration blocks in each site, random selection of a maximum of 13 POS vendors from the sampling frame of each SSU resulted in a total maximum of 78 POS. Following that in every country both study sites had 2 strata (urban and rural), recruited

number of POS could be as high as 312 in each of them.(Khan et al., 2020) A thematic chart of the adopted multi-stage sampling method is presented in Figure S6 (Appendix 3: Chapter 8-Supplementary Figures, pp 223).

8.2.4 Pack Collection

Adapting Tobacco Packs Surveillance System (TPackSS) unique pack sampling process,(Smith et al., 2015) ST sample packs were collected from the randomly selected POS vendors in each SSU. Based on their brand names, pack features (such as size, design, colour, cellophane, material), country of production, presentation, promotional message, text, and pictorial warning, all available unique ST packaged products were purchased. At the first selected POS, all unique packs of locally available ST products were collected. This was followed by the collection of only those packs which were not procured previously, from the subsequent POS.

8.2.5 Training of Staff and Pack Characteristics

The collected sample packs were categorized according to the product type as identified by the WHO FCTC Global Knowledge Hub for ST.(FCTC Secretariat, 2018) The hub categorized the ST products in terms of four parameters, namely, “ingredients used for preparation”, “modality of use”, “places or areas of use” and “most commonly prevalent region/country/gender”.(Khan et al., 2020) Data entry personnel were trained in using the Tobacco Advertisement and Promotion Survey (TAPS) pack analysis tool.(Feighery et al., 2013) The analysis involved recording the following information: ST product category, brand name, country of origin, manufacturer details (name and address), price, tax and ingredient disclosure (whether printed on the pack), pack form (Paper Box, Sachet, Plastic Bottle, Tin Can etc.) and weight (measured in grams), presence and appropriateness of pictorial and textual health warning, culture-specific colour and symbol (e.g. reference picture, flower, animal, place etc.) and/or statement of health claims (e.g. mentioning product is less harmful, refreshing and safer, contains low level of harmful substance etc.). Our trained operators recorded ST pack information in a standardised database developed using Microsoft Access. The packs were double-coded and data were cross checked for accuracy and consistency. The size of warning labels was measured after excluding the black borders. Given the irregular shapes of some ST packs, the face and flat portions were measured; for packs with bevelled and rounded edges, these bevelled and rounded portions were excluded. For the soft packs, the face

portion was measured excluding the foil area. Further methodological details can be found in the TPackSS codebook.(Johns Hopkins, Bloomberg School of Public Health; TPackSS:Bangladesh, 2016; TPackSS:India, 2016; TPackSS:Pakistan, 2013)

8.2.6 Packaging Non-compliance and Defining Illicit Packs

To estimate the share of illicit ST on sale in study areas, we developed a definition of what constitutes “illicit”. We consulted relevant literature(Abdullah et al., 2020; John and Ross, 2018) and the FCTC Article 11.1(a), 11.1(b), and Article 15.2(a)(WHO, 2003) to identify the features that might be used as proxy for illicit tobacco products. Once core features [Market Retail Price (MRP) Disclosure, Sale Statement Disclosure, Tax Stamp and Banderols Display, Pictorial Health Warning (PHW) Pertinence, Appropriate Textual Health Warning (THW), and Misleading Descriptors (MD)] were agreed, these were mapped across the national laws in the three countries (Appendix 3: Chapter 8-Supplementary Tables: Table S20, S21 and S22, pp 216-222).(National Board of Revenue, Bangladesh; National Tobacco Control Cell, Bangladesh; National Tobacco Control Programme, India; Federal Board of Revenue, Pakistan; Tobacco Control Cell, Pakistan) The mapping revealed that the study countries did not have uniform regulations. In Pakistan, there were no regulations that could be applied to ST packs (Table 11). The only rule that existed for ST products in Pakistan, categorised a product as illegal if it is imported and originated from India or Israel (Appendix 3: Chapter 8-Supplementary Tables: Table S22, pp 221-222). In Bangladesh, it was mandatory for ST to carry “Market Retail Price (MRP)” and “Sale Statement” (printing “sales only allowed in (country’s name)” on the pack). In contrast, India did not require a “Sale Statement”. While country-specific laws existed for PHW, THW, and MD in Bangladesh and India, there were no requirements for affixing fiscal instruments (Tax Stamps or Banderols) on ST packs (Table 11).

We used country regulations pertaining to ST packs to select the hallmarks of illicit packs. For Bangladesh and India, a product was considered illicit (unless otherwise stated) if it had any of the following: no MRP printed, no sale statement disclosure (only for Bangladesh), no and/or inappropriate proportion of PHW (Bangladesh – at least 50%, India – at least 85%), no and/or inappropriate THW (not written in principal language) and affixing MD (using culturally specific reference such as colour or symbol and/or words suggesting flavour or strength and/or making health claims). In the absence of ST-

specific regulations in Pakistan, we simply described the proportion of packs under different descriptions and did not classify these as illicit.

Table 11: Hallmarks and definitions of illicit ST packs as per country specific rules

Pack features	Country specific rule existence for ST and illicit hallmarks								
	Bangladesh			India			Pakistan		
	Rule status	Illicit hallmark	Comment	Rule status	Illicit hallmark	Comment	Rule status	Illicit hallmark	Comment
a) MRP disclosure	Yes	Yes	Operational Definition of Illicit ST packs in Bangladesh included 5 parameters defined under pack features (a), (c), (d), (e) and (f). An ST pack found non-compliant with even one of the parameters was considered illicit.	Yes	Yes	Operational Definition of Illicit ST packs in India included 4 parameters defined under pack features (a), (d), (e) and (f). An ST pack found non-compliant with even one of the parameters was considered illicit.	None	No	In the absence of country specific rules in Pakistan, ST packs were not classified as illicit. We merely described the proportion of ST products under various categories.
b) Tax Stamp and Banderols display	None	No		No	No		None	No	
c) Sale statement disclosure	Yes	Yes		None	No		None	No	
d) Pictorial Health Warning (PHW)	Yes	Yes		Yes	Yes		None	No	
e) Textual Health Warning (THW)	Yes	Yes		Yes	Yes		None	No	
f) Misleading Descriptors (MD)	Yes	Yes		Yes	Yes		None	No	

Note: “Sale Statement Disclosure” indicates printing “Sales only Allowed in (country name)”, Misleading Descriptors (MD) includes the use of a culturally specific reference such as colour (such as red, saffron, green etc.) or symbol (such as star, flower, birds, tree, sun, misleading photograph, tar, low tar, mild etc.), use of words indicating flavour, and/or strength (such as super quality, fresh, smooth, special, royal, rose etc.), and affixing health claim (such as mentioning product is less harmful, refreshing and safer, contains low level of harmful substance etc.). In many cases ST packs in Bangladesh and India contains photographs of “Bride”, “Monk”, or a “Hindu God” etc., in Pakistan pictures of “Horse”, “Star”, “Tiger Head” etc. For PHW, the law in Bangladesh and India requires covering at least 50% and 85% of the display area respectively. National laws in both these countries also require THW to be written in the principal language. The word “None” indicates the nonexistence of rule for ST products in the country’s tobacco control policy for the relevant pack features for regulation.

8.2.7 Statistical Analysis

All analysis were stratified by country. We presented frequencies and percentages to describe the features of packs, namely, type of ST products, whether pre-packaged by manufacturer, pack form and whether the name and address manufacturer was printed on the pack. For each compliance feature, we calculated frequencies and percentages of pack that were compliant. Based on country specific defined criteria for illicit ST products, we computed the proportion of illicit products. Estimates of the proportion of illicit products were presented with 95% Confidence Interval (CI). The statistical analysis was carried out using STATA version 15.(StataCorp, 2017)

8.3 Results

We examined the compliance of ST packs in study countries. In addition to each specific illicit hallmark, the overall proportions of illicit ST packs on sale among the total pack purchased were described accordingly.

8.3.1 Sample Description and Compliance Across Countries

Table 12 describes ST packs and their features and compares their compliance with existing packaging and labelling laws across the three countries. We collected 116 unique ST packs (categorised broadly under Zarda, Gul, and Paan Masala with Tobacco) in Bangladesh. The sample for India was 41 (Zarda, Gul, Khaini, Naswar, and Paan Masala with Tobacco) and 64 for Pakistan (Naswar, Gutka, Khaini, Paan Masala with Tobacco, Mawah, and Suns). In Pakistan the samples were dominated by Naswar (59.3%), whereas in India and Bangladesh Paan Masala with Tobacco (46.3%) and Zarda (85.3%) respectively were most common. Across the study countries, ST products were sold both pre-packed and loose (the latter are commonly mixed with other products such as betel leaf and betel nut). A considerable variation in the form of ST packs was observed across the countries. While in Bangladesh, a tin or a can (44.0%), plastic bottles (38.8%), or sachets (12.9%) were used to pack ST by their manufacturers, in India sachets were the predominant (80.4%) type of packaging. Paper packets or boxes (57.8%) and sachets (29.7%) were found to be the most popular form of packaging in Pakistan.

Manufacturer details were missing from 50% of the samples in Pakistan, 20% in Bangladesh, and 15% in India. Similarly, 55%, 22%, and 7% of products in Pakistan, India, and Bangladesh respectively, had no written information on the country of origin. With regards to ingredients disclosure on ST packs, there were marked differences across the countries. In Bangladesh and India, more than half of the ST packs had no information about the ingredients. Among the packs where ingredients were listed, about 97% in Bangladesh and 93% in India had no information regarding the exact weight per ingredient the manufacturer had used for the product. Only around 27% of the ST packs in Pakistan displayed ingredient lists, however, 94% of these lists did not mention their weights.

Considering THW and PHW, in India only 2% of ST packs had no THW. Among those that contained THW, 95% used national or regional languages. On the other hand, around

20% of packs had no THW in Bangladesh and 80% had no THW in Pakistan. Around 87% of ST pack warnings in Bangladesh used the national language but only 8% did so in Pakistan. Similar observations were made for PHWs. Although the majority of ST packs contained PHW in India, 9 out of 10 PHWs were not compliant with the required size (minimum 85% of pack surface). In Bangladesh, 22% of packs had no PHWs and 8 out of 10 PHWs did not meet the size requirements (minimum 50% of pack surface). None of the packs in Pakistan contained PHWs.

None of the ST packs collected in Bangladesh and Pakistan and very few in India (7%) had any quit information. Affixing culturally specific references to attract the respective consumers appeared to be a common practice among the ST manufacturers in the study countries. Among ST packs in Bangladesh, 31% used statements of health claims. About 20% of the ST packs in India contain misleading descriptors of flavour or strength.

Table 12: Comparative analysis of ST pack compliance in Bangladesh, India, and Pakistan

ST products and pack features	Bangladesh (%)	India (%)	Pakistan (%)
Type of ST products			
Zarda	99	10	-
Naswar	-	1	38
Gul	7	3	-
Gutka	-	-	9
Mawah	-	-	3
Snus	-	-	1
Khaini	-	8	8
Paan Masala with tobacco	10	19	5
Packs (N)	116	41	64
Pre-Packaged by manufacturer (yes)	113 (97.41)	41 (100.00)	55 (85.93)
Pack form			
Paper Packet/Box	5 (4.31)	5 (12.20)	37 (57.81)
Tin/Can	51 (43.97)	3 (7.32)	8 (12.50)
Plastic Bottle	45 (38.79)	-	-
Sachet	15 (12.93)	33 (80.49)	19 (29.68)
Name and Address of manufacturer (yes)	93 (80.17)	35 (85.37)	33 (51.56)
Ingredient Disclosure			
Ingredient Listed (yes)	54 (46.55)	17 (41.46)	17 (26.56)
Weight Per Ingredient(yes)	4 (3.45)	3 (7.32)	4 (6.25)
Country of Origin (yes)	107 (93.04)	32 (78.05)	29 (45.31)
Textual Health Warning (THW)			
THW Status (yes)	93 (80.17)	40 (97.56)	13 (20.31)
Language of THW			
National/Regional	81 (87.10)	38 (95.00)	1 (7.69)
Pictorial Health Warning (PHW)			
PHW Status (Any Size) (yes)	90 (77.59)	40 (97.56)	-
Proportion of PHW			
25% - 49%	72 (80.00)	5 (12.19)	-
50% - 74%	15 (16.67)	14 (34.14)	-
75% - 84%	3 (3.33)	18 (43.90)	-
85% and above	-	4 (9.75)	-
Provision of Quit Information (yes)			
Affixing Culturally Specific Reference (yes)	36 (31.03)	6 (14.63)	24 (37.50)
Words Suggesting Flavour or Reduced Strength (yes)	13 (11.20)	8 (19.51)	12 (18.75)
Statement of Health Claim (yes)	36 (31.03)	3 (7.32)	9 (14.06)

Note: Numbers presented are counts and those in parentheses are percentages

8.3.2 Packaging Non-compliance and Percentage of Illicit ST Packs Sales

Alongside the overall proportion of illicit ST packs on sale, Table 13 summarises the proportion of individual hallmarks considered in the definition of illicit. Although required by law, around 57% of ST packs did not have MRP affixed in Bangladesh. Regarding the health warnings, approximately 84% of the packs had either no PHW or inappropriate size of PHW. Another 30% did not have THW or used unprescribed language. 61% of the packs used MD such as culturally specific reference, words indicating flavour and/or strength, and health claims and regarded as illicit. Sale statement disclosure was absent on 72% of packs. Among 116 packs in Bangladesh, 107 were non-compliant and hence the share of illicit ST products was estimated as 92%. In India, the share of illegal products in the market concerning specific features such as MRP (2.4%), THW (7.3%), and MD (31.1%) was considerably lower. Nevertheless, 38 out of 41 ST packs were non-compliant with regards to PHW, making 93% of these illicit. In Pakistan, all 64 products had sale statement disclosure absent and missing or inappropriate PHW, all except one had missing THW and 42% packs had MD. Thus, in Pakistan all ST packs found had improper features.

Table 13: Packaging non-compliance and percentage of illicit ST products in Bangladesh and India, and the percentage ST products with specific pack features in Pakistan

Pack features (Themes for illicit ST products)	Bangladesh		India		Pakistan	
	Non-compliant Packs	Illicit Percentage (95% CI)	Non-compliant Packs	Illicit Percentage (95% CI)	Packs with Features	Percentage of Packs with Specific Features (95% CI)
(a) MRP not printed	66	56.9 (47.4, 66.1)	1	2.4 (0.10, 12.9)	-	-
(c) No sale statement disclosure	84	72.4 (63.6, 80.4)	-	-	64	100 (94.4, 100.0)*
(d) No PHW or inappropriate size of PHW (Bangladesh and Pakistan – below 50%, India – below 85%)	98	84.4 (76.6, 90.5)	38	92.6 (80.1, 98.5)	64	100 (94.4, 100.0)*
(e) No THW or inappropriate language of THW (Not in principal language)	35	30.1 (22.0, 39.4)	3	7.3 (1.5, 19.9)	63	98.4 (91.6, 100.0)
(f) Presence of any Misleading Descriptors (MD) (Culturally specific reference or words indicating flavor and/or strength or health claim)	71	61.2 (51.7, 70.1)	13	31.7 (18.1, 48.1)	27	42.1 (29.9, 55.2)
Overall estimate of non-compliant and hence illicit ST Packs (in Bangladesh, % of ST Packs have at least one of the attributes listed from (a) to (f), in India, % of ST Packs have at least one of the attributes listed in (a), (d), (e) and (f) and in Pakistan (packs with specific features), % of ST Packs have at least one of the attributes listed from (c) to (f)).	107	92.2 (85.8, 96.4)	38	92.6 (80.1, 98.5)	64	100 (94.4, 100.0)*

Note: * Indicates one - sided, 97.5% Confidence Interval. In the absence of country specific rules in Pakistan, ST packs were not classified as illicit. We merely described the proportion of ST products under various categories.

8.4 Discussion

We compared ST pack compliance with national laws in Bangladesh, India, and Pakistan, and almost all ST products were found non-compliant and potentially illicit in Bangladesh and India. In the absence of ST-specific laws in Pakistan, compliance could not be assessed, however, as expected none were found in accordance with the FCTC guidelines. In 2016, non-compliance with regards to PHW among Zarda and Gul in Bangladesh was found to be 40% and 24% respectively;(Rahman et al., 2019) a previous study in India reported only 2% of the packs as compliant with warning size(Saraf et al., 2018) and none of the ST packs had PHW in Pakistan.(Siddiqi et al., 2016b) The effectiveness of appropriate health warning labels in knowledge enhancement, quit intention and youth tobacco uptake is well recognized.(Kennedy et al., 2012; White, Webster and Wakefield, 2008; Hammond et al., 2006, 2003; Hammond, 2011) However, the ST market regulation and enforcement of PHW on ST packs remain ineffective despite these countries being the WHO FCTC signatories. These findings are broadly consistent with previous studies in the region, although differences in the magnitude of non-compliance may reflect variation in regulatory enforcement, market structure, and the role of informal manufacturers.

A further area of concern about ST pack non-compliance is related to THW. Bangladesh and Pakistan respectively had 53% and 68% of ST packs carrying textual health warnings(Siddiqi et al., 2016b) while in India about 93% of the packs were compliant, considering the language as an indicator(Saraf et al., 2018). Although in Bangladesh THW compliance has improved, around 30% of packs still have no THW or have them in inappropriate language. In India, language compliance has remained more or less stable having only 7% non-compliance packs. As expected, the situation has not improved in Pakistan and 98% of packs had no THW.(Siddiqi et al., 2016b) Three-fifths of the packs (61%) used MD in Bangladesh and were categorized as illicit. In India and Pakistan, the share of such packs was 32% and 42% respectively. This is an urgent policy concern as ST products are usually low-cost tobacco options and consumption is prevalent largely in rural areas, low-income classes, and people with low educational attainment.(Bandyopadhyay and Irfan, 2019) Illusive packaging content may undermine the national tobacco control effort by attracting this population.

The absence of ST-specific policies in Pakistan meant that international evidence-based practices outlined in the WHO FCTC guidelines are not in place. In Bangladesh and India

although regulations are in place, their poor implementation e.g., size of PHW or use of MD, has weakened their impact. Additionally, formal guidelines are yet to be adopted for certain WHO FCTC articles. In the absence of formal guidelines, many WHO FCTC articles have not been implemented comprehensively.(Chung-Hall et al., 2019) In contrast, market monitoring and policy surveillance are active for smoking tobacco products. Consequently, their compliance is relatively better in the three countries.(Rahman et al., 2019; Smith et al., 2018; Panigrahi and Sharma, 2019) Recent studies reveal that share of illicit cigarette sale in India is 2.7%,(John and Ross, 2018) in Bangladesh around 2%,(Sadiq, Zaidi and Khurshid, 2019) and in Pakistan 17.8%(Khan et al., 2021). Though Bangladesh, India, and Pakistan ratified the WHO FCTC for comprehensive tobacco control, ST policies and their enforcement mechanisms remained weak; taxes are low and poorly administered; and in general, the ST control policies, where in place, are inadequate.(Khan et al., 2014; Siddiqi et al., 2016b)

The supply chain and market for ST are distinctive with many fragmented and informal supply chain actors. ST production and consumption are culturally accepted in South Asia.(Siddiqi et al., 2016b; Ahmad et al., 2020) The manufacturers of ST products are diverse. Across the three study countries, besides a few influential and enormous companies (e.g. Dharmpal Satyapal Ltd., Som Sugandh Industries Ltd., and Dhariwal Industries Ltd. in India and Kaus Chemical Works, Baba Al – Tajer Dhaka etc. in Bangladesh), the ST producers are largely home-based and work as unregistered small entrepreneurs with informal establishments.(Khan et al., 2014) Stable and high demand, small start-up capital requirement, and low risk with quick - good income play as an incentive for such business.(Siddiqi et al., 2016b) There is no standardization of packs against enormous brands and product diversity for ST. These features, on the other hand, made the ST market fragmented.

The study countries are already overburdened with ST-related diseases.(Siddiqi et al., 2020a) Any practices that make the ST products illicit and inexpensive, will undermine tobacco control initiatives in these countries. Hence, the market and ST supply chain should be integrated within the regular tobacco supply chain and formalized. Standardized rules and practices needed to be in place for its manufacturing and packaging. Integration and emphasis for ST in tobacco control laws, country contextualization of the policies, and effective monitoring, surveillance, and implementation should be a priority. Licensing requirements for manufacturing,

marketing, and distribution of ST products, and effective tracking and tracing of ST products should be in place. Essentially, the ST businesses should exist within a legal framework that is easy to administer.

This multi-country study is one of the very few attempts which aimed to assess ST pack compliances with the legal requirements. Besides the general pack compliance appraisal, it would help the policymakers to understand the nature and extent of illicit products in countries with high ST-related disease burden. It reemphasized the poor regulation problem of the ST market employing rigorous research methods and standardized tools.

Since the results are obtained from only two purposively selected administrative areas in each study country, these cannot be generalised to the whole country and the scope of study remains limited. Nevertheless, the basis of purposive selection was the extent of use, size, and diversity of the population and variety of ST products. Moreover, all PSUs and SSUs were randomly selected, increasing the validity of findings. This random selection strengthened internal validity by reducing selection bias within sampled sites; however, as study areas were purposively selected, the findings may not be generalisable to the entire country. As the analysis relied only on packs and considered their compliances, differentiation between counterfeit and smuggled products was not possible. Although a standardised method (TPackSS)(Smith et al., 2015) for analysing the ST Packs was followed, multiple pre analysis calibration workshops for the data retrievers and double coding and cross checking of the data by independent researchers took place. However, there remains a remote possibility of misclassification, owing to diverse shapes, sizes and specifications of health warning labels and descriptors on ST packs. Also, THW compliance was assessed only with in relation to language and did not include the other specifications such as colour and font coding, and recommended text warnings contemporaneous to the specific PHW. Further research is needed in this regard. While the ST mobile vendors or carts were considered in the sampling frame, in many cases products were not collected because of being unable to trace the vendors. Tracking the overtime trend of illicit share requires real-time information generation with multiple rounds of sellers surveys based on pack collection. In addition, capacity strengthening of relevant authorities for tracking and tracing, and improving the enforcement is needed.

8.5 Conclusions

We found that in Bangladesh, India and Pakistan, either evidence-based policies for ST control are not in place or their enforcement is weak to make any impact. Improving compliance and reducing cheap illegal products may require formalising ST market through business licensing and operational market monitoring. Prioritising ST in policy formulation and implementation should also be considered in this regard.

Chapter 9: Study IV: Improving the Regulation and Monitoring to Control the Non-compliance and illicit ST in Bangladesh: A Qualitative Study

Chapter 9 contains the research paper titled “‘Local government, standardised packaging, and licensing are key’: A stakeholder-based qualitative study on strengthening smokeless tobacco regulation in Bangladesh,” published in the *Tobacco Control* journal as original research. In addition to the structured abstract, contribution, and implications, it includes five sections. Section 9.1 presents the introduction, rationale and aim of the study. Section 9.2 contains the methods, detailing the study settings, participants, process and data collection, and analytical approach. The results are found in section 9.3 detailing the domains and themes. Finally, section 9.4 contains the discussion for the findings and section 9.5 concludes. The citation details of the article are given below,

Abdullah, S.M., Jennings, H.M., Huque, S., Kanaan, M., Huque, R. and Siddiqi, K., (2025). ‘Local government, standardised packaging, and licensing are key’: a stakeholder-based qualitative study on strengthening smokeless tobacco regulation in Bangladesh. *Tobacco Control*. Published Online First: 28 August 2025. Available at: doi: 10.1136/tc-2025-059489

[Note: Table and figure numbers and their in-text referencing are continuous in this chapter and hence differ from the article under review to maintain the overall flow of the thesis.]

‘Local government, standardised packaging, and licensing are key’: A stakeholder-based qualitative study on strengthening smokeless tobacco regulation in Bangladesh

Abstract

Introduction

Smokeless Tobacco (ST) use is widespread and poses a considerable health burden for Bangladesh. However, the tobacco control law enforcement for ST is significantly weaker than for smoking tobacco, leading to a near-total non-compliance of ST products. We explored tobacco control stakeholders’ perspectives on high ST non-compliance, in order to improve regulation in Bangladesh.

Methods

We conducted a qualitative study involving in-depth semi-structured interviews (n=20) with five stakeholder groups (Policymakers, Nongovernmental Organizations, Researchers, International Agencies and Advocacy Networks) between July and September 2024. Participants were asked about their perspectives on non-compliance of ST, policies and enforcement mechanisms, and supply chain control and international collaboration to address ST non-compliance in Bangladesh. We used the framework approach to analyse the data, which involved iteratively coding, charting and interpreting the interview transcripts.

Findings

Stakeholders perceived weak monitoring and enforcement of ST, leading to substantial non-compliance of ST regulation in Bangladesh. Factors such as market’s informality, cultural embedment, and lack of registration and licensing of ST businesses contributed to this. A disjointed regulatory framework and perceived low tax return made ST non-compliance a low priority for regulators. Furthermore, diversity in packaging and targeting of consumers’ social and cultural beliefs by the manufacturers made ST compliance more challenging than cigarettes. Widespread tax evasion arises from a flawed self-declarations system and a lack of explicit tax markers due to regulatory weaknesses and manufacturers’ influence. Bangladesh’s current legal framework fails to address ST product diversity. Participants suggested introducing standardised packaging

and licensing with local government involvement to strengthen regulations and address ST non-compliance.

Conclusion

ST control has long been neglected by policymakers in Bangladesh. Besides government commitment, strengthening regulation to address high ST non-compliance would require implementing evidence-based approaches.

What is already known on this topic

- ST packaging non-compliance in Bangladesh is widespread relative to that in smoking tobacco.
- Informal nature and lack of licensing requirements of ST business weakens law enforcement in Bangladesh.

What this study adds

- Identified the systematic barriers to improve regulation and monitoring for addressing ST non-compliance.
- Findings suggested introducing innovative approaches such as engaging local government for registration and implementing standardised packaging and market-based monitoring to address ST non-compliance. The supply chain needs to be digitalised, and an app-based monitoring could be introduced considering widespread use of smartphones.

How this study might affect research, practice or policy

- The current tobacco control law requires amendments to incorporate ST diversity and implement standardised packaging. It is essential to make registration and licensing for ST businesses mandatory. Local governments can collaborate with central authorities to manage registration and monitoring processes. Additionally, it is crucial to enhance global awareness and international understanding regarding ST non-compliance. Prioritising ST non-compliance in local tobacco control advocacy efforts would require improved policy attention.

9.1 Introduction

Bangladesh has 22 million adults (age above 15 years) who use Smokeless Tobacco (ST), with a prevalence of 20.6% compared to 18.0% for smoking.(Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) One in five adults use ST in the country, of which over 90% consume daily. Notably, ST prevalence is higher among women than men across a range of key demographics, for example: 49.9% of women with no formal education (27.1% men), 35.9% in the lowest wealth quintile (24.8% men), 26.8% in rural areas (17.8% men), and 62.1% among those aged above 65 (33.9% men).(Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) There is a strong urban-rural disparity, with the vast majority (90%) of the ST users (18 million out of 22 million) living in rural areas.(Bangladesh Bureau of Statistics and National Tobacco Control Cell, 2019) ST is also the most common tobacco among Bangladeshi youth, more prevalent among students (4.5%, age 13-15 years) than smoking (2.9%).(Global Youth Tobacco Survey, 2013) Cultural acceptance, affordability, and availability contribute to the high ST prevalence in Bangladesh.(Rahman et al., 2015; Huque et al., 2017)

ST is consumed orally or nasally.(IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, 2007) ST products and their consumption patterns are diverse across the countries. In Bangladesh, the commonly used ST products are *Zarda* (chewing tobacco combined with lime and spices), *Gul* (powdered tobacco leaves), *Sada Pata* (dried tobacco leaves) and *Khoinee* (sun-dried or fermented tobacco leaves).(Abdullah et al., 2022b; Zaman et al., 2014; Hossain et al., 2014) ST products are highly addictive and lead to oral, pharyngeal and esophageal cancers, and risk of cardiovascular mortality.(Siddiqi et al., 2020a; Huque et al., 2024a) Owing to this high use, in 2017 across Bangladesh, at least 16,947 lives and 403,460 Disability-Adjusted Life Years (DALYs) were lost.(Huque et al., 2021)

In Bangladesh, ST was incorporated within tobacco control policy in 2013, eight years after the tobacco control law was enacted.(Huque et al., 2021) Despite being a signatory of the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC), the enforcement of tobacco laws for ST are significantly weaker than for smoking tobacco.(Khan et al., 2014; Abdullah et al., 2022b) Consequently, over 90% of ST products in the market are non-compliant with packaging regulations and potentially illicit,(Abdullah et al., 2022b) compared to only 5.6% for smoking tobacco.(Abdullah et al., 2024) Although ST use is widespread and poses a considerable health burden, the

policies and their enforcement remain inadequate, with no effective standardised regulations in place.(Abdullah et al., 2022b) Research on ST in Bangladesh has primarily focused on usage patterns, health impacts, policy gaps, and the extent of illicit products and packaging non-compliance.(Khan et al., 2014; Huque et al., 2017, 2021, 2024a; Abdullah et al., 2022b; Hossain et al., 2014; Zaman et al., 2014) However, the underlying reasons for weak regulations, monitoring and poor compliance have not been studied sufficiently. A deeper understanding of these aspects is crucial for formulating effective ST policies and strategies to address poor regulatory compliance in Bangladesh. We aimed to explore tobacco control stakeholders' perspectives on the reasons behind poor compliance with ST regulations in Bangladesh.

9.2 Methods

The complexity related to ST compliance issues and the need for an in-depth understanding meant that a qualitative approach was the most appropriate.(Creswell and Poth, 2017) We conducted in-depth interviews with a range of stakeholders, knowledgeable and experienced in the area, exploring their perspectives on non-compliance, regulation and monitoring.

9.2.1 Settings, Participants and Recruitment

Previously, we carried out stakeholder mapping for tobacco control in Bangladesh.(Dobbie et al., 2019; Readshaw et al., 2020) The mapping identified tobacco control organisations in Bangladesh, categorising them into various stakeholder groups while identifying their focal areas and roles in tobacco control (Appendix 4: Chapter 9- Supplementary Tables: Table S23, pp 236-237). Drawing on this stakeholder map, SMA and RH compiled an initial list of interviewees using publicly available information and their familiarity of tobacco control policy environment in Bangladesh, further supplemented by 'snowball' sampling through networks and referrals from other interviewees. We conducted 20 in-depth stakeholder interviews across five groups: Policymakers (n=5), Nongovernmental Organizations (NGOs) (n=5), Researchers (n=2), International Agencies (n=3), and Advocacy Networks (n=5). Tobacco control in Bangladesh includes policymakers enforcing laws, NGOs raising awareness, and international agencies providing support. Researchers inform policies, while advocacy networks push for stricter regulations, collectively striving to reduce tobacco use. We

aimed for balanced representation across groups, ensuring a breadth of experiences while maintaining gender inclusivity in participant selection. Ethics clearance was approved by the Health Sciences Research Governance Committee (HSRG), University of York, UK with reference HSRGC/2024/636/E: Regulation and monitoring of illicit smokeless tobacco (Appendix 4: Chapter 9-Supplementary Files: Ethics Decision Letter, pp 234-235).

9.2.2 Process, Tools and Data Collection

Researchers (SMA, RH) familiar with tobacco control environment in Bangladesh approached potential participants, introducing themselves and their research roles. They explained the research purpose and invited participants via email, providing written information on the scope of interviews. Interested individuals were then contacted to schedule interviews at their convenience, either in person (n=18) or via Zoom (n=2). RH followed up the email invitations by phone, while SMA conducted all the interviews. Participants were assured of confidentiality and received a second information sheet, with details about the research, the interview process and an explanation of their rights. Interview participation was voluntary. Written consent, including permission to record, was obtained from all participants prior to the commencement of the interviews. Verbal consent was recorded for those who participated online.

We (SMA, KS, MK) developed the information sheet, consent form and interview guide (Appendix 4: Chapter 9-Supplementary Files: Participant Information Sheet, Participant Consent Form, In-depth Interview Guide, pp 224-233) in English and translated these to Bengali (SMA, SH). The interview guide was informed by the established framework to control illicit tobacco provided by WHO Protocol to Eliminate Illicit Trade in Tobacco Products (ITP).(WHO, 2012a) Interviews were semi-structured and the guide was organised around three domains: i) awareness about non-compliance and illicit ST; ii) specific packaging non-compliances related to health warning labels, price and sale statement disclosure, misleading descriptors and visible tax marker, policies and enforcement; and iii) supply chain control and international collaboration to curb non-compliance and illicit ST in Bangladesh. We pre-tested the interview guide with one tobacco control researcher (representing the research group) and one advocate (representing advocacy networks) to ensure clarity and relevance.

Data were collected from July 2024 until September 2024. Interviews lasted between 26 and 82 minutes (averaging 51 minutes). Participants had an average of over 16 years of experience in tobacco control engagement. After conducting the initial five interviews, SMA reviewed the recordings of each subsequent interview, noting discussion topics to identify emerging themes. Interviewing continued until two consecutive recordings revealed no new themes, at which point we determined that data saturation had occurred.(Guest, Namey and Chen, 2020; Jassim and Whitford, 2014) A demographic table of the participants is provided in Appendix 4: Chapter 9-Supplementary Tables: Table S24, pp 238-239.

9.2.3 Data Analysis

All interviews were conducted in Bengali, anonymised, transcribed (verbatim) by a professional transcription service, and then translated into English. SMA and SH, with tobacco control research experience in Bangladesh, cross-examined the transcripts to enhance rigour and ensure that data retained the local context.

Framework analysis was used to analyse the data as it enabled a structured and systematic approach to analysing a relatively large data set, following the steps described by Gale et. al (2013).(Gale et al., 2013) An initial coding framework based on the topic guides and research questions was developed by SMA – this included broad domains and sub-categories. Following multiple readings of the transcripts and in discussion with SH and later HMJ the frameworks were refined and organised in Microsoft Excel. Subsequently SMA “charted” the data (summaries, extracts and quotes) from each individual interview onto the “framework” in Microsoft Excel. The Excel sheets were organised according to domains and stakeholder groups, this allowed for comparison across stakeholders. The final stage involved interpreting the data. At this stage the codes were combined to highlight the “key findings” (labelled as “themes”) under each broad domain. SMA reviewed the framework and wrote summaries for each theme by scrutinising the charted interview data and considering the perspectives of different stakeholder groups. The summaries included descriptions, backed up by data and quotes. The summaries were reviewed and discussed with HMJ and reviewed again. The write-up of the themes was subsequently refined, combined and shared with the wider team. We followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) for reporting the results of the study.(Tong, Sainsbury and Craig, 2007)

9.3 Results

The findings are organised into three primary domains, each encompassing several themes that emerged from the interviews (Table 14).

Table 14: Domain and themes for data analysis

Domains	Themes
Non-compliance and illicit ST awareness	1. Poor monitoring and weak enforcement caused high ST non-compliance 2. High ST non-compliance is a low policy priority
Specific packaging non-compliances, policies and enforcement	3. Packaging diversity, regional strategies and implementation gaps lead to non-compliance in ST packaging 4. Tobacco control law did not address ST diversity, causing enforcement gap 5. Involving local government can enhance monitoring, yet the government's commitment has not been forthcoming
Supply chain control and international collaboration	6. Policy amendments mandating standard packaging, licensing, and strengthening National Tobacco Control Cell (NTCC) can improve supply chain monitoring 7. There is a need for international collaboration to enhance ST compliance

9.3.1 Non-compliance and illicit ST awareness

9.3.1.1 Theme 1: Poor monitoring and weak enforcement caused high ST non-compliance

Research participants from all stakeholder groups exhibited a comprehensive awareness (established through their understanding of the concepts and insightful statements) of non-compliance and illicit ST products in Bangladesh. While the information regarding packaging non-compliance and the disparity between smoking and ST was shared, there was consensus that the prevalence of non-compliant ST is considerable and exceeds that of smoking tobacco in the country. Some participants considered the reported rate of over 90% ST non-compliance as alarming and a threat to successful tobacco control

"It is very surprising to me, I thought it would be more than 50% for sure, but I didn't expect that it would reach as high as 90%. It's very alarming....This industry is not regulated....., 90% non-compliance is extreme." (PM-4, 42 years male, 7 years of tobacco control experience)

Participants commonly attributed high ST non-compliance to insufficient monitoring and enforcement compared to smoking tobacco, which stemmed from informality of ST market, lack of registration, and general cultural acceptance of ST in Bangladesh.

"ST produced in Bangladesh (i.e., Zarda or Gul).....there exist numerous small ST industries. Someone can start doing ST business at their household level by buying a small machine. So, there is a huge informal ST sector. This informal sector is kind of out

of control. The system of making these ST companies compliant is absent. (IA-1, 65 years male, 21 years of tobacco control experience)

Alongside these conventional reasons, policymakers contended that there was an inadequate integration of ST in the tobacco control law, a low entry barrier for ST manufacturing and high costs of enforcing compliance which impeded regulatory agencies from stronger enforcement.

“...the entry barrier is very low here and also the cost of ensuring compliance is very high for ST. For these two reasons, it’s natural that non-compliance in ST...” (PM-4, 42 years male, 7 years of tobacco control experience)

Participants from advocacy networks highlighted western influences on Bangladesh's tobacco control advocacy and movement which primarily focussed on smoking tobacco, sometimes at the expense of ST.

"We prioritise smoking tobacco more than ST. We are biased towards Western influence. ST is not seen much in Western countries....problems such as oral cancer are not an issue there. The international tobacco movement is Western-influenced. Hence, we always fail to bring our ST problem to the forefront.” (AN-1, 64 years male, 27 years of tobacco control experience)

9.3.1.2 Theme 2: High ST non-compliance is a low policy priority

It was acknowledged that addressing non-compliance and illicit ST requires specialised knowledge to make informed decisions. However, participants reported that tobacco control activists and researchers show little interest and limited knowledge about ST non-compliance.

"If we look at the tobacco control activists involved with this sector, we will see that they lack interest in ST. They also lack knowledge on illicit and non-compliant ST....researchers probably lack the mandate to focus non-compliant ST...policymakers don't even bother." (NGO-5, 37 years male, 10 years of tobacco control experience)

It was believed that policymakers and researchers often prioritise cigarettes over ST due to global campaigns focused on smoking, necessitating ongoing sensitisation of policymakers who do not effectively address ST non-compliance and taxation issues. This was reported to concern three perspectives: public health (the public health perspective of tobacco control in Bangladesh-safeguarding people from second-hand smoking), revenue (limited strength of National Board of Revenue (NBR) challenges regulating

uncountable informal ST manufacturers and being a low relative return in terms of revenue) and attitude (cultural acceptance of ST and mainly consumed by rural poor women whose health issues are often neglected).

"Policymakers are focused more on cigarettes. The main purpose of tobacco control in Bangladesh is public health and saving people from tobacco....cigarettes has second- and third-hand effects. ST products have a significantly lower amount of such risks.....This might be a reason behind such reluctance towards ST products....The taxation authority also doesn't give much importance to ST products due to their comparatively low amount of revenue." (RE-1, 47 years male, 21 years of tobacco control experience)

"...ST is mainly consumed by poor women....hence, ST is totally undermined. So, there is a social context to this. Women are neglected. Poor women are even more neglected. Nobody cares if they live or die. Their health issue is nobody's concern." (PM-1, 71 years female, 18 years of tobacco control experience)

According to participants, ignoring ST non-compliance hinders Bangladesh's tobacco control success. However, a disjointed regulatory framework, limited jurisdiction, fragmented responsibilities and low perceived tax return resulted in ST being a low policy priority. It was highlighted that the disproportionately high ST prevalence among women and in rural areas poses a significant health concern, making the control of non-compliance and illicit ST a priority. It was reported ensuring compliance and addressing illicit ST must become a policy focus.

"It should get the topmost priority in the tobacco control discourse. It's the only area that hasn't received any policy advocacy attention yet since 2015. I don't know whether any discourse took place about that before. From a tax perspective too, this should be given importance....We need to see whether we are getting the due tax revenue from ST." (NGO-5, 37 years male, 10 years of tobacco control experience)

9.3.2 Specific non-compliances, policies and enforcement

9.3.2.1 Theme 3: Packaging diversity, regional strategies and implementation gaps caused non-compliance in ST packaging

Participants identified significant challenges in compliance with health warning labels, price and sale statement disclosures, misleading descriptors, and visible tax markers. They unanimously agreed that packaging and labelling non-compliance in ST products is widespread and notably higher than that in smoking tobacco. This disparity was attributed to regulatory differences with ST products – as it was often considered a small cottage industry, thereby evading strict oversight. Additionally, participants emphasised that

manufacturers intentionally remain non-compliant with health warning labels to avoid deterring sales.

"If you notice the packet of Zarda or Gul, you will see that the image of the owner is more visible on the packet than the health warning labels. Probably, the manufacturers intentionally make the health warning labels less visible....If the manufacturers use these photos more visibly on ST products, it may affect their sales....They have no reason to use these images willingly....there's weakness in terms of law enforcement and monitoring." (RE-1, 47 years male, 21 years of tobacco control experience)

Referring to low accountability of manufacturers due to no monitoring authority, most participants agreed that ST non-compliance related to price and sale statement disclosure was mainly due to weak policy implementation. Manufacturers avoid mentioning prices on ST packs to exploit market conditions and evade taxes.

"Mentioning price and sale statement disclosure will take extra space. They want to use their own logo or image....Hence, they are reluctant. Tax evasion is a major reason for not mentioning price. If the price is not mentioned, then they can increase the price at any time they want." (IA-3, 45 years male, 25 years of tobacco control experience)

All participants shared similar perceptions about using misleading descriptors on ST packaging. In Bangladesh, ST products are specifically designed and marketed for distinct regions, with packaging reflecting local socio-cultural contexts. Most stakeholders agreed that this region-specific strategy, coupled with the use of misleading descriptors, allows ST manufacturers to effectively target specific customer bases through their cultural, religious, and social beliefs. Additionally, employing familiar and culturally resonant brand names makes these products seem more approachable and connects them to family and cultural traditions.

"You will see the image of a tiger on Gul packs. For women, there are Shova Zarda or Nurani Zarda. We once conducted research on ST product naming.....It's very interesting that it doesn't only include misleading descriptors but also creates an appeal for it in your mind." (PM-1, 71 years female, 18 years of tobacco control experience)

Participants noted that most ST manufacturers in Bangladesh evade taxes, with few registered brands disclosing production volumes through the self-declaration system.

"...our compliance monitoring team found 430 ST brands...The NBR representative replied that only 20 brands were registered to pay tax. They pay tax via the self-declaration method.....Due to self-declaration in the case of ST, the companies can get away from paying high taxes by declaring a low amount of output." (RE-2, 46 years male, 14 years of tobacco control experience)

Participants reported that in Bangladesh, explicit tax marker for ST is absent due to regulatory weaknesses, implementation challenges, and the manufacturers influence on policymakers through local leaders. There is a lack of clear legal provisions for tax marker on ST products. Additionally, the informal nature of the ST market complicates the identification and regulation of manufacturers. Furthermore, legal loopholes in various frameworks, including environmental and labour laws, further benefit ST products. For instance, weak labour laws and limited chemical use regulations allow informal ST manufacturers to exploit underage labour and use hazardous ingredients while manufacturing, respectively. While the regulation of ST involves multiple agencies, there is no clear ownership or accountability and there was reported a significant knowledge gap within regulatory agencies about the dynamics of the ST market.

"The law has various loopholes that benefit the ST products. Band-roll, labour law, cottage industry, environmental law, etc. have created a safe haven for ST business. Hence, ST is not included in NBR, NTCC, Directorate of National Consumer Rights Protection, etc. None of them can reach ST. Ultimately, it has no regulation...due to multi-sectoral involvement, nobody feels any responsibility..... The government has no technical knowledge, monitoring, or capacity regarding ST's business marketing pattern... There exists a knowledge gap " (IA-2, 54 years male, 25 years of tobacco control experience)

Participants proposed a multifaceted approach to enhancing ST packaging compliance. Essential proposed steps included: identifying non-compliant manufacturers, implementing market-based monitoring, implementing an obligatory registration and licensing system integrated with local governments, and enforcing ST wholesale markets (instead of only retail).

"We need an innovative approach to address the issue...we need to look at the marketing chain. The companies don't give the products directly to the retailers. There are wholesalers....The law enforcement authority can do a backward intervention in the supply chain and monitor the wholesalers of ST products. (IA-1, 65 years male, 21 years of tobacco control experience)

It was highlighted that a unified effort across ministries, civil society and activists is required and an effective collaboration among the task force committees for tobacco control is needed.

"No single ministry or wing can pull it off singlehandedly...There are four task force committees (national, divisional, district, and upazila) under the tobacco control law. All these task force committees must work actively....we have to unite all the ministries, civil society organisations, and activists to determine a roadmap." (RE-2, 46 years male, 14 years of tobacco control experience)

Considering standard packaging a fundamental step, participants emphasised the creation of a new “schedule” (approved list) of various ST and a specialised tax policy to implement tax marker on ST packs. There is also a need for stronger advocacy to showcase ST’s tax potential.

“We must create a new ‘schedule’ of authorised and unauthorised ST... we can create a separate policy for ST... NBR doesn’t prioritise ST as a tax area. It’s a failure of our advocacy campaign. We have failed to make them understand that it has huge potential as a tax area...The packaging issue is fundamental here.” (PM-5, 42 years male, 15 years of tobacco control experience)

9.3.2.2 Theme 4: Tobacco control law ignored ST diversity, causing enforcement gap

While participants from international agencies deemed the legal tobacco control framework adequate, those from policymakers, NGOs, researchers, and advocacy networks agreed that the current law inadequately addresses ST diversity in Bangladesh. It was felt it should provide clear guidelines on ST packaging, including specifications for type, material, and design to enhance regulation.

"It's (Tobacco Control Law) not comprehensive. The ST products are exempted from many of the compliance laws. In the tobacco control law, we are more concerned about smoke-free public space than non-compliance of ST." (NGO-4, 57 years male, 26 years of tobacco control experience)

Regardless of their professional group, nearly all participants indicated a substantial enforcement gap for ST. They argued for stronger regulatory measures, enhanced monitoring, and more effective enforcement strategies.

"Our tobacco control law’s enforcement is almost non-existent for ST...You can ask the Ministry of Health regarding the amount of fine earned by enforcing the tobacco control law. You will get no information. Because there is law, but its enforcement is not taking place." (AN-5, 37 years male, 9 years of tobacco control experience)

Concerning ST regulation, the current “mobile court” (mobile judicial unit led by executive magistrates that visit locations to deliver prompt justice for minor offences) is limited in both scope and impact as it primarily enforces section 5 (tobacco advertisement) of the tobacco control law. Participants indicated that section 10 (addressing ST packaging compliance) is seldom enforced. Furthermore, the personal motivations of local administrative officials, due to the sensitisation of tobacco control

advocates, often influence the frequency and effectiveness of mobile courts, leading to inconsistencies in enforcement.

"The coverage (of mobile courts) is not much. If the district commissioner or executive magistrate of a district is personally motivated (due to influence or good relations with tobacco control advocates), then mobile courts in those areas are more frequent and consistent. Unfortunately, most of the mobile courts are conducted according to Section 5 of the law. It's concerned with tobacco advertising. There is rarely any mobile court on Section 10 of the law." (IA-3, 45 years male, 25 years of tobacco control experience)

9.3.2.3 Theme 5: Involving local government can enhance monitoring, yet the government's commitment remains a hurdle

Participants from various stakeholder groups identified several obstacles to enhancing the monitoring of ST non-compliance. Due to the local administration's low prioritisation of tobacco control, the task force committees for surveillance were unable to achieve their intended objective of ensuring compliance with tobacco control laws.

"The (tobacco control) task force committees are not being able to make the least possible contribution towards the goal it was meant to achieve and the purpose it was meant to serve. The local administrative leaders (i.e., TNO, DC) of the task force committees give the least priority to tobacco control. The task force committees should have monthly meetings. But this meeting often gets included in other meetings and gets discussed only for 2-5 minutes...the meeting only discusses cigarettes during the 2-5 minutes it gets. ST doesn't get mentioned." (RE-1, 47 years male, 21 years of tobacco control experience)

Insufficient government commitment, in addition to ST's informality, lack of registration and licensing, and regulatory agencies' resource limitations, were major barriers to ST regulation enforcement.

"The government lacks commitment. Due to the low amount of tax revenue earned from ST, NBR doesn't prioritise it either. Even if there are mobile courts, cigarettes are given focus...this is the main obstacle" (NGO-1, 49 years male, 15 years of tobacco control experience)

Furthermore, the NTCC, which is pivotal in regulatory efforts, faces significant challenges, such as insufficient dedicated staff and a reliance on project-based personnel.

"NTCC does not have its own staff anywhere in Bangladesh. It's mainly run by project staff...Digital monitoring is required." (IA-3, 45 years male, 25 years of tobacco control experience)

Participants considered the unutilised government network at the local level as important facilitator for enhanced monitoring of ST. Furthermore, they emphasised that with the widespread use of smartphones, authorities could leverage digital tools to capture and report non-compliant ST products, thereby enhancing surveillance capabilities.

"The local government can be involved here. Each local government should maintain and monitor the ST factories and point of sale under their jurisdiction area...There can be separate ST licensing, which is to be obtained from the local government...We have around 30,000 elected ward members in the local government....They can function as health vigilance workers." (PM-5, 42 years male, 15 years of tobacco control experience)

"For packaging, we can think of introducing web or app-based monitoring. Then our sanitary inspectors can update their daily reports on the DGHS website. They can do it from their mobile...We should develop an easy and simple mechanism that can be used by everyone from their device." (IA-3, 45 years male, 25 years of tobacco control experience)

9.3.3 Supply chain control and international collaboration

9.3.3.1 Theme 6: Policy amendments mandating standardised packaging, licensing, and strengthening National Tobacco Control Cell (NTCC) can improve supply chain monitoring

There was a broad consensus across participant stakeholder groups that Bangladesh's tobacco control law, particularly regarding ST, requires significant revisions. They stressed the need for a tobacco tax policy and a specific section for ST within tobacco control law. Participants called for standardised packaging for ST products and measures to curb loose sales. They noted that recommendations for law amendments often come from international donors and consultants who might ignore the unique local context. Participants recommended prioritising ST in the government's operational framework and establishing an autonomous organogram for NTCC for empowerment.

"We can't expect much in the proposed amendment (tobacco control law) regarding ST...the tobacco control law hasn't been developed keeping the ST in mind....our draft proposals are being submitted via donors...who check to see whether it meets the international standard. They don't have ST in mind...as a result, we lose the Bangladesh context." (NGO-4, 57 years male, 26 years of tobacco control experience)

"Under the tobacco control law, NTCC should be allowed to function as an autonomous or semi-autonomous organisation. It will be a big step forward towards tobacco control." (RR-1, 47 years male, 21 years of tobacco control experience)

Participants suggested that effective collaboration between the NTCC, the NBR, and local government would enhance ST regulation and ensure a sustainable model for monitoring non-compliance. The majority of participants advocated for a multi-sectoral approach, recognising that tobacco control is not the responsibility of a single ministry.

"...it's not the responsibility of a single ministry...Multiple ministries are involved with the tobacco control law. The Ministry of Commerce, Agriculture, Industry, etc. are involved. You can't be dependent on the Ministry of Health alone...we need a multi-sectoral approach here." (PM-1, 71 years female, 18 years of tobacco control experience)

9.3.3.2 Theme 7: There is a need for international collaboration to enhance ST compliance

Participants suggested that lessons from neighbouring countries can be invaluable. They highlighted that collaboration to share successful strategies could bolster efforts against ST non-compliance. In addition to sharing lessons, participants agreed that the signing and ratification of the ITP would be essential for enhancing supply chain control and addressing ST non-compliance in Bangladesh.

"Structure and design of the usage of Bangladeshi ST products are different from the global practice. Hence, the policymaking and implementation are also different...We can learn from countries that have successfully regulated the usage of ST products....the experiences of neighbouring countries will definitely be helpful." (RE-2, 46 years female, 14 years of tobacco control experience)

"It's important to sign and ratify the ITP for Bangladesh...More or less those who are related with tobacco control and also among the local authorities, the knowledge gap regarding illicit tobacco exists. So, my personal opinion is government should pursue this ITP." (PM-4, 42 years male, 7 years of tobacco control experience)

Besides international collaboration, participants from NGOs and advocacy networks highlighted that donors funding tobacco control research should prioritise ST in Bangladesh. They stressed enhancing the awareness of global community and international understanding regarding ST non-compliance.

"In the FCTC and ITP, you will notice that ST didn't get priority...Hence, we need to think about the international understanding level...non-compliant ST should get international priority as well....overall, the global community is not concerned about ST." (NGO-4, 57 years male, 26 years of tobacco control experience)

9.4 Discussion

This study is the first, to our knowledge, to explore stakeholders' perceptions of the widespread non-compliance and illicit ST in Bangladesh with an aim to improve regulation and monitoring. ST is interwoven in Bangladesh's culture and social practices. It is particularly common among women, who may refrain from smoking due to social stigma. Despite the high prevalence of ST use and widespread stakeholder awareness of ST non-compliance, we found that regulation and law enforcement remain a low priority. Our findings indicate that this may be largely due to policymakers and enforcement agencies primary focus on smoking tobacco, neglecting ST. This was reported to be largely due to the tobacco control advocacy movement driven by funds from a more "Western-centric" perspective emphasising smoking tobacco, through initiative excluding ST such as "smoke-free laws" and "cigarette taxation". While such efforts are no doubt important, they are often non-inclusive, neglecting ST regulation in the local tobacco control efforts. Another issue highlighted by participants in the research was that ST products and packages are diverse, creating difficulty in implementing packaging rules and the existing fiscal instruments. The informal nature of the ST market itself makes ST regulation and enforcement difficult. Several recommendations were made by the research participants, with the engagement of local government for licencing and monitoring regarded as efficient and sustainable for addressing ST non-compliance.

Our findings indicate that the regularity disparity between smoking and ST aligns with a broader narrative, with similar disparities reported in Southeast Asia and Africa.(Kengadaran and Anusha, 2020; Siddiqi et al., 2017; Mehrotra et al., 2019) This misalignment is attributed to cultural and social factors, policymakers being lenient to ST regulation, and global influence on tobacco control policy priorities. The smoking-focused Western tobacco control movement is considered an impediment to advancing tobacco control policies for ST in Southeast Asia.(Siddiqi, Arora and Gupta, 2023) ST's deep-rooted cultural acceptance, especially among rural poor women appears to perpetuate its low policy priority in Bangladesh.(Siddiqi et al., 2016a; Hossain et al., 2014) Public health issues of rural poor women receive less policy attention due to their weak political representation. Existing research shows an underrepresentation of women's health concerns in tobacco control discourse in other countries leading to ST's policy neglect, which also appears to be the case in Bangladesh.(Moore et al., 2009) The broader association of tobacco use with poverty may also help to understand ST's low

priority in the context of Bangladesh – particularly given its association with rural areas.(Moore et al., 2009)

This research concurs with our earlier research which found the informal nature of ST market, further complicating regulation, enforcement of any regulation and overall accountability.(Abdullah et al., 2022b) Informality and a lack of licensing make regulation of ST difficult and a low priority in countries such as Bangladesh.(Huque et al., 2017, 2021, 2024a; Nasiruddin et al., 2019) ST is decentralised, small-scale and often mobile; the lack of mandatory licensing for ST businesses means they are often unlicensed making regulation and enforcement of ST difficult. Similar difficulties are observed in neighbouring countries, India and Pakistan.(Khan et al., 2014; Siddiqi et al., 2020b; Yadav et al., 2018) Tracking and tracing manufacturers and their products is challenging under such structures – and regulatory agencies such as the NBR and NTCC lack the technical knowledge, tools and workforce to monitor and regulate the ST market effectively.(Huque et al., 2024b) Hence mapping of ST manufacturers and developing a surveillance system for effective regulation is recommended in other studies.(Huque et al., 2017) However, fragmented responsibilities and lack of coordination among regulatory bodies is also emphasised in other research,(Huque et al., 2024b) hence hindering comprehensive regulation and complicate enforcement. This is similar to other contexts, for example in Kenya and Indonesia it was reported that unclear roles and responsibilities of regulatory agencies were considered as an impediment for successful implementation of tobacco control policy.(Astuti, Assunta and Freeman, 2020; Mohamed et al., 2018)

With the current system, the regulation of non-compliance and illicit ST in Bangladesh faces unique challenges due to its cultural acceptance, market informality and limited policy attention. Addressing these challenges would require a centralised and multi-faceted approach. Raising ST focus advocacy, strengthening supply chain monitoring regulatory frameworks and improving compliance mechanisms through systematic monitoring and surveillance is essential. Policy amendments are needed to address ST heterogeneity in product and packaging. Additionally, a tobacco tax policy should be in place. Standardised packaging with a digital tracking system should be introduced to ensure supply chain compliance and improve surveillance. The importance of such policy step for high ST burden countries is reported in other studies.(Yadav et al., 2018, 2020) Licensing for tobacco retailing assist in enhancing compliance with tobacco control laws.(He et al., 2024; Melody, Martin-Gall and Veitch, 2021; Ross et al., 2015; Tauras et

al., 2007) Accordingly, the licensing and registration for ST manufacturing and business should be obligatory with a central database, a policy recommendation also endorsed by other research.(Huque et al., 2021)

Engaging local government in licencing and monitoring was suggested by stakeholders in the research as an efficient and sustainable way to address ST non-compliance. NGOs involved in tobacco control advocacy can voluntarily support local government in improving monitoring and surveillance. Instead of sole reliance on a “mobile court” system, expanding enforcement authority to local governments and introducing stricter penalties for non-compliance, targeting both manufacturers and wholesalers is recommended. By leveraging lessons from smoking tobacco control and international best practices, Bangladesh can build a more robust and equitable system to regulate ST. Participation in the ITP is imperative and would strengthen efforts in this regard. Existing research in Bangladesh also emphasises on the importance of collaboration with neighbouring countries to address non-compliant and illicit ST.(Naznin et al., 2021) Furthermore, research and advocacy must occur to ensure equitable focus on ST issues within the international tobacco control movement. Policy design based on assumptions for tobacco control in high-income countries might not be true for low-middle income countries (LMICs).(Siddiqi, Arora and Gupta, 2023) Thus, tobacco control funders should consider the local contexts when establishing tobacco control research and advocacy priorities in ST-burdened LMICs.

We acknowledge some weaknesses in this research. A potential limitation is the unequal gender balance of participants interviewed, with only 2 of the 20 participants being women. This reflects the gender disparity in the tobacco control movement in Bangladesh. However, the vast experience of the participants and the rich information substantiates this limitation. Application of collaborative coding and use of verbatim quotes with persistent observation made the findings credible for country and context. However, they might not be fully transferable to other LMICs. The strength of the research is that through such in-depth qualitative research enabled a deep understanding of issues related to ST regulation and enforcement in Bangladesh from a diverse range of perspectives.

9.5 Conclusion

Although Bangladesh is overburdened with ST, unlike the policy and advocacy attention for smoking, ST control receives little priority from researchers and policymakers. The findings from this research contribute to the understanding of systematic barriers to control of ST non-compliance in Bangladesh. By identifying the interplay between policy gaps, enforcement challenges, and distinct market dynamics, this study can enrich frameworks on regulatory compliance for ST. Standardised packaging, registration and licencing and engagement of local government for monitoring and surveillance would be the key to address Bangladesh's high ST non-compliance. Innovative and evidence-based approaches need to be implemented. While the generalisability of the findings is limited, other LMICs especially from Southeast Asia facing poor ST compliance can learn from the findings.

Part IV – Overall summary and conclusions

The fourth and final part of the thesis contains the overall summary and conclusions. It includes one chapter that synthesises the main findings from the interpretative research chapters. This is followed by a discussion of policy and research implications, along with the strengths, limitations, and overall contributions of the research. The section concludes with final remarks.

Chapter 10: Summary and Conclusions

Chapter 10 titled as “Summary and Conclusions” has four sections. Section 1 titled summary of interpretative research chapters provides the summary findings from the four research chapters that intend to answer the research questions. Section 2 contains the implications including both research and policy implications. Strengths, limitations and research contributions are discussed in section 3. Finally, section 4 contains the limitations.

10.1 Summary of substantive research chapters

10.1.1 Study I: Methods followed and Magnitudes Estimated for Illicit Trade in Tobacco in LMICs

This systematic review synthesised findings from 48 studies across 39 LMICs, with the majority of evidence coming from Asia to estimate the share of illicit tobacco trade and examine the methodologies used. Pack analysis produced lower estimates of the share of illicit tobacco (14.0%; 95% CI: 10.0–18.6) than gap analysis (21.1%; 95% CI: 11.0–32.8), with an overall estimate for smoking tobacco at 14.4% (95% CI: 10.5–18.9). In contrast, the share of illicit ST, reported in only three countries through two studies, was substantially higher (86.9%; 95% CI: 51.1–100.0). Studies funded by industry or undisclosed sources exhibited higher illicit estimates and mostly applied gap analysis. Most studies utilised indirect indicators like packaging compliance or price thresholds, with limited reliance on tax stamp verification, especially in independently funded research. Quality assessment indicated a moderate risk of bias in most studies, with industry-funded studies more often rated as high risk. Small study effects were not evident, suggesting minimal publication bias in meta-analysis.

The review noted considerable variability in the estimates of illicit tobacco across 39 LMICs, influenced by factors such as tobacco type, funding source, and method employed. Pack analysis generally yielded lower estimates than gap analysis, and independently funded studies showed more methodological rigor than those funded by the tobacco industry. While smoking tobacco, especially cigarettes, dominated the literature, smokeless tobacco is extremely understudied despite its widespread use and high disease burden. Accordingly, it emphasises the need for more independent, high-quality studies, particularly on smokeless and novel tobacco products in LMICs. Many studies lacked robust methodologies due to the absence of systems like tax stamps and track-and-trace. The review underscores a gap in high-quality evidence, especially for smokeless tobacco and in countries that ratified the illicit tobacco protocol, calling for broader, more consistent research efforts and improved data systems in LMICs. Although the results remain affected by heterogeneity and moderate study quality, a comprehensive search strategy, broader inclusion and stratification by tobacco type, estimation method and funding source provided a more nuanced understanding of the illicit tobacco trade in LMICs.

10.1.2 Study II: Magnitude and Pattern of Illicit Cigarette sold as Retail in Bangladesh: A Pack Analysis Approach

This study analysed 24,363 cigarette packs collected from two sources (retail shops and litter) across eight administrative districts (Comilla, Chapainawabganj, Dhaka, Maulavibazar, Mymensingh, Patuakhali, Satkhira, and Thakurgaon) with urban-rural and border-nonborder stratification. Results showed that 5.62% (95%CI: 4.3-7.1) of the collected packs in the sampled districts were illicit, primarily due to domestic tax evasion (5.32%; 95%CI: 5.04-5.60) rather than packaging non-compliance (0.77%; 95%CI: 0.4-1.4). Most illicit cigarette packs were compliant in packaging but evaded tax. This feature was consistent across administrative and border-non-border locations and price segments. Rural and border areas, and particularly Maulvibazar and Patuakhali district, exhibited higher proportion of illicit cigarette packs. Low-price segment cigarettes showed the highest proportion of illicit, and littered packs consistently had more illicit proportion than retail-sourced packs. While nearly all packs adhered to packaging regulations, the study found that using packaging compliance as a proxy for detecting tax evasion was highly specific but not sensitive, correctly identifying 99.71% (95%CI: 99.6-99.8) of tax-paid packs, but only around 9.26% (95%CI: 8.9-9.6) of tax-evaded ones. Cigarette price segments and the type of retail shops emerged as significant factors for cigarette tax evasion in the estimation of odds ratios. Low-price cigarettes (OR: 3.48; 95%CI: 2.10-5.75) and those sold in unconventional shops (OR: 1.99; 95%CI: 1.12-3.54), were more likely to be tax evaded than high-price cigarettes and those sold in formal shops, respectively.

Bangladesh's illicit cigarette share remains relatively low. The study confirmed that domestic tax evasion, particularly in low-priced segments, in specific administrative districts and in unconventional retail shops drive the majority of illicit cigarettes. Administrative disparities, weak enforcement, and the absence of licensing for cigarette retailers contribute to this pattern. The findings also emphasised the limited utility of packaging compliance as a sole monitoring tool and advocate for the urgent implementation of a digital track-and-trace system. Additionally, Bangladesh's delayed ratification of the WHO FCTC Illicit Trade Protocol is an impediment. Despite the relatively low share, the findings highlight the need for sustained policy action and strengthened enforcement to prevent further growth of illicit cigarette trade in Bangladesh.

10.1.3 Study III: Estimating the illicit tobacco trade in Smokeless Tobacco Market: An Exploratory Study from South Asian Countries

This multi-country study assessed the compliance of ST packaging with existing national packaging and labelling regulations in Bangladesh, India, and Pakistan. The lack of explicit tax markers (e.g. tax stamps) for ST packs necessitated the use of packaging compliance as a proxy indicator for identifying illicit products. A total of 116, 41, and 64 unique ST packs were collected from Bangladesh, India, and Pakistan, respectively. The analysis revealed substantial cross-country variation in product types and packaging forms, with Zarda dominating in Bangladesh, Paan Masala with Tobacco in India, and Naswar in Pakistan. High non-compliance was observed across all countries, particularly regarding use of misleading descriptors, missing manufacturer details, price disclosure, and health warnings. PHW were absent or undersized in 84.4% (95%CI: 76.6-90.5) of Bangladeshi and 92.6% (95%CI: 80.1-98.5) of Indian packs, and entirely absent in Pakistan. In Pakistan, the absence of ST-specific legal standards limited the assessment of compliance, though none of the products adhered to the WHO FCTC guidelines. Based on at least one packaging violation criterion, 92.2% (95%CI: 85.8-96.4) of ST products in Bangladesh and 92.6% (95%CI: 80.1-98.5) in India were classified as illicit, while 100% (95%CI: 94.4-100.0) of products in Pakistan exhibited non-compliant features.

The findings highlighted widespread non-compliance with ST packaging regulations in Bangladesh, India, and Pakistan. While legal frameworks exist in Bangladesh and India, weak enforcement undermines their effectiveness; Pakistan lacks ST-specific policies altogether. Despite WHO FCTC signatories, all three countries demonstrated inadequate regulatory oversight and enforcement in the ST market, relative to the better-regulated smoking tobacco market. The fragmented, informal ST supply chain and the absence of standardised packaging regulations and tracking systems exacerbate regulatory challenges. Thus, there is need for formal integration of ST markets into regulatory frameworks, standardised packaging laws, and strengthened surveillance and enforcement mechanisms. The results highlight an urgent need for comprehensive, context-specific ST control policies.

10.1.4 Study IV: Improving the Regulation and Monitoring to Control the Non-compliance and illicit ST in Bangladesh: A Qualitative Study

This qualitative study explored tobacco control stakeholders' perceptions of widespread non-compliance and illicit ST in Bangladesh to enhance regulatory efforts. The findings highlighted complex challenges in regulating ST non-compliance, stemming from regulatory gaps, limited policy prioritisation, and a robust informal market. All stakeholder groups acknowledged a strong awareness of ST non-compliance, attributing it to poor monitoring, weak enforcement, and inadequate integration of ST within the national tobacco control framework. The informal nature of ST production, often small-scale and unregistered, along with socio-cultural acceptance and minimal government interest, has led to low policy priority for ST compared to smoking tobacco. Key issues included packaging non-compliance, diverse regional marketing strategies, misleading descriptors, and the absence of clear legal provisions for tax markers and standardised packaging. Stakeholders criticised the lack of specific regulations for ST diversity in existing laws and pointed out enforcement weaknesses due to fragmented responsibilities and institutional capacities. Although local governments could play a crucial role in ST monitoring, they remain underutilised due to low political commitment and inadequate coordination.

Bangladesh's tobacco control efforts disproportionately focus on smoking tobacco despite high ST prevalence. There is a pressing need to prioritise ST issues within the national and global tobacco control agenda, as policies from high-income countries may not be applicable to LMICs like Bangladesh. Key recommendations include obligatory licensing, standardized packaging, and enhanced local government engagement to improve ST regulation. Addressing ST non-compliance necessitates systematic reforms and a comprehensive regulatory framework with inter-agency coordination. Strengthening agencies like NTCC and NBR, learning from regional best practices, and ratifying the ITP are crucial for enhancing supply chain transparency and international cooperation to combat ST non-compliance.

10.2 Research implications

This thesis identifies significant regulatory and evidential gaps regarding ITT in LMICs, particularly focusing on Bangladesh. It delineates the unique challenges posed by the ST informality in this context. Notwithstanding the establishment of the WHO FCTC ITP in

2012, comprehensive systematic evidence concerning the prevalence and dynamics of illicit tobacco remains lacking in many LMICs, including among the signatories of ITP. The absence of fiscal markings, such as tax stamps on tobacco packaging, has compelled researchers to depend primarily on packaging compliance as an indirect indicator of tax evasion. Therefore, there is an urgent need for standardised fiscal and regulatory instruments applicable to all tobacco types, currently overlooked in most national tobacco control policies.

In Bangladesh, since cigarette packs largely comply with packaging regulations, government can pursue further tax increases with minimal risk of inflating illicit cigarette markets. However, to sustain this progress, targeted interventions are needed, particularly enhanced regulatory oversight of informal retailers and cigarettes in the low-price segment, where the share of non-compliant and tax evaded cigarettes remains relatively higher. Simultaneously, there is a pressing need to enforce standardised packaging regulations for ST products and to amend existing tobacco control laws to reflect the product diversity within the ST market. Introducing mandatory registration and licensing systems for tobacco manufacturing and retailing, especially for ST would not only facilitate regulation but also help integrate these actors into formal monitoring systems. Strengthening collaboration between local and central authorities is essential for effective implementation.

Evidence on standardised packaging for ST remains limited globally, particularly in LMIC contexts. While standardised packaging represents a comprehensive regulatory approach, strengthening and enforcing PHWs, already partially implemented in neighbouring countries (e.g. India), may be a more feasible interim step in Bangladesh. Such phased implementation could support regulatory transition towards more comprehensive packaging standardisation. In practical terms, standardised packaging for ST would require harmonised specifications across diverse product forms (e.g. sachets, tins, plastic containers), including standardisation of pack shape, size, and material to facilitate correct placement and visibility of health warnings. Given the heterogeneity of ST packaging, regulations could define permissible packaging formats and materials, similar to approaches used for other tobacco products with varied packaging types such as cigars, where packaging diversity is documented and identified as a target for regulatory intervention.(Giovenco et al., 2022; Jensen et al., 2023) Evidence from Bangladesh suggests that standard cylindrical tin packs with defined dimensions and

minimum product quantities can improve the prominence and placement of PHWs on both sides of the pack, thereby enhancing noticeability and perceived harm.(Czaplicki et al., 2024) Similarly, studies from India demonstrate that standard pack formats, such as paper sachets or cylindrical tins with large, clearly printed warnings covering a substantial proportion of the pack surface can increase warning visibility and harm perception compared to existing heterogeneous packs.(Barker et al., 2025) Beyond structural standardisation, additional plain packaging measures, such as restricting colours, imagery, and branding elements, may be required to reduce product appeal and ensure that health warnings remain the most salient feature of the pack.

A structured licensing system for ST manufacturers, distributors, and retailers could further strengthen regulatory oversight and improve compliance with tobacco control laws. Licensing would require all actors in the ST supply chain to obtain formal registration linked to a centralised digital database, enabling routine monitoring, renewal requirements, and enforcement actions for non-compliance. Evidence from tobacco control suggests that licensing can reduce the density of retail outlets, limit access to illicit or non-compliant products, and improve accountability within the supply chain.(WHO, 2012a; Alebshehy, Asif and Boeckmann, 2023; Nagelhout et al., 2023) In contexts such as Bangladesh, where the ST market is characterised by fragmented production and a large informal retail sector, licensing could facilitate identification of manufacturers and vendors, support tax administration, and enable targeted inspections.(Siddiqi et al., 2016b; Khan et al., 2014) Operationally, such a system could be implemented through local government structures, with clear criteria for registration, periodic renewal, and penalties for non-compliance, including suspension or revocation of licences. Integration with digital tools—such as unique identification numbers or linkage with track-and-trace systems—could further enhance transparency and enforcement efficiency. Importantly, licensing could serve as a foundational mechanism to support other regulatory interventions, including standardised packaging, health warning compliance, and taxation measures, by ensuring that all actors within the supply chain are visible and accountable to regulatory authorities.

From a research perspective, these studies highlight the critical need for more robust, methodologically sound investigations into the prevalence and drivers of ITT, especially for ST and novel tobacco products. Given the limited availability of reliable data in many

LMICs, future research must prioritise the development of standardised measurement frameworks that can be replicated across diverse contexts. Furthermore, future research should focus on generating reliable, context-specific estimates of ITT and advancing global recognition of ST non-compliance as a public health priority. These implications call for a coordinated, evidence-based approach to policy, practice, and research to effectively address ITT and strengthen public health outcomes in Bangladesh and other LMICs.

10.3 Research Strengths

A major strength of this thesis lies in its comprehensive and mixed-method approach to examining the ITT in LMICs, with special focus in Bangladesh. It offers a strong, policy-relevant body of evidence by systematically analysing the scope and regulatory compliance of both smoking and ST. It provides a multidimensional and nuanced understanding of the illicit tobacco issue by combining a rigorous systematic review, quantitative analysis of cigarette packs data for Bangladesh, ST compliance assessments for Bangladesh and cross-country comparison, and in-depth qualitative stakeholder interviews.

The methodological rigor across all four studies enhances the reliability and validity of the findings. The systematic review utilised a clearly defined inclusion framework, exhaustive search strategies covering both peer-reviewed and grey literature, and objective selection procedures, including double screening and transparent exclusion criteria. Subgroup analysis, stratification of analysis based on type of tobacco and funding source, and statistical testing for small-study effects made the meta-analysis robust. Application of objective indicators (e.g. tax stamp legitimacy on cigarette packs and compliance of ST packs with regulations) strengthens internal validity. The large sample size of cigarette pack data and the inclusion of both urban and rural areas, as well as border and non-border regions, provide important contextual breadth to the findings. Additionally, the use of an established analytical framework (TPackSS) for the ST compliance assessment ensured the quality control and consistency. Application of collaborative coding and inclusion of diverse tobacco control stakeholders registered the comprehensiveness of qualitative data analysis. The thesis addresses significant evidence gaps by focusing on ST regulation, a relatively neglected area in global tobacco control discourse. It generated policy-relevant insights that can inform regulatory design,

enforcement mechanisms, and advocacy strategies not only in Bangladesh but also in other LMICs with similar tobacco control contexts. Collectively, the methodological diversity, policy relevance, and original contributions to both empirical data and conceptual understanding underscore the overall strength of this thesis.

10.4 Research Limitations

Despite its several strengths, the thesis has some inherent limitations. One constraint is the representativeness of the cigarette pack and ST pack data that limits the generalisability of the study findings. The cigarette pack data, although districts were selected randomly, did not have any sample from areas such as Chittagong Hill Tracts, Cox's Bazar, Teknaf, regions known for their proximity to illicit trade routes. Similarly, in the multi-country ST compliance study, data were collected from only two purposively selected administrative areas, which, although justified by high ST prevalence and diversity, limit the generalizability of the results to national levels. Additionally, since the data was cross sectional and collected at a single point in time the findings could not account for potential seasonal variation in ITT and could not track changes over time in response to policy shifts. Language restrictions in the systematic review may have led to the exclusion of relevant studies published in non-English languages, thus possibly narrowing the evidence base. Furthermore, in the qualitative study, the gender imbalance among participants, reflects broader structural issues within the tobacco control movement but also limits the diversity of perspectives captured. Classification challenges related to counterfeit and smuggled cigarettes exist and the findings of ST work rely on indirect measurement. These limitations highlight the need for more inclusive, longitudinal, and methodologically adaptive studies to further strengthen policy responses to address ITT.

A further consideration relates to the conceptualisation and measurement of ITT within this thesis. The operational definition of ITT relied primarily on observable indicators such as tax stamp legitimacy and packaging compliance, which, while methodologically practical in data-constrained settings, may not fully capture all dimensions of illicit trade (e.g. smuggling versus domestic tax evasion). The use of pack-based approaches provides objective and verifiable measures but may underestimate illicit trade where evasion does not manifest through observable pack features. Conversely, reliance on proxy indicators such as packaging compliance for ST introduces potential misclassification. These

methodological trade-offs highlight the need for strengthened data systems, including tax markers and track-and-trace mechanisms, and for future research to integrate multiple complementary approaches to generate more comprehensive and comparable estimates of ITT in Bangladesh and other LMICs.

10.5 Research contributions

This thesis contributes significantly to the tobacco control field, particularly in the area of illicit tobacco research. Since the establishment of the WHO FCTC ITP in 2012, there have been few attempts to assess the global prevalence of ITT in LMICs. The thesis represents the first systematic review of the ITT literature, providing updated prevalence estimates in LMICs and detailing the methodologies researchers have employed. The review is first ever of its kind that stratified the analysis based on the method of estimation, type of tobacco and funding source. It reveals the limited evidence in illicit ST research and the reliance on indirect measures of tax evasion in illicit tobacco studies due to the absence of fiscal markers. Furthermore, it underscores the scarcity of evidence across many LMICS. It also registered the importance of data record keeping system in LMICs in the context of LMICs.

The secondary analysis of cigarettes pack data provided the first ever independent estimate of the illicit cigarette for Bangladesh based on tax stamp legitimacy. Also, it provided the first ever evidence to reveal the structure of illicit and its pattern over administrative districts, urban-rural and border-non-border locations, and different price segments. Analyzing the specificity and sensitivity of packaging compliance in detecting cigarette tax evasion, it established the importance of implementation of explicit fiscal marker for the robust assessment of tax evasion and illicit tobacco. The secondary analysis of the ST data revealed the disparity in tobacco control regulation. There was no obligatory fiscal market on the ST packs. Besides Bangladesh (the main focus country in this thesis) considering the exploratory nature of the research question it included India and Pakistan in the analysis. This multi-country analysis is unique in the context of non-compliance and illicit ST in this region. It revealed the pervasive non-compliance in ST in the study countries.

For Bangladesh, while the cigarette packs were compliant, there was near total non-compliance of ST packs. Following, the thesis generated unique research evidence by

analysing qualitative interview data to identify the initiatives needed to improve regulation of illicit and non-compliant ST in Bangladesh. The findings contributed towards an in-depth understanding of the systematic issues that need to be addressed to control the high prevalence of non-compliant ST. The findings were unique as it registered the importance of integrating ST with the local government system considering its informality for ensuring the regulation besides introducing standard packaging and obligatory licensing. This is extremely important as this can be followed in other settings with a similar ST context.

10.6 Conclusion

ITT is a global concern that undermines tobacco control initiatives. LMICs face the adverse consequences of tobacco. Accordingly, this thesis examines ITT with a focus on LMICs, using Bangladesh as a case study. Inclusive of all types of tobacco, it attempts to update the evidence for LMICs, generate estimates for Bangladesh, and identify initiatives to improve regulations for more effective control. It was found that the share of illicit cigarettes in Bangladesh is primarily driven by domestic tax evasion. Packaging non-compliance is a more concerning issue for ST in Bangladesh than for cigarettes. The collective evidence from substantive research chapters suggest the followings:

1. LMICs must operationalise the WHO FCTC ITP through implementation of track-and-trace systems and tax stamp mechanisms, alongside expanded research on novel and ST products.
2. Bangladesh's relatively low level of cigarette tax evasion indicates room for further tax and packaging reform, including simplification of its tobacco tax structure and improved enforcement. Additionally, Bangladesh needs a comprehensive tobacco tax policy that would make the existing structure simplified and improve the tax administration.
3. The informal and culturally embedded nature of ST markets, coupled with weak regulatory enforcement, calls for policy prioritisation of ST control.
4. ST remains neglected in policy, advocacy, and research; addressing its widespread non-compliance requires standardised packaging, mandatory registration and licensing, and greater involvement of local governments in enforcement. Moving forward, innovative, evidence-based, and context-sensitive strategies are essential to reduce the burden of illicit tobacco in Bangladesh and other LMICs.

Appendices

Appendix 1: Chapter 6-Supplementary file

Search strategy

Database: Ovid MEDLINE(R) (1946 to July 16, 2023)

#	Searches	Results
1	Tobacco*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	151046
2	exp Tobacco, Smokeless/ or exp Tobacco Products/ or exp Tobacco Smoking/	17265
3	birri*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	8
4	beedi*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	89
5	zarda*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	116
6	naswar*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	56
7	gutka*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	143
8	khaini*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	66
9	hand rolled cigarette*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	72
10	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9	153180
11	(Tobacco* adj3 tax*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	1098
12	(value added tax adj3 tobacco*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	1
13	(vat* adj3 tobacco*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	1
14	(excise tax* adj3 tobacco*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	151
15	(surcharge adj3 tobacco*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	8
16	(import duty adj3 tobacco*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	1
17	(tobacco* adj3 tax evasion*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	8

37	(illicit* cigarette* adj3 market*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	28
38	(cigarette* adj3 tax evasion*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	6
39	(tobacco* adj3 tax evasion*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	8
40	(cigarette* adj3 tax avoid*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	14
41	(tobacco* adj3 tax avoid*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	6
42	(counterfeit* adj3 cigarette*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	21
43	(counterfeit* adj3 tax stamp*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	5
44	(counterfeit* adj3 excise stamp*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	0
45	(bootlegging* adj3 tobacco*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	0
46	(bootlegg* adj3 cigarette*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	4
47	(bootlegg* adj3 cigarette*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	4
48	(bootlegg* adj3 tobacco*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	0
49	(tobacco* adj3 packaging compliance*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	0
50	illicit whites*.mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	1
51	(afghan* or africa* or albania* or algeria* or angola* or argentin* or armenia* or azerbaijan* or bangladesh* or bengal* or bangal* or belarus* or belorus* or byelarus* or byelorus* or belize* or benin* or dahomey or bhutan* or bolivia* or bosnia* or herzegovin* or botswan* or batswan* or bechuanaland* or brazil* or brasil* or bulgaria* or burkina* or burkinese* or upper volta* or burundi* or urundi* or cabo verde* or cape verde* or cambodia* or kampuchea* or khmer* or cameroon* or cameroun* or ubangi shari* or chad* or china* or chinese or colombia* or comoro* or comore* or comorian* or mayotte* or congo* or zaire* or costa rica* or "cote d'ivoir*" or "cote d'ivoir*" or cote divoir* or cote d ivoir* or ivory coast* or ivorian* or cuba or cuban or cubans or "cuba's" or djibouti* or french somaliland* or dominica* or ecuador* or egypt* or united arab republic* or el salvador* or salvador* or guinea* or equatoguinea* or eritrea* or swaziland* or swazi* or swati* or ethiopia* or fiji* or gabon* or gabonese* or gabonaise* or gambia* or ((georgia or georgian or georgians) not (atlanta or california or florida)) or ghana* or grenada* or grenadian* or guatemala* or guyana* or guiana* or guyanese* or haiti* or hispaniola* or hondura* or india* or indonesia* or iran* or iraq* or jamaica* or jordan* or kazakh* or kenya* or karabati* or korea* or kosovo* or kosova* or kyrgyz* or kirgiz* or kirghiz* or laos or lao or laotian* or lebanon* or lebanese* or lesotho* or lesothan* or lesothonian* or basutoland* or mosotho* or basotho* or liberia* or libya* or jamahiriya* or macedonia* or madagasca* or malagasy* or malawi* or nyasaland* or malaysia* or malay* federation or maldives* or maldivian* or indian ocean or mali or malian* or "mali's" or micronesia* or marshallese* or kiribati* or marshall island* or tuvalu* or mauritania* or mauritan* or mauritius* or mexico* or mexican* or moldova* or moldovia* or mongol* or montenegr* or morocco* or moroccan* or ifni or mozambique* or mozambican* or myanmar* or burma* or burmese or namibia* or nepal* or nicaragua* or	2883785

	niger* or omanis or "oman's" or pakistan* or palestine* or gaza* or west bank* or panama* or paraguay* or peru or peruvian* or "peru's" or philippine* or philipine* or philippine* or philippine* or filipino* or filipina* or romania* or russia* or ussr* or soviet* or rwanda* or rwandese or ruanda* or ruandese or samoa* or navigator island* or pacific island* or polynesia* or "sao tome and principe*" or sao tomean* or santomean* or senegal* or serbia* or sierra leone* or melanesia* or solomon island* or norfolk island* or somali* or sri lanka* or ceylon* or saint lucia* or st lucia* or saint vincent* or st vincent* or vincentian* or grenadine* or sudan* or surinam* or syria* or tajik* or tadjik* or tadzhik* or tanzania* or tanganyika* or thai* or timor leste* or east timor* or timorese* or togo or togoles* or "togo's" or tonga* or tunisia* or turkiy* or turkey* or turk or turks or turkish or turkmen* or uganda* or ukraine* or uzbek* or vanuatu* or new hebrides* or venezuela* or vietnam* or viet nam* or yemen* or yugoslav* or zambia* or zimbabwe* or rhodesia* or arab* countr* or middle east* or global south or sahara* or subsahara* or magreb* or maghrib* or west indies* or caribbean* or central america* or latin america* or south america* or central asia* or north asia* or northern asia* or southeastern asia* or south eastern asia* or southeast asia* or south east asia* or west asia* or western asia* or east europe* or eastern europe* or developing countr* or developing nation* or developing population* or developing world or less developed countr* or less developed nation* or less developed world or lesser developed countr* or lesser developed nation* or lesser developed world or under developed countr* or under developed nation* or under developed world or underdeveloped countr* or underdeveloped nation* or underdeveloped world or middle income countr* or middle income nation* or middle income population* or low income countr* or low income nation* or low income population* or lower income countr* or lower income nation* or lower income population* or underserved countr* or underserved nation* or underserved population* or under served population* or under served nation* or under served population* or deprived countr* or deprived population* or high burden countr* or high burden nation* or countdown countr* or countdown nation* or poor countr* or poor nation* or poor population* or poor world or poorer countr* or poorer nation* or poorer population* or poorer world or developing econom* or less developed econom* or underdeveloped econom* or under developed econom* or middle income econom* or low income econom* or lower income econom* or low gdp or low gnp or low gross domestic or low gross national or lower gdp or lower gnp or lower gross domestic or lower gross national or lmic or lmic or third world or lami countr* or transitional countr* or emerging econom* or emerging nation*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms, population supplementary concept word, anatomy supplementary concept word]	
52	19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50	1070
53	10 and 51 and 52	245
54	limit 53 to (english language and yr="2012 -Current")	180

Database: Embase 1974 to 2023 July 16

#	Searches	Results
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2	exp Tobacco, Smokeless/ or exp Tobacco Products/ or exp Tobacco Smoking/	509391
3	birri*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	23
4	beedi*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	211
5	zarda*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	271
6	naswar*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	95
7	gutka*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	302
8	khaini*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	90
9	hand rolled cigarette*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	84
10	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9	577173
11	(Tobacco* adj3 tax*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	1351
12	(value added tax adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	1
13	(vat* adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	3
14	(excise tax* adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	179
15	(surcharge adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	17
16	(import duty adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	2
17	(tobacco* adj3 tax evasion*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	8
18	11 or 12 or 13 or 14 or 15 or 16 or 17	1372
19	illicit tobacco*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	101
20	illicit cigarette*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	109
21	(Illicit* adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	1090
22	(illicit* adj3 smoke* tobacco).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	8
23	(illicit* adj3 cigarette*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	386
24	(illicit* trade adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	62
25	illicit cigarette market.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	28
26	(illicit* trade adj3 cigarette*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	25
27	(illicit* sale* adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	2
28	(illicit* sale* adj3 cigarette*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	1
29	(smuggling* adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	57

30	(smuggle* adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	11
31	(smuggle* adj3 cigarette*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	36
32	(counterfeit* adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	10
33	(illicit* cigarette* adj3 sale*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	5
34	illicit cigarette sale*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	2
35	(illicit* cigarette* adj3 consumption*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	31
36	(illicit* cigarette* adj3 production*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	1
37	(illicit* cigarette* adj3 market*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	34
38	(cigarette* adj3 tax evasion*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	6
39	(tobacco* adj3 tax evasion*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	8
40	(cigarette* adj3 tax avoid*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	15
41	(tobacco* adj3 tax avoid*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	7
42	(counterfeit* adj3 cigarette*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	22
43	(counterfeit* adj3 tax stamp*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	4
44	(counterfeit* adj3 excise stamp*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	0
45	(bootlegging* adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	0
46	(bootlegg* adj3 cigarette*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	4
47	(bootlegg* adj3 cigarette*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	4
48	(bootlegg* adj3 tobacco*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	0
49	(tobacco* adj3 packaging compliance*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	0
50	illicit whites*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	1
51	(afghan* or africa* or albania* or algeria* or angola* or argentin* or armenia* or azerbaijan* or bangladesh* or bengal* or bangal* or belarus* or belorus* or byelarus* or byelorus* or belize* or benin* or dahomey or bhutan* or bolivia* or bosnia* or herzegovin* or botswan* or batswan* or bechuanaland* or brazil* or brasil* or bulgaria* or burkina* or burkinese* or upper volta* or burundi* or urundi* or cabo verde* or cape verde* or cambodia* or kampuchea* or khmer* or cameroon* or cameroun* or ubangi shari* or chad* or china* or chinese or colombia* or comoro* or comore* or comorian* or mayotte* or congo* or zaire* or costa rica* or "cote d'ivoir*" or "cote d' ivoir*" or cote divoir* or cote d ivoir* or ivory coast* or ivorian* or cuba or cuban or cubans or "cuba's" or djibouti* or french somaliland* or dominica* or ecuador* or egypt* or united arab republic* or el salvador* or salvadoran* or guinea* or equatoguinea* or eritrea* or swaziland* or swazi* or swati* or ethiopia* or fiji* or gabon* or gabonese* or gabonaise* or gambia* or ((georgia or georgian or georgians) not (atlanta or california or florida)) or ghana* or grenada* or grenadian* or guatemala* or guyana* or guiana* or guyanese* or haiti* or hispaniola* or hondura* or india* or indonesia* or iran* or iraq* or jamaica* or jordan* or kazakh* or	3637768

	kenya* or karabati* or korea* or kosovo* or kosova* or kyrgyz* or kirgiz* or kirghiz* or laos or lao or laotian* or lebanon* or lebanese* or lesotho* or lesothan* or lesothonian* or basutoland* or mosotho* or basotho* or liberia* or libya* or jamahiriya* or macedonia* or madagasca* or malagasy* or malawi* or nyasaland* or malaysia* or malay* federation or maldives* or maldivian* or indian ocean or mali or malian* or "mali's" or micronesia* or marshallese* or kiribati* or marshall island* or tuvalu* or mauritania* or mauritan* or mauritius* or mexico* or mexican* or moldova* or moldovia* or mongol* or montenegr* or morocco* or moroccan* or ifni or mozambique* or mozambican* or myanmar* or burma* or burmese or namibia* or nepal* or nicaragua* or niger* or omanis or "oman's" or pakistan* or palestin* or gaza* or west bank* or panama* or paraguay* or peru or peruvian* or "peru's" or philippine* or philipine* or phillipine* or phillippine* or filipino* or filipina* or romania* or russia* or ussr* or soviet* or rwanda* or rwandese or ruanda* or ruandese or samoa* or navigator island* or pacific island* or polynesia* or "sao tome and principe*" or sao tomean* or santomean* or senegal* or serbia* or sierra leone* or melanesia* or solomon island* or norfolk island* or somali* or sri lanka* or ceylon* or saint lucia* or st lucia* or saint vincent* or st vincent* or vincentian* or grenadine* or sudan* or surinam* or syria* or tajik* or tadjik* or tadzhik* or tanzania* or tanganyika* or thai* or timor leste* or east timor* or timorese* or togo or togoles* or "togo's" or tonga* or tunisia* or turkiy* or turkey* or turk or turks or turkish or turkmen* or uganda* or ukrain* or uzbek* or vanuatu* or new hebrides* or venezuela* or vietnam* or viet nam* or yemen* or yugoslav* or zambia* or zimbabwe* or rhodesia* or arab* countr* or middle east* or global south or sahara* or subsahara* or magreb* or maghrib* or west indies* or caribbean* or central america* or latin america* or south america* or central asia* or north asia* or northern asia* or southeastern asia* or south eastern asia* or southeast asia* or south east asia* or west asia* or western asia* or east europe* or eastern europe* or developing countr* or developing nation* or developing population* or developing world or less developed countr* or less developed nation* or less developed world or lesser developed countr* or lesser developed nation* or lesser developed world or under developed countr* or under developed nation* or under developed world or underdeveloped countr* or underdeveloped nation* or underdeveloped world or middle income countr* or middle income nation* or middle income population* or low income countr* or low income nation* or low income population* or lower income countr* or lower income nation* or lower income population* or underserved countr* or underserved nation* or underserved population* or under served population* or under served nation* or under served population* or deprived countr* or deprived population* or high burden countr* or high burden nation* or countdown countr* or countdown nation* or poor countr* or poor nation* or poor population* or poor world or poorer countr* or poorer nation* or poorer population* or poorer world or developing econom* or less developed econom* or underdeveloped econom* or under developed econom* or middle income econom* or low income econom* or lower income econom* or low gdp or low gnp or low gross domestic or low gross national or lower gdp or lower gnp or lower gross domestic or lower gross national or lmic or lmics or third world or lami countr* or transitional countr* or emerging econom* or emerging nation*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	
52	19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50	1541
53	10 and 51 and 52	388
54	limit 53 to (english language and yr="2012 -Current")	289

Database: Econlit 1886 to July 16, 2023

#	Searches	Results
1	Tobacco*.mp. [mp=heading words, abstract, title, country as subject]	15137
2	[exp Tobacco, Smokeless/ or exp Tobacco Products/ or exp Tobacco Smoking/]	0
3	birri*.mp. [mp=heading words, abstract, title, country as subject]	3
4	beedi*.mp. [mp=heading words, abstract, title, country as subject]	16
5	zarda*.mp. [mp=heading words, abstract, title, country as subject]	0
6	naswar*.mp. [mp=heading words, abstract, title, country as subject]	0
7	gutka*.mp. [mp=heading words, abstract, title, country as subject]	0
8	khaini*.mp. [mp=heading words, abstract, title, country as subject]	0
9	hand rolled cigarette*.mp. [mp=heading words, abstract, title, country as subject]	3
10	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9	15145
11	(Tobacco* adj3 tax*).mp. [mp=heading words, abstract, title, country as subject]	193
12	(value added tax adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	0
13	(vat* adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	0
14	(excise tax* adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	34
15	(surcharge adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	0
16	(import duty adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	1
17	(tobacco* adj3 tax evasion*).mp. [mp=heading words, abstract, title, country as subject]	0
18	11 or 12 or 13 or 14 or 15 or 16 or 17	196
19	illicit tobacco*.mp. [mp=heading words, abstract, title, country as subject]	5
20	illicit cigarette*.mp. [mp=heading words, abstract, title, country as subject]	5
21	(Illicit* adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	9
22	(illicit* adj3 smoke* tobacco).mp. [mp=heading words, abstract, title, country as subject]	0
23	(illicit* adj3 cigarette*).mp. [mp=heading words, abstract, title, country as subject]	10
24	(illicit* trade adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	4
25	illicit cigarette market.mp. [mp=heading words, abstract, title, country as subject]	0
26	(illicit* trade adj3 cigarette*).mp. [mp=heading words, abstract, title, country as subject]	2
27	(illicit* sale* adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	0
28	(illicit* sale* adj3 cigarette*).mp. [mp=heading words, abstract, title, country as subject]	0
29	(smuggling* adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	6
30	(smuggle* adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	0
31	(smuggle* adj3 cigarette*).mp. [mp=heading words, abstract, title, country as subject]	8
32	(counterfeit* adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	0
33	(illicit* cigarette* adj3 sale*).mp. [mp=heading words, abstract, title, country as subject]	1
34	illicit cigarette sale*.mp. [mp=heading words, abstract, title, country as subject]	1
35	(illicit* cigarette* adj3 consumption*).mp. [mp=heading words, abstract, title, country as subject]	2
36	(illicit* cigarette* adj3 production*).mp. [mp=heading words, abstract, title, country as subject]	0
37	(illicit* cigarette* adj3 market*).mp. [mp=heading words, abstract, title, country as subject]	0
38	(cigarette* adj3 tax evasion*).mp. [mp=heading words, abstract, title, country as subject]	0
39	(tobacco* adj3 tax evasion*).mp. [mp=heading words, abstract, title, country as subject]	0
40	(cigarette* adj3 tax avoid*).mp. [mp=heading words, abstract, title, country as subject]	8
41	(tobacco* adj3 tax avoid*).mp. [mp=heading words, abstract, title, country as subject]	0
42	(counterfeit* adj3 cigarette*).mp. [mp=heading words, abstract, title, country as subject]	3
43	(counterfeit* adj3 tax stamp*).mp. [mp=heading words, abstract, title, country as subject]	0
44	(counterfeit* adj3 excise stamp*).mp. [mp=heading words, abstract, title, country as subject]	0
45	(bootlegging* adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	0
46	(bootlegg* adj3 cigarette*).mp. [mp=heading words, abstract, title, country as subject]	4
47	(bootlegg* adj3 cigarette*).mp. [mp=heading words, abstract, title, country as subject]	4
48	(bootlegg* adj3 tobacco*).mp. [mp=heading words, abstract, title, country as subject]	0
49	(tobacco* adj3 packaging compliance*).mp. [mp=heading words, abstract, title, country as subject]	0
50	illicit whites*.mp. [mp=heading words, abstract, title, country as subject]	1
51	(afghan* or africa* or albania* or algeria* or angola* or argentin* or armenia* or azerbaijan* or bangladesh* or bengal* or bangal* or belarus* or belorus* or byelarus* or byelorus* or belize* or benin* or dahomey or bhutan* or bolivia* or bosnia* or herzegovin* or botswana* or batswan* or bechuanaland* or brazil* or brasil* or bulgaria* or burkina* or burkinese* or upper volta* or burundi* or urundi* or cabo verde* or cape verde* or cambodia* or kampuchea* or khmer* or cameroon* or cameroun* or ubangi shari* or chad* or china* or chinese or colombia* or comoro* or comore* or comorian* or mayotte* or congo* or zaire* or costa rica* or "cote d'ivoir*" or "cote d'ivoir*" or cote divoir* or cote d ivoir* or ivory coast* or ivorian* or cuba or cuban or cubans or "cuba's" or djibouti* or french somaliland* or dominica* or ecuador* or egypt* or united arab republic* or el salvador* or salvadoran* or guinea* or equatoguinea* or eritrea* or swaziland* or swazi* or swati* or ethiopia* or fiji* or gabon* or gabonese* or gabonaise* or gambia* or ((georgia or georgian or georgians) not (atlanta or california or florida)) or ghana* or grenada* or grenadian* or guatemala* or guyana* or guiana* or guyanese* or haiti* or hispaniola* or hondura* or india* or indonesia* or iran* or iraq* or jamaica* or jordan* or kazakh* or kenya* or karabati* or korea* or kosovo* or kosova* or kyrgyz* or kirgiz* or kirghiz* or laos or lao or laotian* or lebanon*	426299

	or lebanese* or lesotho* or lesothan* or lesothonian* or basutoland* or mosotho* or basotho* or liberia* or libya* or jamahiriya* or macedonia* or madagascar* or malagasy* or malawi* or nyasaland* or malaysia* or malay* federation or maldives* or maldivian* or indian ocean or mali or malian* or "mali's" or micronesia* or marshallese* or kiribati* or marshall island* or tuvalu* or mauritania* or mauritan* or mauritius* or mexico* or mexican* or moldova* or moldovia* or mongol* or montenegr* or morocco* or moroccan* or ifni or mozambique* or mozambican* or myanmar* or burma* or burmese or namibia* or nepal* or nicaragua* or niger* or omanis or "oman's" or pakistan* or palestine* or gaza* or west bank* or panama* or paraguay* or peru or peruvian* or "peru's" or philippine* or philipine* or philippine* or philippine* or filipino* or filipina* or romania* or russia* or ussr* or soviet* or rwanda* or rwandese or ruanda* or ruandese or samoa* or navigator island* or pacific island* or polynesia* or "sao tome and principe*" or sao tomean* or santomean* or senegal* or serbia* or sierra leone* or melanesia* or solomon island* or norfolk island* or somali* or sri lanka* or ceylon* or saint lucia* or st lucia* or saint vincent* or st vincent* or vincentian* or grenadine* or sudan* or surinam* or syria* or tajik* or tadjik* or tadjik* or tanzania* or tanganyika* or thai* or timor leste* or east timor* or timorese* or togo or togoles* or "togo's" or tonga* or tunisia* or turkiy* or turkey* or turk or turks or turkish or turkmen* or uganda* or ukraine* or uzbek* or vanuatu* or new hebrides* or venezuela* or vietnam* or viet nam* or yemen* or yugoslav* or zambia* or zimbabwe* or rhodesia* or arab* countr* or middle east* or global south or sahara* or subsahara* or magreb* or maghrib* or west indies* or caribbean* or central america* or latin america* or south america* or central asia* or north asia* or northern asia* or southeastern asia* or south eastern asia* or southeast asia* or south east asia* or west asia* or western asia* or east europe* or eastern europe* or developing countr* or developing nation* or developing population* or developing world or less developed countr* or less developed nation* or less developed world or lesser developed countr* or lesser developed nation* or lesser developed world or under developed countr* or under developed nation* or under developed world or underdeveloped countr* or underdeveloped nation* or underdeveloped world or middle income countr* or middle income nation* or middle income population* or low income countr* or low income nation* or low income population* or lower income countr* or lower income nation* or lower income population* or underserved countr* or underserved nation* or underserved population* or under served population* or under served nation* or under served population* or deprived countr* or deprived population* or high burden countr* or high burden nation* or countdown countr* or countdown nation* or poor countr* or poor nation* or poor population* or poor world or poorer countr* or poorer nation* or poorer population* or poorer world or developing econom* or less developed econom* or underdeveloped econom* or under developed econom* or middle income econom* or low income econom* or lower income econom* or low gdp or low gnp or low gross domestic or low gross national or lower gdp or lower gnp or lower gross domestic or lower gross national or lmic or lmics or third world or lami countr* or transitional countr* or emerging econom* or emerging nation*).mp. [mp=heading words, abstract, title, country as subject]	
52	19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50	45
53	10 and 51 and 52	8
54	limit 53 to (english language and yr="2012 -Current")	6

Database: APA PsycInfo 1806 to July Week 3 2023

#	Searches	Results
1	Tobacco*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	49460
2	exp Tobacco, Smokeless/ or exp Tobacco Products/ or exp Tobacco Smoking/	36750
3	birri*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	2
4	beedi*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	15
5	zarda*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	7
6	naswar*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	5
7	gutka*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	15
8	khaini*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	7
9	hand rolled cigarette*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	15
10	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9	49574
11	(Tobacco* adj3 tax*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	323
12	(value added tax adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
13	(vat* adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	1
14	(excise tax* adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	45
15	(surcharge adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	2
16	(import duty adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
17	(tobacco* adj3 tax evasion*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
18	11 or 12 or 13 or 14 or 15 or 16 or 17	326
19	illicit tobacco*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	19
20	illicit cigarette*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	28
21	(Illicit* adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	503
22	(illicit* adj3 smoke* tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	4
23	(illicit* adj3 cigarette*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	213
24	(illicit* trade adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	13
25	illicit cigarette market.mpp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	4
26	(illicit* trade adj3 cigarette*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	4
27	(illicit* sale* adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
28	(illicit* sale* adj3 cigarette*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
29	(smuggling* adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	11
30	(smuggle* adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	4
31	(smuggle* adj3 cigarette*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	8
32	(counterfeit* adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	3
33	(illicit* cigarette* adj3 sale*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	1
34	illicit cigarette sale*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	1
35	(illicit* cigarette* adj3 consumption*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	12

36	(illicit* cigarette* adj3 production*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
37	(illicit* cigarette* adj3 market*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	5
38	(cigarette* adj3 tax evasion*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	5
39	(tobacco* adj3 tax evasion*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
40	(cigarette* adj3 tax avoid*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	4
41	(tobacco* adj3 tax avoid*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	3
42	(counterfeit* adj3 cigarette*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	9
43	(counterfeit* adj3 tax stamp*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
44	(counterfeit* adj3 excise stamp*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
45	(bootlegging* adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
46	(bootlegg* adj3 cigarette*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	2
47	(bootlegg* adj3 cigarette*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	2
48	(bootlegg* adj3 tobacco*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
49	(tobacco* adj3 packaging compliance*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
50	illicit whites*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	0
51	(afghan* or africa* or albania* or algeria* or angola* or argentin* or armenia* or azerbaijan* or bangladesh* or bengal* or bangal* or belarus* or belorus* or byelarus* or belize* or benin* or dahomey or bhutan* or bolivia* or bosnia* or herzegovin* or botswana* or batswan* or bechuanaland* or brazil* or brasil* or bulgaria* or burkina* or burkinese* or upper volta* or burundi* or urundi* or cabo verde* or cape verde* or cambodia* or kampuchea* or khmer* or cameroon* or cameroun* or ubangi shari* or chad* or china* or chinese or colombia* or comoro* or comore* or comorian* or mayotte* or congo* or zaire* or costa rica* or "cote d'ivoir*" or "cote d'ivoir*" or cote divoir* or cote d ivoir* or ivory coast* or ivorian* or cuba or cuban or cubans or "cuba's" or djibouti* or french somaliland* or dominica* or ecuador* or egypt* or united arab republic* or el salvador* or salvadoran* or guinea* or equatoguinea* or eritrea* or swaziland* or swazi* or swati* or ethiopia* or fiji* or gabon* or gabonese* or gabonaise* or gambia* or ((georgia or georgian or georgians) not (atlanta or california or florida)) or ghana* or grenada* or grenadian* or guatemala* or guyana* or guiana* or guyanese* or haiti* or hispaniola* or hondura* or india* or indonesia* or iran* or iraq* or jamaica* or jordan* or kazakh* or kenya* or karabati* or korea* or kosovo* or kosova* or kyrgyz* or kirgiz* or kirghiz* or laos or lao or laotian* or lebanon* or lebanese* or lesotho* or lesothan* or lesothonian* or basutoland* or mosotho* or basotho* or liberia* or libya* or jamahiriya* or macedonia* or madagascar* or malagasy* or malawi* or nyasaland* or malaysia* or malay* federation or maldives* or maldivian* or indian ocean or mali or malian* or "mali's" or micronesia* or marshallese* or kiribati* or marshall island* or tuvalu* or mauritania* or mauritan* or mauritius* or mexico* or mexican* or moldova* or moldovia* or mongol* or montenegr* or morocco* or moroccan* or ifni or mozambique* or mozambican* or myanmar* or burma* or burmese or namibia* or nepal* or nicaragua* or niger* or omanis or "oman's" or pakistan* or palestin* or gaza* or west bank* or panama* or paraguay* or peru or peruvian* or "peru's" or philippine* or philipine* or phillipine* or phillippine* or filipino* or filipina* or romania* or russia* or ussr* or soviet* or rwanda* or rwandese or ruanda* or ruandese or samoa* or navigator island* or pacific island* or polynesia* or "sao tome and principe*" or sao tomean* or santomean* or senegal* or serbia* or sierra leone* or melanesia* or solomon island* or norfolk island* or somali* or sri lanka* or ceylon* or saint lucia* or st lucia* or saint vincent* or st vincent* or vinentian* or grenadine* or sudan* or surinam* or syria* or tajik* or tadjik* or tadjik* or tanzania* or tanganyika* or thai* or timor leste* or east timor* or timorese* or togo or togoles* or "togo's" or tonga* or tunisia* or turkiy* or turkey* or turk or turks or turkish or turkmen* or uganda* or ukraine* or uzbek* or vanuatu* or new hebrides* or venezuela* or vietnam* or viet nam* or yemen* or yugoslav* or zambia* or zimbabwe* or rhodesia* or arab* countr* or middle east* or global south or sahara* or subsahara* or magreb* or maghrib* or west indies* or caribbean* or central america* or latin america* or south america* or central asia* or north asia* or northern asia* or southeastern asia* or south eastern asia* or southeast asia* or south east asia* or west asia* or western asia* or east europe* or eastern europe* or developing countr* or developing nation* or developing population* or developing world or less developed countr* or less developed nation* or less developed world or lesser developed countr* or lesser developed nation* or lesser developed world or under developed countr* or under developed nation* or under developed world or underdeveloped countr* or underdeveloped nation* or underdeveloped world or middle income countr* or middle income nation* or middle income population* or low income countr* or low income nation* or low income population* or lower income countr* or lower income nation* or lower income population* or underserved countr* or underserved nation* or underserved population* or under served population* or under served nation* or under served population* or deprived countr* or deprived population* or high burden countr* or high burden nation* or countdown countr* or countdown nation* or poor countr* or poor nation* or poor population* or poor world or poorer countr* or poorer nation* or poorer population* or poorer world or developing econom* or less developed econom* or underdeveloped econom* or under developed econom* or middle income econom* or low income econom* or lower income econom* or low gdp or low gnp or low gross domestic or low gross national or lower gdp or lower gnp or lower gross domestic or lower gross national or lmic or lmics or third world or lami	498831

	countr* or transitional countr* or emerging econom* or emerging nation*).mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word]	
52	19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50	727
53	10 and 51 and 52	136
54	limit 53 to (english language and yr="2012 -Current")	81

Database: CINAHL Ultimate (Limiters - Published Date: 20120101- July, 2023; English Language)

#	Query	Results
S1	tobacco*	26,926
S2	birri*	111
S3	beedi*	63
S4	Jarda*	121
S5	Zarda*	84
S6	naswar*	11
S7	gutka*	40
S8	khaini*	7
S9	"hand-rolled cigarettes"	11
S10	smoking tobacco*	19,952
S11	smokeless tobacco*	1,597
S12	illicit tobacco*	378
S13	illicit cigarette*	185
S14	illicit* N3 tobacco*	320
S15	illicit* N3 smoke* tobacco	8
S16	illicit* N3 cigarette*	146
S17	illicit* trade N3 tobacco	45
S18	illicit cigarette* market	11
S19	illicit* trade N3 cigarette*	19
S20	illicit* sale* N3 tobacco*	4
S21	illicit* sale* N3 cigarette*	3
S22	smuggling* N3 tobacco*	13
S23	smuggle* N3 tobacco*	2
S24	smuggle* N3 cigarette*	7
S25	counterfeit* N3 tobacco*	3
S26	(illicit* cigarette*) N3 sale*	3
S27	illicit cigarette* sale*	4
S28	(illicit* cigarette*) N3 consumption*	16
S29	(illicit* cigarette*) N3 production*	1
S30	(illicit* cigarette*) N3 market*	12
S31	cigarette* N3 (tax evasion*)	4
S32	tobacco* N3 (tax evasion*)	8
S33	cigarette* N3 (tax avoid*)	12
S34	tobacco* N3 (tax avoid*)	6
S35	counterfeit* N3 cigarette*	5
S36	counterfeit* N3 (tax stamp*)	1
S37	counterfeit* N3 (excise stamp*)	0
S38	bootlegging* N3 tobacco*	1
S39	bootlegg* N3 cigarette*	3
S40	bootlegg* N3 cigarette*	3
S41	bootlegg* N3 tobacco*	1
S42	tobacco* N3 packaging compliance*	1
S43	illicit whites*	2
S44	S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43	564
S45	afghan* or africa* or albania* or algeria* or angola* or argentin* or armenia* or azerbaijan* or bangladesh* or bengal* or bangal* or belarus* or belorus* or byelarus* or byelorus* or belize* or benin* or dahomey or bhutan* or bolivia* or bosnia* or herzegovin* or botswan* or batswan* or bechuanaland* or brazil* or brasil* or bulgaria* or burkina* or burkinese* or upper volta* or burundi* or urundi* or cabo verde* or cape verde* or cambodia* or kampuchea* or khmer* or cameroon* or cameroun* or ubangi shari* or chad* or china* or chinese or colombia* or comoro* or comore* or comorian* or mayotte* or congo* or zaire* or costa rica* or "cote d'ivoir*" or "cote d' ivoir*" or cote divoir* or cote d ivoir* or ivory coast* or ivorian* or cuba or cuban or cubans or "cuba's" or djibouti* or french somaliland* or dominica* or ecuador* or egypt* or united arab republic* or el salvador* or salvadoran* or guinea* or equatoguinea* or eritrea* or swaziland* or swazi* or swati* or ethiopia* or fiji* or gabon* or gabonese* or gabonaise* or gambia* or ((georgia or georgian or georgians) not (atlanta or california or florida)) or ghana* or grenada* or grenadian* or guatemala* or guyana* or guiana* or guyanese* or haiti* or hispaniola* or hondura* or india* or indonesia* or iran* or iraq* or jamaica* or jordan* or kazakh* or kenya* or karabati* or korea* or kosovo* or kosova* or kyrgyz* or kirgiz* or kirghiz* or laos or lao or laotian* or lebanon* or lebanese* or lesotho* or lesothan* or lesothonian* or basutoland* or mosotho* or basotho* or liberia* or libya* or jamahiriya* or macedonia* or madagasca* or malagasy* or malawi* or nyasaland* or malaysia* or malay* federation or maldives* or maldivian* or indian ocean or mali or malian* or "mali's" or	544,976

	micronesia* or marshallese* or kiribati* or marshall island* or tuvalu* or mauritania* or mauritan* or mauritius* or mexico* or mexican* or moldova* or moldovia* or mongol* or montenegr* or morocco* or moroccan* or ifni or mozambique* or mozambican* or myanmar* or burma* or burmese or namibia* or nepal* or nicaragua* or niger* or omanis or "oman's" or pakistan* or palestine* or gaza* or west bank* or panama* or paraguay* or peru or peruvian* or "peru's" or philippine* or philipine* or philippine* or philippine* or filipino* or filipina* or romania* or russia* or ussr* or soviet* or rwanda* or rwandese or ruanda* or ruandese or samoa* or navigator island* or pacific island* or polynesia* or "sao tome and principe*" or sao tomean* or santomean* or senegal* or serbia* or sierra leone* or melanesia* or solomon island* or norfolk island* or somali* or sri lanka* or ceylon* or saint lucia* or st lucia* or saint vincent* or st vincent* or vincentian* or grenadine* or sudan* or surinam* or syria* or tajik* or tadjik* or tadzhik* or tanzania* or tanganyika* or thai* or timor leste* or east timor* or timorese* or togo or togoles* or "togo's" or tonga* or tunisia* or turkiy* or turkey* or turk or turks or turkish or turkmen* or uganda* or ukraine* or uzbek* or vanuatu* or new hebrides* or venezuela* or vietnam* or viet nam* or yemen* or yugoslav* or zambia* or zimbabwe* or rhodesia* or arab* countr* or middle east* or global south or sahara* or subsahara* or magreb* or maghrib* or west indies* or caribbean* or central america* or latin america* or south america* or central asia* or north asia* or northern asia* or southeastern asia* or south eastern asia* or southeast asia* or south east asia* or west asia* or western asia* or east europe* or eastern europe* or developing countr* or developing nation* or developing population* or developing world or less developed countr* or less developed nation* or less developed world or lesser developed countr* or lesser developed nation* or lesser developed world or under developed countr* or under developed nation* or under developed world or underdeveloped countr* or underdeveloped nation* or underdeveloped world or middle income countr* or middle income nation* or middle income population* or low income countr* or low income nation* or low income population* or lower income countr* or lower income nation* or lower income population* or underserved countr* or underserved nation* or underserved population* or under served population* or under served nation* or under served population* or deprived countr* or deprived population* or high burden countr* or high burden nation* or countdown countr* or countdown nation* or poor countr* or poor nation* or poor population* or poor world or poorer countr* or poorer nation* or poorer population* or poorer world or developing econom* or less developed econom* or underdeveloped econom* or under developed econom* or middle income econom* or low income econom* or lower income econom* or low gdp or low gnp or low gross domestic or low gross national or lower gdp or lower gnp or lower gross domestic or lower gross national or lmics or lmics or third world or lami countr* or transitional countr* or emerging econom* or emerging nation*	
S46	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11	37,265
S47	S44 AND S45 AND S46	139

Database: Web of Science (From: January 01 2012 to July 16, 2023)

#	Query	Results
1	(((((TS=(Tobacco*)) OR TS=(birri*)) OR TS=(beedi*)) OR TS=(zarda*)) OR TS=(naswar*)) OR TS=(gutka*)) OR TS=(khaini*)) OR TS=("hand rolled cigarette")) OR TS=("smoking tobacco")) OR TS=("smokeless tobacco")	88,315
2	((((((((((((((((((((((TS=(illicit tobacco*)) OR TS=(illicit cigarette*)) OR TS=(illicit* Near/3 tobacco*)) OR TS=(illicit* Near/3 smoke* tobacco)) OR TS=(illicit* Near/3 cigarette*)) OR TS=(illicit* trade Near/3 tobacco*)) OR TS=(illicit cigarette market)) OR TS=(illicit* trade Near/3 cigarette*)) OR TS=(illicit* sale* Near/3 tobacco*)) OR TS=(illicit* sale* Near/3 cigarette)) OR TS=(smuggling* Near/3 tobacco*)) OR TS=(smuggle* Near/3 tobacco*)) OR TS=(smuggle* Near/3 cigarette*)) OR TS=(counterfeit* Near/3 tobacco*)) OR TS=(illicit* cigarette* Near/3 sale*)) OR TS=(illicit cigarette sale*)) OR TS=(illicit* cigarette* Near/3 consumption*)) OR TS=(illicit* cigarette* Near/3 production*)) OR TS=(illicit* cigarette* Near/3 market*)) OR TS=(cigarette* Near/3 tax evasion*)) OR TS=(tobacco* Near/3 tax evasion*)) OR TS=(cigarette* Near/3 tax avoid*)) OR TS=(tobacco* Near/3 tax avoid*)) OR TS=(counterfeit* Near/3 cigarette*)) OR TS=(counterfeit* Near/3 tax stamp*)) OR TS=(counterfeit* Near/3 excise stamp*)) OR TS=(bootlegging* Near/3 tobacco*)) OR TS=(bootlegg* Near/3 cigarette*)) OR TS=(bootlegg* Near/3 cigarette*)) OR TS=(bootlegg* Near/3 tobacco*)) OR TS=(tobacco* Near/3 packaging compliance*)) OR TS=(illicit whites*))	2,435
	(TI=("developing countr*" or "low middle income countr*" or "low* and middle income countr*" or "low* or middle income countr*" or lmic* or afghan* or albania* or algeria* or angola* or argentin* or armenia* or azerbaijan* or azeri* or bangladesh* or basotho* or belarus* or belize* or benin* or bhutan* or bissau-guinea* or bolivia* or bosnia* or botswan* or brazil* or "burkina faso" or burkinabe* or burmese or burundi* or "cabo verde*" or cambodia* or cameroon* or "central african republic" or chad or chadian* or china or chinese or columbia* or comor* or congo* or "costa rica*" or "cote d'ivoire" or cuba* or "democratic people's republic of korea" or djibouti* or dominica* or ecuador* or egypt* or "el salvador*" or equatoguinea* or "equatorial guinea*" or eritrea* or eswatini or ethiopia* or fiji* or filipin* or futunan* or gabon* or gambia* or "gaza strip" or georgia* or ghana* or grenada or grenadian* or grenadines or guatemala* or guinea-bissau* or guyan* or haiti* or herzogovin* or hondura* or india or indian* or indonesia* or iran* or iraq* or ivorian* or "ivory coast" or i-kiribati* or jamaica* or jordan* or kazakh* or kenya* or kirghiz* or kirgiz* or kiribati* or kosov* or kyrgyz* or "lao people's democratic republic" or lao* or leban* or lesotho* or liberia* or libyan* or madagascar* or malawi* or malaysia* or maldiv* or mali or malian* or malinese* or "marshall island*" or marshallese* or mauritania* or mauriti* or mexican* or mexico or micronesia* or moldova* or mongolia* or mongol or mongol's or mongols* or montenegr* or montserrat* or morocc* or mosotho* or mozambique or mozambican* or myanma* or nepal* or namibia* or nauru* or nicaragua* or niue* or niger* or ni-vanuatu* or "north korea*" or macedonia* or pakistan* or palestine* or panama* or "papua new guinea*" or papuan* or paraguay* or peru* or philippine* or rwanda* or "saint helen*" or "saint lucia*" or "saint vincent*" or salvadoran* or salvadorean* or salvadorian* or samoa* or "sao tome*" or senegal* or serbia* or "sierra leone*" or "solomon island*" or somali* or "south africa*" or "sri lanka*" or sudan* or suriname* or swati* or swazi* or syria* or tajik* or tanzania* or thai* or timor-leste or timorese or togo or togolese or tokelau* or tonga* or tunisia* or turk or turkey or turkish or turkmen* or turk's or turks or tuvalu* or uganda* or ukraine* or uzbek* or vanuatu* or venezuela* or vietnam* or "wallis and fortuna" or wallisian* or "west bank" or yemen* or zambia* or zimbabwe*)) or AB=(("developing countr*" or "low middle income countr*" or "low* and middle income countr*" or "low* or middle income countr*" or lmic* or afghan* or albania* or algeria* or angola* or argentin* or armenia* or azerbaijan* or azeri* or bangladesh* or basotho* or belarus* or belize* or benin* or bhutan* or bissau-guinea* or bolivia* or bosnia* or botswan* or brazil* or "burkina faso" or burkinabe* or burmese or burundi* or "cabo verde*" or cambodia* or cameroon* or "central african republic" or chad or chadian* or china or chinese or columbia* or comor* or congo* or "costa rica*" or "cote d'ivoire" or cuba* or "democratic people's republic of korea" or djibouti* or dominica* or ecuador* or egypt* or "el salvador*" or equatoguinea* or "equatorial guinea*" or eritrea* or eswatini or ethiopia* or fiji* or filipin* or futunan* or gabon* or gambia* or "gaza strip" or georgia* or ghana* or grenada or grenadian* or grenadines or guatemala* or guinea-bissau* or guyan* or haiti* or herzogovin* or hondura* or india or indian* or indonesia* or iran* or iraq* or ivorian* or "ivory coast" or i-kiribati* or jamaica* or jordan* or kazakh* or kenya* or kirghiz* or kirgiz* or kiribati* or kosov* or kyrgyz* or "lao people's democratic republic" or lao* or leban* or lesotho* or liberia* or libyan* or madagascar* or malawi* or malaysia* or maldiv* or mali or malian* or malinese* or "marshall island*" or marshallese* or mauritania* or mauriti* or mexican* or mexico or micronesia* or moldova* or mongolia* or mongol or mongol's or mongols* or montenegr* or montserrat* or morocc* or mosotho* or mozambique or mozambican* or myanma* or nepal* or namibia* or nauru* or nicaragua* or niue* or niger* or ni-vanuatu* or "north korea*" or macedonia* or pakistan* or palestine* or panama* or "papua new guinea*" or papuan* or paraguay* or peru* or philippine* or rwanda* or "saint helen*" or "saint lucia*" or "saint vincent*" or salvadoran* or salvadorean* or salvadorian* or samoa* or "sao tome*" or senegal* or serbia* or "sierra leone*" or "solomon island*" or somali* or "south africa*" or "sri lanka*" or sudan* or suriname* or swati* or swazi* or syria* or tajik* or tanzania* or thai* or timor-leste or timorese or togo or togolese or tokelau* or tonga* or tunisia* or turk or turkey or turkish or turkmen* or turk's or turks or tuvalu* or uganda* or ukraine* or uzbek* or vanuatu* or venezuela* or vietnam* or "wallis and fortuna" or wallisian* or "west bank" or yemen* or zambia* or zimbabwe*))	3,101,410
4	#1 AND #2 AND #3	461

Database: Scopus (From: January 01 2012 to July 16, 2023)

#	Query	Results
1	(TITLE-ABS-KEY (tobacco*) OR TITLE-ABS-KEY (birri*) OR TITLE-ABS-KEY (beedi*) OR TITLE-ABS-KEY (zarda*) OR TITLE-ABS-KEY (naswar*) OR TITLE-ABS-KEY (gutka*) OR TITLE-ABS-KEY (khaini*) OR TITLE-ABS-KEY ("hand rolled cigarette") OR TITLE-ABS-KEY ("Smoking Tobacco") OR TITLE-ABS-KEY ("Smokeless Tobacco")) AND PUBYEAR > 2011	108,462
2	(TITLE-ABS-KEY ("illicit tobacco") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit cigarette*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* w/3 tobacco*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (illicit* W/3 "smoke* tobacco") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (illicit* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* trade" W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit cigarette market") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* trade" W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* sale*" W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* sale*" W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (smuggling* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (smuggle* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (smuggle* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 sale*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 consumption) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 production) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 market*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (cigarette* W/3 "tax evasion*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (tobacco* W/3 "tax evasion*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (cigarette* W/3 "tax avoid*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (tobacco* W/3 "tax avoid*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit whites*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (tobacco* W/3 "packaging compliance*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (bootlegg* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (bootlegg* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (bootlegging* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 "excise stamp*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 "tax stamp*") AND PUBYEAR > 2011)	549
3	(TITLE-ABS-KEY ("illicit tobacco") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit cigarette*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* w/3 tobacco*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (illicit* W/3 "smoke* tobacco") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (illicit* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* trade" W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit cigarette market") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* trade" W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* sale*" W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* sale*" W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (smuggling* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (smuggle* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (smuggle* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 sale*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 consumption) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 production) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 market*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (cigarette* W/3 "tax evasion*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (tobacco* W/3 "tax evasion*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (cigarette* W/3 "tax avoid*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (tobacco* W/3 "tax avoid*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit whites*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (tobacco* W/3 "packaging compliance*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (bootlegg* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (bootlegg* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (bootlegging* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 "excise stamp*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 "tax stamp*") AND PUBYEAR > 2011) AND (TITLE-ABS-KEY (tobacco*) OR TITLE-ABS-KEY (birri*) OR TITLE-ABS-KEY (beedi*) OR TITLE-ABS-KEY (zarda*) OR TITLE-ABS-KEY (naswar*) OR TITLE-ABS-KEY (gutka*) OR TITLE-ABS-KEY (khaini*) OR TITLE-ABS-KEY ("hand rolled cigarette") OR TITLE-ABS-KEY ("smoking tobacco") OR TITLE-ABS-KEY ("smokeless tobacco")) AND PUBYEAR > 2011 AND (LIMIT-TO (LANGUAGE , "English")	384
4	TITLE-ABS-KEY ("developing countr*" OR "low middle income countr*" OR "low* and middle income countr*" OR "low* or middle income countr*" OR lmic* OR afghan* OR albania* OR algeria* OR angola* OR argentin* OR armenia* OR azerbaijan* OR azeri* OR bangladesh* OR basotho* OR belarus* OR belize* OR benin* OR bhutan* OR bissau-guinea* OR bolivia* OR bosnia* OR botswana* OR brazil* OR "burkina faso" OR burkinabe* OR burmese OR burundi* OR "cabo verde*" OR cambodia* OR cameroon* OR "central african republic" OR chad OR chadian* OR china OR chinese OR columbia* OR comor* OR congo* OR "costa rica*" OR "cote d'ivoire" OR cuba* OR "democratic people's republic of korea" OR djibouti* OR dominica* OR ecuador* OR egypt* OR "el salvador*" OR equatoguinea* OR "equatorial guinea*" OR eritrea* OR eswatini OR ethiopia* OR fiji* OR filipin* OR futunan* OR gabon* OR gambia* OR "gaza strip" OR georgia* OR ghana* OR grenada OR grenadian* OR grenadines OR guatemala* OR guinea-bissau* OR guyan* OR haiti* OR herzegovin* OR hondura* OR india OR indian* OR indonesia* OR iran* OR iraq* OR ivorian* OR "ivory coast" OR i-kiribati* OR jamaica* OR jordan* OR kazakh* OR kenya* OR kirghiz* OR kirgiz* OR kiribati* OR kosov*	197,084

	OR kyrgyz* OR "lao people's democratic republic" OR lao* OR leban* OR lesotho* OR liberia* OR libyan* OR madagascar* OR malawi* OR malaysia* OR maldiv* OR mali OR malian* OR malinese* OR "marshall island*" OR marshallese* OR mauritania* OR mauriti* OR mexican* OR mexico OR micronesia* OR moldova* OR mongolia* OR mongol OR mongol's OR mongols* OR montenegr* OR montserrat* OR morocc* OR mosotho* OR mozambique OR mozambican* OR myanma* OR nepal* OR namibia* OR nauru* OR nicaragua* OR niue* OR niger* OR ni-vanuatu* OR "north korea*" OR macedonia* OR pakistan* OR palestin* OR panama* OR "papua new guinea*" OR papuan* OR paraguay* OR peru* OR philippine* OR rwanda* OR "saint helen*" OR "saint lucia*" OR "saint vincent*" OR salvadoran* OR salvadorean* OR salvadorian* OR samoa* OR "sao tome*" OR senegal* OR serbia* OR "sierra leone*" OR "solomon island*" OR somali* OR "south africa*" OR "sri lanka*" OR sudan* OR suriname* OR swati* OR swazi* OR syria* OR tajik* OR tanzania* OR thai* OR timor-leste OR timorese OR togo OR togolese OR tokelau* OR tonga* OR tunisia* OR turk OR turkey OR turkish OR turkmen* OR turk's OR turks OR tuvalu* OR uganda* OR ukrain* OR uzbek* OR vanuatu* OR venezuela* OR vietnam* OR "wallis and fortuna" OR wallisian* OR "west bank" OR yemen* OR zambia* OR zimbabwe*) AND PUBYEAR > 2011 AND PUBYEAR < 2025	
5	(TITLE-ABS-KEY ("developing countr*" OR "low middle income countr*" OR "low* and middle income countr*" OR "low* or middle income countr*" OR lmic* OR afghan* OR albania* OR algeria* OR angola* OR argentina* OR armenia* OR azerbaijan* OR azeri* OR bangladesh* OR basotho* OR belarus* OR belize* OR benin* OR bhutan* OR bissau-guinea* OR bolivia* OR bosnia* OR botswan* OR brazil* OR "burkina faso" OR burkinabe* OR burmese OR burundi* OR "cabo verde*" OR cambodia* OR cameroon* OR "central african republic" OR chad OR chadian* OR china OR chinese OR colombia* OR comor* OR congo* OR "costa rica*" OR "cote d'ivoire" OR cuba* OR "democratic people's republic of korea" OR djibouti* OR dominica* OR ecuador* OR egypt* OR "el salvador*" OR equatoguinea* OR "equatorial guinea*" OR eritrea* OR eswatini OR ethiopia* OR fiji* OR filipin* OR futunan* OR gabon* OR gambia* OR "gaza strip" OR georgia* OR ghana* OR grenada* OR grenadian* OR grenadines OR guatemala* OR guinea-bissau* OR guyan* OR haiti* OR herzegovin* OR hondura* OR india OR indian* OR indonesia* OR iran* OR iraq* OR ivorian* OR "ivory coast" OR i-kiribati* OR jamaica* OR jordan* OR kazakh* OR kenya* OR kirghiz* OR kirgiz* OR kiribati* OR kosov* OR kyrgyz* OR "lao people's democratic republic" OR lao* OR leban* OR lesotho* OR liberia* OR libyan* OR madagascar* OR malawi* OR malaysia* OR maldiv* OR mali OR malian* OR malinese* OR "marshall island*" OR marshallese* OR mauritania* OR mauriti* OR mexican* OR mexico OR micronesia* OR moldova* OR mongolia* OR mongol OR mongol's OR mongols* OR montenegr* OR montserrat* OR morocc* OR mosotho* OR mozambique OR mozambican* OR myanma* OR nepal* OR namibia* OR nauru* OR nicaragua* OR niue* OR niger* OR ni-vanuatu* OR "north korea*" OR macedonia* OR pakistan* OR palestin* OR panama* OR "papua new guinea*" OR papuan* OR paraguay* OR peru* OR philippine* OR rwanda* OR "saint helen*" OR "saint lucia*" OR "saint vincent*" OR salvadoran* OR salvadorean* OR salvadorian* OR samoa* OR "sao tome*" OR senegal* OR serbia* OR "sierra leone*" OR "solomon island*" OR "south africa*" OR "sri lanka*" OR sudan* OR suriname* OR swati* OR swazi* OR syria* OR tajik* OR tanzania* OR thai* OR timor-leste OR timorese OR togo OR togolese OR tokelau* OR tonga* OR tunisia* OR turk OR turkey OR turkish OR turkmen* OR turk's OR turks OR tuvalu* OR uganda* OR ukrain* OR uzbek* OR vanuatu* OR venezuela* OR vietnam* OR "wallis and fortuna" OR wallisian* OR "west bank" OR yemen* OR zambia* OR zimbabwe*) AND PUBYEAR > 2011) AND ((TITLE-ABS-KEY ("illicit tobacco") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit cigarette*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* w/3 tobacco*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (illicit* W/3 "smoke* tobacco") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (illicit* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (illicit* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* trade" W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit cigarette market") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* trade" W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* sale*" W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* sale*" W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (smuggling* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (smuggle* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (smuggle* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 sale*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 consumption) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 production) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit* cigarette*" W/3 market*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (cigarette* W/3 "tax evasion*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (tobacco* W/3 "tax evasion*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (cigarette* W/3 "tax avoid*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (tobacco* W/3 "tax avoid*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY ("illicit whites*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (tobacco* W/3 "packaging compliance*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (bootlegg* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (bootlegg* W/3 cigarette*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (bootlegging* W/3 tobacco*) AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 "excise stamp*") AND PUBYEAR > 2011) OR (TITLE-ABS-KEY (counterfeit* W/3 "tax stamp*") AND PUBYEAR > 2011) AND (TITLE-ABS-KEY (tobacco*) OR TITLE-ABS-KEY (birri*) OR TITLE-ABS-KEY (beedi*) OR TITLE-ABS-KEY (zarda*) OR TITLE-ABS-KEY (naswar*) OR TITLE-ABS-KEY (gutka*) OR TITLE-ABS-KEY (khaini*) OR TITLE-ABS-KEY ("hand rolled cigarette") OR TITLE-ABS-KEY ("smoking tobacco") OR TITLE-ABS-KEY ("smokeless tobacco")) AND PUBYEAR > 2011) AND (LIMIT-TO (LANGUAGE , "English"))	128

#	Query	Results
1	Search: (((((((((tobacco*) OR (birri*) OR (beedi*) OR (zarda*) OR (naswar*) OR (gutka*)) OR (khaini*)) OR (hand rolled cigarette*)) OR (smokeless tobacco*)) OR (smoking tobacco*)) Filters: from 2012 - 2023 ("tobacco*[All Fields] OR "birri*[All Fields] OR "beedi*[All Fields] OR "zarda*[All Fields] OR "naswar*[All Fields] OR "gutka*[All Fields] OR "khaini*[All Fields] OR ((("hand"[MeSH Terms] OR "hand"[All Fields]) AND ("rolled"[All Fields] OR "rolling"[All Fields] OR "rolls"[All Fields]) AND "cigarette*[All Fields] OR ((("lobeline"[Supplementary Concept] OR "lobeline"[All Fields] OR "smokeless"[All Fields] OR "lobeline"[MeSH Terms] AND "tobacco*[All Fields] OR ((("smoke"[Supplementary Concept] OR "smoke"[All Fields] OR "smoke"[MeSH Terms] OR "smoke s"[All Fields] OR "smoked"[All Fields] OR "smokes"[All Fields] OR "smoking"[MeSH Terms] OR "smoking"[All Fields] OR "smokings"[All Fields] OR "smoking s"[All Fields]) AND "tobacco*[All Fields])) AND (2012:2023[pdat])	81,773
2	Search: (((((((((((((((((((((((((((((((("illicit tobacco") OR ("illicit cigarette") OR (illicit ~3 smoke* tobacco)) OR (illicit ~3 cigarette*)) OR ("illicit trade" ~3 tobacco*)) OR ("illicit cigarette market") OR ("illicit* sale*" ~ tobacco*)) OR ("illicit* sale*" ~ cigarette*)) OR (smuggling* ~3 tobacco*)) OR (smuggle* ~3 tobacco*)) OR (smuggle* ~3 cigarette*)) OR (counterfeit* ~3 tobacco*)) OR (illicit cigarette sale*)) OR ("illicit* cigarette*" ~3 sale*)) OR ("illicit* cigarette*" ~3 consumption)) OR ("illicit* cigarette*" ~3 production)) OR ("illicit* cigarette*" ~3 market*)) OR (cigarette* ~3 tax evasion*)) OR (tobacco* ~3 tax evasion*)) OR (cigarette* ~3 tax avoid*)) OR (tobacco* ~3 tax avoid*)) OR (counterfeit* ~3 cigarette*)) OR (counterfeit* ~3 tax stamp*)) OR ("counterfeit*[All Fields] AND "3"[All Fields] AND ("excisable"[All Fields] OR "excise"[All Fields] OR "excised"[All Fields] OR "excises"[All Fields] OR "excising"[All Fields] OR "excision"[All Fields] OR "excisions"[All Fields] AND "stamp*[All Fields])) OR ("bootlegging*[All Fields] AND "3"[All Fields] AND ("tobacco"[MeSH Terms] OR "tobacco"[All Fields] OR "tobacco products"[MeSH Terms] OR ("tobacco"[All Fields] AND "products"[All Fields]) OR "tobacco products"[All Fields] OR "tobaccos"[All Fields] OR "tobacco s"[All Fields])))) OR (bootlegg* ~3 cigarette*)) OR (bootlegg* ~3 tobacco*)) OR (tobacco* ~3 packaging compliance) Filters: English, from 2012/1/1 - 3000/12/12 ("illicit tobacco*[All Fields] OR "illicit cigarette*[All Fields] OR ((("illicit"[All Fields] OR "illicits"[All Fields] AND "3"[All Fields] AND "smoke*[All Fields] AND ("tobacco"[MeSH Terms] OR "tobacco"[All Fields] OR "tobacco products"[MeSH Terms] OR ("tobacco"[All Fields] AND "products"[All Fields]) OR "tobacco products"[All Fields] OR "tobaccos"[All Fields] OR "tobacco s"[All Fields])) OR ((("illicit"[All Fields] OR "illicits"[All Fields] AND "3"[All Fields] AND "cigarette*[All Fields] OR ("illicit trade"[All Fields] AND ("3"[All Fields] AND "tobacco*[All Fields])) OR "illicit cigarette market"[All Fields] OR ("illicit sale*[All Fields] AND "tobacco*[All Fields] OR ("illicit sale*[All Fields] AND "cigarette*[All Fields] OR ("smuggling*[All Fields] AND "3"[All Fields] AND "tobacco*[All Fields] OR ("smuggle*[All Fields] AND "3"[All Fields] AND "tobacco*[All Fields] OR ("smuggle*[All Fields] AND "3"[All Fields] AND "cigarette*[All Fields] OR ("counterfeit*[All Fields] AND "3"[All Fields] AND "tobacco*[All Fields] OR ((("illicit"[All Fields] OR "illicits"[All Fields] AND "cigarette*[All Fields] OR "cigarette s"[All Fields] OR "cigaretts"[All Fields] OR "tobacco products"[MeSH Terms] OR ("tobacco"[All Fields] AND "products"[All Fields]) OR "tobacco products"[All Fields] OR "cigarette"[All Fields] OR "cigarettes"[All Fields] AND "sale*[All Fields] OR ("illicit cigarette*[All Fields] AND ("3"[All Fields] AND "sale*[All Fields])) OR ("illicit cigarette*[All Fields] AND ("3"[All Fields] AND "consumptions"[All Fields] OR "economics"[MeSH Terms] OR "economics"[All Fields] OR "consumption"[All Fields])) OR ("illicit cigarette*[All Fields] AND ("3"[All Fields] AND ("economics"[MeSH Terms] OR "economics"[All Fields] OR "production"[All Fields] OR "productions"[All Fields] OR "efficiency"[MeSH Terms] OR "efficiency"[All Fields] OR "productivity"[All Fields] OR "product"[All Fields] OR "product s"[All Fields] OR "productive"[All Fields] OR "productively"[All Fields] OR "productivities"[All Fields] OR "products"[All Fields])) OR ("illicit cigarette*[All Fields] AND ("3"[All Fields] AND "market*[All Fields])) OR ("cigarette*[All Fields] AND "3"[All Fields] AND "tax"[All Fields] AND "evasion*[All Fields] OR ("tobacco*[All Fields] AND "3"[All Fields] AND "tax"[All Fields] AND "evasion*[All Fields] OR ("cigarette*[All Fields] AND "3"[All Fields] AND "tax"[All Fields] AND "avoid*[All Fields] OR ("tobacco*[All Fields] AND "3"[All Fields] AND "tax"[All Fields] AND "avoid*[All Fields] OR ("counterfeit*[All Fields] AND "3"[All Fields] AND "cigarette*[All Fields] OR ("counterfeit*[All Fields] AND "3"[All Fields] AND "tax"[All Fields] AND "stamp*[All Fields]) OR ("counterfeit*[All Fields] AND "3"[All Fields] AND ("excisable"[All Fields] OR "excise"[All Fields] OR "excised"[All Fields] OR "excises"[All Fields] OR "excising"[All Fields] OR "excision"[All Fields] OR "excisions"[All Fields] AND "stamp*[All Fields]) OR ("bootlegging*[All Fields] AND "3"[All Fields] AND ("tobacco"[MeSH Terms] OR "tobacco"[All Fields] OR "tobacco products"[MeSH Terms] OR ("tobacco"[All Fields] AND "products"[All Fields]) OR "tobacco products"[All Fields] OR "tobaccos"[All Fields] OR "tobacco s"[All Fields])) OR ("bootlegg*[All Fields] AND "3"[All Fields] AND "cigarette*[All Fields] OR ("bootlegg*[All Fields] AND "3"[All Fields] AND "tax"[All Fields] AND "tobacco*[All Fields] OR ("tobacco*[All Fields] AND "3"[All Fields] AND ("package"[All Fields] OR "packages"[All Fields] OR "product packaging"[MeSH Terms] OR ("product"[All Fields] AND "packaging"[All Fields] OR "product packaging"[All Fields] OR "packaged"[All Fields] OR "packaging"[All Fields] OR "drug packaging"[MeSH Terms] OR ("drug"[All Fields] AND "packaging"[All Fields] OR "drug packaging"[All Fields] OR "packagings"[All Fields]) AND ("compliances"[All Fields] OR "patient compliance"[MeSH Terms] OR ("patient"[All Fields] AND "compliance"[All Fields]) OR "patient compliance"[All Fields] OR "compliance"[All Fields] OR "compliance"[MeSH Terms])))) AND ((2012/1/1:3000/12/12[pdat]) AND (english[Filter]))	619
3	Search: low-income-countr*[Title/Abstract] or middle-income-countr*[Title/Abstract] or low-middle-income-countr*[Title/Abstract] or low*-and-middle-income-countr*[Title/Abstract] or low*-or-middle-income-countr*[Title/Abstract] or lmic*[Title/Abstract] or "Afghanistan"[Mesh] or "Albania"[Mesh] or "Aleria"[Mesh] or "Angola"[Mesh] or "Argentina"[Mesh] or "Armenia"[Mesh] or "Azerbaijan"[Mesh]	676,050

or "Atlantic Islands"[Mesh] or "Bangladesh"[Mesh] or "Belize"[Mesh] or "Benin"[Mesh] or "Bhutan"[Mesh] or "Bolivia"[Mesh] or "Bosnia and Herzegovina"[Mesh] or "Botswana"[Mesh] or "Brazil"[Mesh] or "Burkina Faso"[Mesh] or "Burundi"[Mesh] or "Cabo Verde"[Mesh] or "Cambodia"[Mesh] or "Cameroon"[Mesh] or "Central African Republic"[Mesh] or "Chad"[Mesh] or "China"[Mesh] or "Colombia"[Mesh] or "Comoros"[Mesh] or "Congo"[Mesh] or "Costa Rica"[Mesh] or "Cote d'Ivoire"[Mesh] or "Cuba"[Mesh] or "Democratic People's Republic of Korea"[Mesh] or "Democratic Republic of the Congo"[Mesh] or "Developing Countries"[Mesh] or "Djibouti"[Mesh] or "Dominica"[Mesh] or "Dominican Republic"[Mesh] or "Ecuador"[Mesh] or "Egypt"[Mesh] or "El Salvador"[Mesh] or "Equatorial Guinea"[Mesh] or "Eritrea"[Mesh] or "Eswatini"[Mesh] or "Ethiopia"[Mesh] or "Fiji"[Mesh] or "Gabon"[Mesh] or "Gambia"[Mesh] or "Georgia (Republic)"[Mesh] or "Ghana"[Mesh] or "Grenada"[Mesh] or "Guatemala"[Mesh] or "Guinea"[Mesh] or "Guinea-Bissau"[Mesh] or "Guyana"[Mesh] or "Haiti"[Mesh] or "Honduras"[Mesh] or "India"[Mesh] or "Indian Ocean Islands"[Mesh] or "Iraq"[Mesh] or "Jamaica"[Mesh] or "Jordan"[Mesh] or "Kazakhstan"[Mesh] or "Kenya"[Mesh] or "Kosovo"[Mesh] or "Kyrgyzstan"[Mesh] or "Laos"[Mesh] or "Lebanon"[Mesh] or "Lesotho"[Mesh] or "Liberia"[Mesh] or "Libya"[Mesh] or "Madagascar"[Mesh] or "Malawi"[Mesh] or "Malaysia"[Mesh] or "Mali"[Mesh] or "Mauritania"[Mesh] or "Mauritius"[Mesh] or "Melanesia"[Mesh] or Mexico[Mesh] or "Micronesia"[Mesh] or "Middle East"[Mesh] or "Moldova"[Mesh] or "Mongolia"[Mesh] or "Montenegro"[Mesh] or "Morocco"[Mesh] or "Mozambique"[Mesh] or "Myanmar"[Mesh] or "Namibia"[Mesh] or "Nepal"[Mesh] or "Nicaragua"[Mesh] or "Niger"[Mesh] or "Nigeria"[Mesh] or "Pakistan"[Mesh] or "Panama"[Mesh] or "Papua New Guinea"[Mesh] or "Paraguay"[Mesh] or "Peru"[Mesh] or "Philippines"[Mesh] or "Polynesia"[Mesh] or "Republic of Belarus"[Mesh] or "Republic of North Macedonia"[Mesh] or "Rwanda"[Mesh] or "Saint Lucia"[Mesh] or "Saint Vincent and the Grenadines"[Mesh] or "Sao Tome and Principe"[Mesh] or "Samoa"[Mesh] or "Senegal"[Mesh] or "Serbia"[Mesh] or "Sierra Leone"[Mesh] or "Somalia"[Mesh] or "South Africa"[Mesh] or "South Sudan"[Mesh] or "Sri Lanka"[Mesh] or "Sudan"[Mesh] or "Suriname"[Mesh] or "Syria"[Mesh] or "Tajikistan"[Mesh] or "Tanzania"[Mesh] or "Thailand"[Mesh] or "Timor-Leste"[Mesh] or "Togo"[Mesh] or "Tonga"[Mesh] or "Tunisia"[Mesh] or "Turkey"[Mesh] or "Turkmenistan"[Mesh] or "Uganda"[Mesh] or "Ukraine"[Mesh] or "Uzbekistan"[Mesh] or "Vanuatu"[Mesh] or "Venezuela"[Mesh] or "Vietnam"[Mesh] or "West Indies"[Mesh] or "Yemen"[Mesh] or "Zambia"[Mesh] or "Zimbabwe"[Mesh] or gaza-strip[Title/Abstract] or kiribati*[Title/Abstract] or maldiv*[Title/Abstract] or marshall-island*[Title/Abstract] or montserrat*[Title/Abstract] or nauru*[Title/Abstract] or niue*[Title/Abstract] or palestine*[Title/Abstract] or solomon-island*[Title/Abstract] or saint-helena*[Title/Abstract] or tokelau*[Title/Abstract] or tuvalu*[Title/Abstract] or wallis-and-futuna[Title/Abstract] or west-bank[Title/Abstract] Filters: English, from 2012/1/1 - 3000/12/12 ("low income countr*[Title/Abstract] OR "middle income countr*[Title/Abstract] OR "low middle income countr*[Title/Abstract] OR "low and middle income countr*[Title/Abstract] OR "low or middle income countr*[Title/Abstract] OR "lmc*[Title/Abstract] OR "Afghanistan"[MeSH Terms] OR "Albania"[MeSH Terms] OR "Algeria"[MeSH Terms] OR "Angola"[MeSH Terms] OR "Argentina"[MeSH Terms] OR "Armenia"[MeSH Terms] OR "Azerbaijan"[MeSH Terms] OR "Atlantic Islands"[MeSH Terms] OR "Bangladesh"[MeSH Terms] OR "Belize"[MeSH Terms] OR "Benin"[MeSH Terms] OR "Bhutan"[MeSH Terms] OR "Bolivia"[MeSH Terms] OR "Bosnia and Herzegovina"[MeSH Terms] OR "Botswana"[MeSH Terms] OR "Brazil"[MeSH Terms] OR "Burkina Faso"[MeSH Terms] OR "Burundi"[MeSH Terms] OR "Cabo Verde"[MeSH Terms] OR "Cambodia"[MeSH Terms] OR "Cameroon"[MeSH Terms] OR "Central African Republic"[MeSH Terms] OR "Chad"[MeSH Terms] OR "China"[MeSH Terms] OR "Colombia"[MeSH Terms] OR "Comoros"[MeSH Terms] OR "Congo"[MeSH Terms] OR "Costa Rica"[MeSH Terms] OR "Cote d'Ivoire"[MeSH Terms] OR "Cuba"[MeSH Terms] OR "Democratic People's Republic of Korea"[MeSH Terms] OR "Democratic Republic of the Congo"[MeSH Terms] OR "Developing Countries"[MeSH Terms] OR "Djibouti"[MeSH Terms] OR "Dominica"[MeSH Terms] OR "Dominican Republic"[MeSH Terms] OR "Ecuador"[MeSH Terms] OR "Egypt"[MeSH Terms] OR "El Salvador"[MeSH Terms] OR "Equatorial Guinea"[MeSH Terms] OR "Eritrea"[MeSH Terms] OR "Eswatini"[MeSH Terms] OR "Ethiopia"[MeSH Terms] OR "Fiji"[MeSH Terms] OR "Gabon"[MeSH Terms] OR "Gambia"[MeSH Terms] OR "georgia republic"[MeSH Terms] OR "Ghana"[MeSH Terms] OR "Grenada"[MeSH Terms] OR "Guatemala"[MeSH Terms] OR "Guinea"[MeSH Terms] OR "Guinea-Bissau"[MeSH Terms] OR "Guyana"[MeSH Terms] OR "Haiti"[MeSH Terms] OR "Honduras"[MeSH Terms] OR "India"[MeSH Terms] OR "Indian Ocean Islands"[MeSH Terms] OR "Iraq"[MeSH Terms] OR "Jamaica"[MeSH Terms] OR "Jordan"[MeSH Terms] OR "Kazakhstan"[MeSH Terms] OR "Kenya"[MeSH Terms] OR "Kosovo"[MeSH Terms] OR "Kyrgyzstan"[MeSH Terms] OR "Laos"[MeSH Terms] OR "Lebanon"[MeSH Terms] OR "Lesotho"[MeSH Terms] OR "Liberia"[MeSH Terms] OR "Libya"[MeSH Terms] OR "Madagascar"[MeSH Terms] OR "Malawi"[MeSH Terms] OR "Malaysia"[MeSH Terms] OR "Mali"[MeSH Terms] OR "Mauritania"[MeSH Terms] OR "Mauritius"[MeSH Terms] OR "Melanesia"[MeSH Terms] OR "mexico"[MeSH Terms] OR "micronesia"[MeSH Terms] OR "Middle East"[MeSH Terms] OR "Moldova"[MeSH Terms] OR "Mongolia"[MeSH Terms] OR "Montenegro"[MeSH Terms] OR "Morocco"[MeSH Terms] OR "Mozambique"[MeSH Terms] OR "Myanmar"[MeSH Terms] OR "Namibia"[MeSH Terms] OR "Nepal"[MeSH Terms] OR "Nicaragua"[MeSH Terms] OR "Niger"[MeSH Terms] OR "Nigeria"[MeSH Terms] OR "Pakistan"[MeSH Terms] OR "Panama"[MeSH Terms] OR "Papua New Guinea"[MeSH Terms] OR "Paraguay"[MeSH Terms] OR "Peru"[MeSH Terms] OR "Philippines"[MeSH Terms] OR "Polynesia"[MeSH Terms] OR "Republic of Belarus"[MeSH Terms] OR "Republic of North Macedonia"[MeSH Terms] OR "Rwanda"[MeSH Terms] OR "Saint Lucia"[MeSH Terms] OR "Saint Vincent and the Grenadines"[MeSH Terms] OR "Sao Tome and Principe"[MeSH Terms] OR "Samoa"[MeSH Terms] OR "Senegal"[MeSH Terms] OR "Serbia"[MeSH Terms] OR "Sierra Leone"[MeSH Terms] OR "Somalia"[MeSH Terms] OR "South Africa"[MeSH Terms] OR "South Sudan"[MeSH Terms] OR "Sri Lanka"[MeSH Terms] OR "Sudan"[MeSH Terms] OR "Suriname"[MeSH Terms] OR "Syria"[MeSH Terms] OR "Tajikistan"[MeSH Terms] OR "Tanzania"[MeSH Terms] OR "Thailand"[MeSH Terms] OR "Timor-Leste"[MeSH Terms] OR "Togo"[MeSH Terms] OR "Tonga"[MeSH Terms] OR "Tunisia"[MeSH Terms] OR "Turkey"[MeSH Terms] OR "Turkmenistan"[MeSH Terms] OR "Uganda"[MeSH Terms] OR "Ukraine"[MeSH Terms] OR "Uzbekistan"[MeSH Terms] OR "Vanuatu"[MeSH Terms] OR "Venezuela"[MeSH Terms] OR	
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	"Vietnam"[MeSH Terms] OR "West Indies"[MeSH Terms] OR "Yemen"[MeSH Terms] OR "Zambia"[MeSH Terms] OR "Zimbabwe"[MeSH Terms] OR "gaza-strip"[Title/Abstract] OR "kiribati"[Title/Abstract] OR "maldivi"[Title/Abstract] OR "marshall island"[Title/Abstract] OR "montserrat"[Title/Abstract] OR "nauru"[Title/Abstract] OR "niue"[Title/Abstract] OR "palestin"[Title/Abstract] OR "solomon island"[Title/Abstract] OR "saint helena"[Title/Abstract] OR "tokelau"[Title/Abstract] OR "tuvalu"[Title/Abstract] OR "wallis-and-futuna"[Title/Abstract] OR "west-bank"[Title/Abstract] AND ((2012/1/1:3000/12/12[pdat]) AND (english[Filter]))	
4	Search: (((("tobacco"[All Fields] OR "birri"[All Fields] OR "beedi"[All Fields] OR "zarda"[All Fields] OR "naswar"[All Fields] OR "gutka"[All Fields] OR "khaini"[All Fields] OR ("hand"[MeSH Terms] OR "hand"[All Fields]) AND ("rolled"[All Fields] OR "rolling"[All Fields] OR "rolls"[All Fields]) AND "cigarette"[All Fields]) OR ("lobeline"[Supplementary Concept] OR "lobeline"[All Fields] OR "smokeless"[All Fields] OR "lobeline"[MeSH Terms]) AND "tobacco"[All Fields]) OR ((("smoke"[Supplementary Concept] OR "smoke"[All Fields] OR "smoke"[MeSH Terms] OR "smoke s"[All Fields] OR "smoked"[All Fields] OR "smokes"[All Fields] OR "smoking"[MeSH Terms] OR "smoking"[All Fields] OR "smokings"[All Fields] OR "smoking s"[All Fields]) AND "tobacco"[All Fields])) AND (2012:2023[pdat])) AND (((((((((((((((((((("illicit tobacco") OR ("illicit cigarette") OR (illicit ~3 smoke* tobacco) OR (illicit ~3 cigarette*) OR ("illicit trade" ~3 tobacco*) OR ("illicit cigarette market") OR ("illicit* sale" ~ tobacco*) OR ("illicit* sale" ~ cigarette*) OR (smuggling* ~3 tobacco*) OR (smuggle* ~3 tobacco*) OR (smuggle* ~3 cigarette*) OR (counterfeit* ~3 tobacco*) OR (illicit cigarette sale*) OR ("illicit* cigarette*" ~3 sale*) OR ("illicit* cigarette*" ~3 consumption) OR ("illicit* cigarette*" ~3 production) OR ("illicit* cigarette*" ~3 market*) OR (cigarette* ~3 tax evasion*) OR (tobacco* ~3 tax evasion*) OR (cigarette* ~3 tax avoid*) OR (tobacco* ~3 tax avoid*) OR (counterfeit* ~3 cigarette*) OR (counterfeit* ~3 tax stamp*) OR ("counterfeit"[All Fields] AND "3"[All Fields] AND ("excisable"[All Fields] OR "excise"[All Fields] OR "excised"[All Fields] OR "excises"[All Fields] OR "excising"[All Fields] OR "excision"[All Fields] OR "excisions"[All Fields]) AND "stamp"[All Fields])) OR ("bootlegging"[All Fields] AND "3"[All Fields] AND ("tobacco"[MeSH Terms] OR "tobacco"[All Fields] OR "tobacco products"[MeSH Terms] OR "tobacco"[All Fields] AND "products"[All Fields]) OR "tobacco products"[All Fields] OR "tobaccos"[All Fields] OR "tobacco s"[All Fields])))) OR (bootlegg* ~3 cigarette*) OR (bootlegg* ~3 tobacco*) OR (tobacco* ~3 packaging compliance) AND ((2012/1/1:3000/12/12[pdat]) AND (english[Filter])))) AND (low-income-countr*[Title/Abstract] or middle-income-countr*[Title/Abstract] or low-middle-income-countr*[Title/Abstract] or low*-and-middle-income-countr*[Title/Abstract] or low*-or-middle-income-countr*[Title/Abstract] or lmic*[Title/Abstract] or "Afghanistan"[Mesh] or "Albania"[Mesh] or "Algeria"[Mesh] or "Angola"[Mesh] or "Argentina"[Mesh] or "Armenia"[Mesh] or "Azerbaijan"[Mesh] or "Atlantic Islands"[Mesh] or "Bangladesh"[Mesh] or "Belize"[Mesh] or "Benin"[Mesh] or "Bhutan"[Mesh] or "Bolivia"[Mesh] or "Bosnia and Herzegovina"[Mesh] or "Botswana"[Mesh] or "Brazil"[Mesh] or "Burkina Faso"[Mesh] or "Burundi"[Mesh] or "Cabo Verde"[Mesh] or "Cambodia"[Mesh] or "Cameroon"[Mesh] or "Central African Republic"[Mesh] or "Chad"[Mesh] or "China"[Mesh] or "Colombia"[Mesh] or "Comoros"[Mesh] or "Congo"[Mesh] or "Costa Rica"[Mesh] or "Cote d'Ivoire"[Mesh] or "Cuba"[Mesh] or "Democratic People's Republic of Korea"[Mesh] or "Democratic Republic of the Congo"[Mesh] or "Developing Countries"[Mesh] or "Djibouti"[Mesh] or "Dominica"[Mesh] or "Dominican Republic"[Mesh] or "Ecuador"[Mesh] or "Egypt"[Mesh] or "El Salvador"[Mesh] or "Equatorial Guinea"[Mesh] or "Eritrea"[Mesh] or "Eswatini"[Mesh] or "Ethiopia"[Mesh] or "Fiji"[Mesh] or "Gabon"[Mesh] or "Gambia"[Mesh] or "Georgia (Republic)"[Mesh] or "Ghana"[Mesh] or "Grenada"[Mesh] or "Guatemala"[Mesh] or "Guinea"[Mesh] or "Guinea-Bissau"[Mesh] or "Guyana"[Mesh] or "Haiti"[Mesh] or "Honduras"[Mesh] or "India"[Mesh] or "Indian Ocean Islands"[Mesh] or "Iraq"[Mesh] or "Jamaica"[Mesh] or "Jordan"[Mesh] or "Kazakhstan"[Mesh] or "Kenya"[Mesh] or "Kosovo"[Mesh] or "Kyrgyzstan"[Mesh] or "Laos"[Mesh] or "Lebanon"[Mesh] or "Lesotho"[Mesh] or "Liberia"[Mesh] or "Libya"[Mesh] or "Madagascar"[Mesh] or "Malawi"[Mesh] or "Malaysia"[Mesh] or "Mali"[Mesh] or "Mauritania"[Mesh] or "Mauritius"[Mesh] or "Melanesia"[Mesh] or Mexico[Mesh] or "Micronesia"[Mesh] or "Middle East"[Mesh] or "Moldova"[Mesh] or "Mongolia"[Mesh] or "Montenegro"[Mesh] or "Morocco"[Mesh] or "Mozambique"[Mesh] or "Myanmar"[Mesh] or "Namibia"[Mesh] or "Nepal"[Mesh] or "Nicaragua"[Mesh] or "Niger"[Mesh] or "Nigeria"[Mesh] or "Pakistan"[Mesh] or "Panama"[Mesh] or "Papua New Guinea"[Mesh] or "Paraguay"[Mesh] or "Peru"[Mesh] or "Philippines"[Mesh] or "Polynesia"[Mesh] or "Republic of Belarus"[Mesh] or "Republic of North Macedonia"[Mesh] or "Rwanda"[Mesh] or "Saint Lucia"[Mesh] or "Saint Vincent and the Grenadines"[Mesh] or "Sao Tome and Principe"[Mesh] or "Samoa"[Mesh] or "Senegal"[Mesh] or "Serbia"[Mesh] or "Sierra Leone"[Mesh] or "Somalia"[Mesh] or "South Africa"[Mesh] or "South Sudan"[Mesh] or "Sri Lanka"[Mesh] or "Sudan"[Mesh] or "Suriname"[Mesh] or "Syria"[Mesh] or "Tajikistan"[Mesh] or "Tanzania"[Mesh] or "Thailand"[Mesh] or "Timor-Leste"[Mesh] or "Togo"[Mesh] or "Tonga"[Mesh] or "Tunisia"[Mesh] or "Turkey"[Mesh] or "Turkmenistan"[Mesh] or "Uganda"[Mesh] or "Ukraine"[Mesh] or "Uzbekistan"[Mesh] or "Vanuatu"[Mesh] or "Venezuela"[Mesh] or "Vietnam"[Mesh] or "West Indies"[Mesh] or "Yemen"[Mesh] or "Zambia"[Mesh] or "Zimbabwe"[Mesh] or gaza-strip[Title/Abstract] or kiribati*[Title/Abstract] or maldivi*[Title/Abstract] or marshall-island*[Title/Abstract] or montserrat*[Title/Abstract] or nauru*[Title/Abstract] or niue*[Title/Abstract] or palestin*[Title/Abstract] or solomon-island*[Title/Abstract] or saint-helena*[Title/Abstract] or tokelau*[Title/Abstract] or tuvalu*[Title/Abstract] or wallis-and-futuna[Title/Abstract] or west-bank[Title/Abstract]) Filters: English, from 2012/1/1 - 2023/16/07	120

Database: The Cochrane Library (From: January 01 2012 to July 16, 2023)

ID	Search	Hits
#1	(Tobacco*):ti,ab,kw (Word variations have been searched) with Cochrane Library publication date from Jan 2012 to present	9077
#2	(birri*):ti,ab,kw (Word variations have been searched) with Cochrane Library publication date from Jan 2012 to present	6
#3	beedi* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	45
#4	zarda* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	46
#5	naswar* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	4
#6	gutka* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	19
#7	khaini with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	8
#8	hand rolled cigarette* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	13
#9	smoking tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	9471
#10	smokeless tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	357
#11	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10	11871
#12	illicit tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	187
#13	illicit cigarette* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	102
#14	illicit* near/3 tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	35
#15	illicit* near/3 smoke* tobacco with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	11
#16	illicit* near/3 cigarette* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	18
#17	illicit* trade near/3 tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#18	illicit cigarette market with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	7
#19	illicit* trade near/3 cigarette* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	1
#20	illicit* sale* near/3 tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#21	illicit* sale* near/3 cigarette* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#22	smuggling* near/3 tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#23	smuggle* near/3 tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#24	smuggle* near/3 cigarette* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#25	counterfeit* near/3 tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#26	illicit* cigarette* near/3 sale* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#27	illicit cigarette sale* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	3
#28	illicit* cigarette* near/3 consumption* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	6
#29	illicit* cigarette* near/3 production* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#30	illicit* cigarette* near/3 market* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	1
#31	cigarette* near/3 tax evasion* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#32	tobacco* near/3 tax evasion* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#33	cigarette* near/3 tax avoid* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	1
#34	tobacco* near/3 tax avoid* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	8
#35	counterfeit* near/3 cigarette* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#36	bootlegging* near/3 tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#37	bootlegg* near/3 cigarette* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0

#38	bootlegg* near/3 cigarette* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#39	bootlegg* near/3 tobacco* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	0
#40	tobacco* near/3 packaging compliance* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	3
#41	illicit whites* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	15
#42	#12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	247
#43	afghan* OR africa* OR albania* OR algeria* OR angola* OR argentin* OR armenia* OR azerbaijan* OR bangladesh* OR bengal* OR bangal* OR belarus* OR belorus* OR byelarus* OR byelorus* OR belize* OR benin* OR dahomey OR bhutan* OR bolivia* OR bosnia* OR herzegovin* OR botswan* OR batswan* OR bechuanaland OR brazil* OR brasil* OR bulgaria* OR burkina* OR burkinese* OR upper-volta* OR burundi* OR urundi* OR cabo-verde* OR cape-verde* OR cambodia* OR kampuchea* OR khmer* OR cameroon* OR cameroon* OR ubangi-shari* OR chad* OR china* OR chinese OR colombia* OR comoro* OR comore* OR comorian* OR mayotte* OR congo* OR zaire* OR costa-rica* OR (cote* AND *ivoir*) OR ivory-coast* OR ivorian* OR cuba* OR djibouti* OR french-somaliland* OR dominica* OR ecuador* OR egypt* OR united-arab-republic* OR el-salvador* OR salvadoran* OR guinea* OR equatoguinea* OR eritrea* OR eswatini* OR swaziland* OR swazi* OR swati* OR ethiopia* OR fiji* OR gabon* OR gabonese* OR gabonaise* OR gambia* OR ((georgia OR georgian OR georgians) NOT (atlanta OR california OR florida)) OR ghana* OR grenada* OR grenadian* OR guatemala* OR guyana* OR guiana* OR guyanese* OR haiti* OR hispaniola* OR hondura* OR india* OR indonesia* OR iran* OR iraq* OR jamaica* OR jordan* OR kazakh* OR kenya* OR karabati* OR korea* OR kosovo* OR kosova* OR kyrgyz* OR kirgiz* OR kirghiz* OR laos OR lao OR laotian* OR lebanon* OR lebanese* OR lesotho* OR lesothan* OR lesothonian* OR basutoland* OR mosotho* OR basotho* OR liberia* OR libya* OR jamahiriya* OR macedonia* OR madagasca* OR malagasy* OR malawi* OR nyasaland* OR malaysia* OR malay-federation OR malaya-federation OR malayan-federation OR maldives* OR maldivian* OR indian-ocean* OR mali* OR micronesia* OR marshallese* OR kiribati* OR marshall-island* OR nauran* OR tuvalu* OR mauritania* OR mauritan* OR mauritius* OR mexico* OR mexican* OR moldova* OR moldovia* OR mongol* OR montenegr* OR morocco* OR moroccan* OR ifni OR mozambique* OR mozambican* OR myanmar* OR burma* OR burmese OR namibia* OR nepal* OR netherlands-antill* OR nicaragua* OR niger* OR pakistan* OR palestine* OR gaza* OR west-bank* OR panama* OR paraguay* OR peru* OR philippine* OR philipine* OR philippine* OR philippine* OR filipino* OR filipina* OR romania* OR russia* OR ussr* OR soviet* OR rwanda* OR rwandese OR ruanda* OR ruandese OR samoa* OR navigator-island* OR pacific-island* OR polynesia* OR sao-tome* OR santomean* OR senegal* OR serbia* OR melanesia* OR solomon-island* OR norfolk-island* OR somali* OR sri-lanka* OR ceylon* OR saint-lucia* OR st-lucia* OR saint-vincent* OR st-vincent* OR vincentian* OR grenadine* OR sudan* OR surinam* OR syria* OR tajik* OR tadjik* OR tadjik* OR tanzania* OR tanganyika* OR thai* OR timor-leste* OR east-timor* OR timorese* OR togo* OR tonga* OR tunisia* OR turkiy* OR turkey* OR turk OR turks OR turkish OR turkmen* OR uganda* OR ukrain* OR uzbek* OR vanuatu* OR new-hebrides OR venezuela* OR vietnam* OR viet-nam* OR yemen* OR yugoslav* OR zambia* OR zimbabwe* OR rhodesia* OR arab-countr* OR arabic-countr* OR middle-east* OR global-south OR sahara* OR subsahara* OR magreb* OR maghrib* OR west-indies* OR caribbean* OR central-america* OR latin-america* OR south-america* OR central-asia* OR north-asia* OR northern-asia* OR southeastern-asia* OR south-eastern-asia* OR southeast-asia* OR south-east-asia* OR west-asia* OR western-asia* OR east-europe* OR eastern-europe* OR developing-countr* OR developing-nation* OR developing-population* OR developing-world OR less-developed-countr* OR less-developed-nation* OR less-developed-world OR lesser-developed-countr* OR lesser-developed-nation* OR lesser-developed-world OR under-developed-countr* OR under-developed-nation* OR under-developed-world OR underdeveloped-countr* OR underdeveloped-nation* OR underdeveloped-world OR middle-income-countr* OR middle-income-nation* OR middle-income-population* OR low-income-countr* OR low-income-nation* OR low-income-population* OR lower-income-countr* OR lower-income-nation* OR lower-income-population* OR underserved-countr* OR underserved-nation* OR underserved-population* OR under-served-population* OR under-served-nation* OR under-served-population* OR deprived-countr* OR deprived-population* OR high-burden-countr* OR high-burden-nation* OR countdown-countr* OR countdown-nation* OR poor-countr* OR poor-nation* OR poor-population* OR poor-world OR poorer-countr* OR poorer-nation* OR poorer-population* OR poorer-world OR developing-econom* OR less developed-econom* OR underdeveloped-econom* OR under-developed-econom* OR middle-income-econom* OR low-income-econom* OR lower-income-econom* OR low-gdp OR low-gnp OR low-gross-domestic OR low-gross-national OR lower-gdp OR lower-gnp OR lower-gross-domestic OR lower-gross-national OR lmic OR lmic OR third-world OR lami-countr* OR transitional-countr* OR emerging-econom* OR emerging-nation* with Cochrane Library publication date from Jan 2012 to present (Word variations have been searched)	307558
#44	#11 AND #42 AND #43 with Cochrane Library publication date from Jan 2012 to present, in Cochrane Reviews (Word variations have been searched)	32

Database: Registers, Websites and Organizations

Sl.	Source	Number
1	REEP (University of Cape Town, South Africa)	32
2	Tobacconomics, (University of Illinois at Chicago, US)	24
3	WHO FCTC Knowledge Hub on Tobacco Taxation and Illicit Trade – E Library	39

Database: Guided Google Search and Grey Literature

Sl.	Source	Number
1	Guided Google Search: “Country Name”, "Illicit tobacco" OR "illicit cigarette" OR "tax evaded cigarette" OR "COUNTERFEIT CIGARETTE"	9
2	ProQuest Dissertations and Theses: "illicit tobacco" OR "illicit cigarette" OR "tax evaded cigarette" OR "counterfeit cigarette" OR "smuggled cigarette" AND LMICs Limits: From 01 January 2012 to 31 December 2023; Language English	48
3	DART-Europe E-theses Portal: "illicit tobacco" OR "illicit cigarette" OR "tax evaded cigarette" OR "counterfeit cigarette" OR "smuggled cigarette"	4

Title and abstract screening form

Administrative information for the study		
Study title (Citation)		
Date of Screening (Title and Abstract)		
Reviewer Initial		
Inclusion Criteria		
		Status (Yes, No, Uncertain)
Study Context	Perspective – Tobacco Control	
	Setting – LMICs	
	Phenomena – Illicit Tobacco	
	Environment – Illicit tobacco sales and/or consumption (counterfeit, smuggling, bootlegging, tax evasion, illicit whites and packaging non-compliance)	
	Timing – 2012 - 2023	
	Findings – Share of illicit tobacco sales and/or consumption	
Inclusion Status	Included	
	Uncertain	
	Excluded	

Full-text screening form

Administrative information for the study		
Study title (Citation)		
Date of Screening (Full Text)		
Reviewer Initial		
Study Author and Corresponding Author – Contact Details		
Eligibility check for the study		
Study Characteristics	Criteria	Status (Yes, No)
Perspective (Per)	Tobacco control	
Setting (S)	Any LMIC or group of LMICs	
Phenomena (P)	Illicit tobacco	
Environment (E)	Sales and/or consumption of illicit tobacco (counterfeit, smuggling, tax evasion, and packaging non-compliance)	
Timing (Ti)	2012 - 2023	
Findings (F)	Share of illicit tobacco sales and/or consumption	
Study Design and Type of Tobacco	Primary, Secondary, Smoking tobacco, Smokeless tobacco	
Language	English	
Decision regarding inclusion of the study		
Included		
Excluded	Reasons: Different country category ☐ Different time ☐ Different language ☐ Different Findings ☐ Different Method (e.g. comparing trend) ☐ Duplicates/Reports containing the same results in other published article ☐ Didn't quantify the findings ☐ Didn't mention the estimation method ☐ Different Perspective. ☐ Different Phenomena ☐ Unavailable full text ☐	

Data extraction form

Title	
Journal	
Citation	
DOI	
Publication Type	
Contact (Corresponding Author)	
Aims & Objectives	
Methodology	
Study design- Type of data used- Primary ☐ Secondary ☐ Dataset description – Study setting/Place – Study period – Sample Size (if any) -	Type of tobacco products included- Smoked ☐ Smokeless ☐ Both ☐ Type of illicit estimated – Tax evasion ☐ Smuggling ☐ Counterfeit ☐ Bootlegging ☐ Illicit White ☐ Pack Non-compliance ☐
Estimation Method: Trade monitoring ☐ Tax gap Analysis ☐ Econometric modelling ☐ Expert opinion ☐ Key Informant Interview ☐ Pack analysis ☐ Pack Source – Smokers ☐ Pack Source – Retailers ☐ Pack Source – Littered ☐ Pack Source – Others ☐ Survey of tobacco users ☐ Analysing seizure of illegal tobacco ☐	Comparator/ control (if any): Not Required
Results	
Outcomes- Share/Extent/Magnitude/Percentage/Proportion of illicit tobacco sales- illicit tobacco consumption- illicit tobacco (market share)- smuggled tobacco- counterfeit tobacco- bootlegged tobacco- tax evaded tobacco- illicit white- non-compliant tobacco- Measures (mark and fill the value where applicable) – Proportion/Share RR ☐ OR ☐ RD ☐ Marginal Effect ☐ Effect Estimate ☐ Other (mention): _____ Confidence Interval (95%): Lower ☐ Upper ☐ Not provided ☐ Standard Error: Value ☐ Not provided ☐	
Key Conclusions-	
Limitations-	
Strengths-	
Funding source	Conflict of interest
Any other comments-	

Critical appraisal form

Sl.	Domain	Criteria/Characteristics	Responses	Total Criteria for Overall Assessment Domain (weight)
1	Peer reviewed	Peer reviewed/Refers to a peer review process	Yes/No/Unclear	1 (0.05)
2	Funding	Acknowledged	Yes/No/Unclear	2 (0.10)
		Have no conflict of interest	Yes/No/Unclear	
3	Replicability and Theory Relevance	Explains the phenomena of illicit and/or distinguishes the types of tax evasion and avoidance	Yes/No/Unclear	4 (0.20)
		Consider factors that can influence illicit or scope of tax evasion/avoidance	Yes/No/Unclear	
		Data and methods are properly elaborated; Availability of data	Yes/No/Unclear	
		Assumptions mentioned clearly	Yes/No/Unclear	
4	Generalizability and Criteria Selection	Sample size and design is well explained	Yes/No/Unclear	5 (0.25)
		Sample is unbiasedly/objectively selected	Yes/No/Unclear	
		Sample is representative and allow for generalization	Yes/No/Unclear	
		Illicit specification is based on objective criteria e.g. tax stamp authenticity, pack features, price, place of purchase etc.	Yes/No/Unclear/Not Applicable	
		Cross verification of self-reported illicit with objective criteria	Yes/No/Unclear/Not Applicable	
5	Definition and Identification of Illicit Products	Distinguishes between different types of illicit tobacco e.g. (counterfeit, smuggling, bootlegging, illicit whites, pack non-compliance, tax evasion etc.)	Yes/No/Unclear/Not Applicable	3 (0.15)
		Conversion factor is well established and transparent (converting cigarette sticks to/from weight measure, converting daily or weekly consumption to yearly consumption)	Yes/No/Unclear/Not Applicable	
		Illicit product is identified by independent researcher and/or lab and/or expert opinion and/or forensic analysis	Yes/No/Unclear/Not Applicable	
6	Result and Cross Validation of Illicit Estimate	Estimates are presented along with confidence interval or standard error or standard deviation	Yes/No/Unclear	4 (0.20)
		Size of illicit share is expressed as ratio of total market	Yes/No/Unclear	
		Multiple methods and/or multiple information used for cross verification of illicit estimates	Yes/No/Unclear	
		Repeated the illicit estimates over time using the same method	Yes/No/Unclear	
7	Limitation acknowledgement	Acknowledge the methodological limitation or weakness applied for the estimation	Yes/No/Unclear	1 (0.05)
Domain specific weight = (Number of criteria in each domain/Total number of criteria) Domain specific score = (Number of criteria in the domain* Domain specific weight) Score for individual study: (Sum of domain specific scores over seven domains)*10 Maximum Score for a Study would be: $(1*0.05+2*0.10+4*0.20+5*0.25+3*0.15+4*0.20+1*0.05)*10 = 36$ Minimum Score for a Study would be: $(0*0.05+0*0.10+0*0.20+0*0.25+0*0.15+0*0.20+0*0.05)*10 = 0$ Risk Category for quality of illicit estimates in a study: Serious (Score: 11 and below); Moderate (Score below 22); Low (Score 22 and above)				

Note: Adopted from Ross (2015).

Ross H. Understanding and measuring tax avoidance and evasion: A methodological guide. 2015. DOI:10.13140/RG.2.1.3420.0486.

https://portal-uat.who.int/fctcapps/sites/default/files/kh-media/e-library-doc/2019/10/Ross_Methods_to_Measure_Illicit-Trade_03-17-15.pdf

Chapter 6-Supplementary tables

Table S1: PerSPECTiF specification of the review question

Component	Specification
Perspective (Per)	From the perspective of Tobacco control
Setting (S)	In the setting of LMICs
Phenomena (P)	How does the phenomena of illicit tobacco?
Environment (E)	Within the environment of sales and/or consumption of counterfeit, smuggled, tax evaded, bootlegged, non-compliant and illicit white tobacco.
Comparator (C)	Not available
Timing (Ti)	In the time period after initiation of illicit tobacco trade protocol
Findings (F)	Share of illicit tobacco sales and/or consumption in LMICs

Table S2: List of Low and Middle Income Countries (LMICs)

Region	Low and Middle Income Countries (LMICs)
Africa	Eastern Africa: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Somalia, South Sudan, Uganda, United Republic of Tanzania, Zambia, Zimbabwe
	Middle Africa: Angola, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Sao Tome and Principe
	Northern Africa: Algeria, Egypt, Libya, Morocco, Sudan, Tunisia
	Southern Africa: Botswana, Eswatini, Lesotho, Namibia, South Africa
	Western Africa: Benin, Burkina Faso, Cabo Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo
Asia	Central Asia: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan
	Eastern Asia: China, Democratic People's Republic of Korea (North Korea), Mongolia
	Southeast Asia: Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Thailand, Timor-Leste, Viet Nam
	Southern Asia: Afghanistan, Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, Sri Lanka
	Western Asia: Armenia, Azerbaijan, Georgia, Iraq, Jordan, Lebanon, State of Palestine, Syrian Arab Republic, Türkiye, Yemen
Europe	Eastern Europe: Belarus, Bulgaria, Republic of Moldova, Romania, Russian Federation, Ukraine
	Southern Europe: Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia
Latin America and the Caribbean	Caribbean: Cuba, Dominican Republic, Grenada, Haiti, Jamaica, Saint Lucia, Saint Vincent and the Grenadines
	Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua
	South America: Argentina, Bolivia, Brazil, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Venezuela
Oceania	Melanesia: Fiji, Papua New Guinea, Solomon Islands, Vanuatu
	Micronesia: Kiribati, Micronesia
	Polynesia: Samoa, Tonga

Table S3: Eligibility criteria and grouping of the studies included in the review

Study Inclusion Criteria		
Study Characteristics	Per (Perspective)	Studies that have “tobacco control” as the perspective. All types of tobacco (smoking and smokeless) will be considered under the perspective.
	S (Setting)	Studies that were conducted for or focused on LMICs. It will adopt the current World Bank’s income classification for countries (per capita Gross National Income (GNI) for low-income countries is US\$ 1,085 or less; lower-middle-income countries is between US\$ 1,086 and US\$ 4,255; upper-middle-income countries is between US\$ 4,256 and US\$ 13,205). The list of included countries along with their geographic location is given in Table S1 (Supplementary Tables).
	P (Phenomena)	Studies that have the phenomena of illicit tobacco.
	E (Environment)	Within the environment of sales and/or consumption, studies can contain estimates of illicit tobacco in the form of a percentage or share of illicit tobacco, tax-evaded tobacco, non-compliant tobacco, smuggled tobacco, bootlegged tobacco, counterfeit tobacco and illicit whites.
	C (Comparator)	Not Available
	Ti (Time/Timing)	Since the WHO FCTCs (Framework Convention on Tobacco Control) Protocol to Eliminate Illicit Trade in Tobacco Products was enacted in 2012, the time duration for the searched literature would be spanning from 2012 to 2023.
	F (Findings)	Share of illicit tobacco sales and/or consumption in LMICs
Report Characteristics	Research Design	Studies with quantitative and mixed-method research design.
	Outcome	Studies explicitly quantified and recorded the findings on share of illicit tobacco as outcome.
	Language	Considering time constraint, English will be used as a language restriction for the inclusion.
	Geographic Location	The review will include all the illicit tobacco studies from LMICs. Also, multi-country and/or regional evidences containing LMICs will be eligible.
	Publication status and quality	Besides published peer reviewed literatures the review will consider reports and conference abstracts as grey literatures. Although the quality assessment will be made for all the included studies, no exclusion will be performed based on that.
Grouping characteristics of the included studies for synthesis		The studies will be grouped for synthesizing on the basis of following– Type of tobacco – Smoking and Smokeless. Method - Observational studies (pack examination), cross-sectional surveys (survey of tobacco users), interviews (key informant interviews and expert opinions), and secondary analysis (tobacco trade monitoring, tax gap analysis, econometric modeling and seizure of illegal tobacco). Funding source – Independent funding and tobacco industry funded (or undisclosed or limitedly disclosed funding information).
Exclusion Criteria		
Language and Geographic location		Studies from the High-Income Countries (HICs) will not be considered and also those published in local languages regardless of the geographic location will be excluded.

Table S4: Outcome domain and effect measure

Outcome domain	Explanation	Measure
Estimate of share of illicit tobacco sales and consumption	Share of illicit tobacco (smoking, smokeless or both). It can also be presented as share of any of the followings, -tax evaded tobacco -smuggled tobacco -counterfeit tobacco -non-compliant tobacco -counterfeit tax stamp -bootlegged tobacco - illicit whites	The measure of interest for the outcome is a ratio measure i.e. proportion or percentage of illicit tobacco. Given that any study reports the estimate using multiple methods, all estimates will be recorded. They will be synthesized accordingly in different sub-group of studies based on estimation method of illicit tobacco.
Methods used for measuring illicit tobacco	Methodological approach used to identify the share of illicit tobacco	Identification of method(s) followed for the study which can be listed as below, -Pack analysis -Survey of tobacco users -Trade monitoring -Tax gap Analysis -Econometric modelling -Expert opinion -Key Informant Interview -Analysing seizure illegal tobacco Given that any study used multiple methods, all methods will be recorded.
Study design	Nature of the research design used to address the research question.	-Quantitative -Mixed method
Place and time	Place where the study was conducted and publication year	-It can include any one or multiple countries that are listed in LMIC category. -Study publication year.
Sample size and source	The size of the sample for the study and the source from where it has been collected	Depending on the method used for measuring share of illicit tobacco it can be the number of, -Tobacco users (smokers or smokeless tobacco users) -Tobacco Pack (Smoking/Smokeless) -Reported data -Interview of tobacco experts
Data collection	Country or countries covered by the study and year covered.	-Countries covered by the study and for which the share of illicit is estimated. -Year of data collection/Year for which the secondary data is referred to.
Analytical method	Data analysis method used in the study	Quantitative analysis method used for the study: -Descriptive approach -Analytical approach (Data driven analysis and modelling)
Funding source	The source of funding for the study	-Independent funding -Tobacco Industry Funded/Undisclosed funding information/Limited information on funding/Uncertain about funding information.

Table S5: List of studies included in the systematic review

Serial	Study Title	Authors	Article ID (DOI/Link)	Publication Year
SL1	Tobacco tax evasion in Western Balkan countries: tax evasion prevalence and evasion determinants	M. Vladislavljevic; J. Zubovic; O. Jovanovic; M. Djukic; N. Trajkova Najdovska; E. Pula; D. Gligoric; A. Gjika	10.1136/tobaccocontrol-2021-056879	2022
SL2	The illicit cigarette market in six South African townships	K. van der Zee; N. Vellios; C. van Walbeek; H. Ross	10.1136/tobaccocontrol-2019-055136	2020
SL3	Illicit/cheap cigarettes in South Africa	K. van der Zee; C. van Walbeek; S. Magadla	10.1007/s12117-019-09372-9	2020
SL4	Cross-validation of four different survey methods used to estimate illicit cigarette consumption in Brazil	A. S. Szklo; R. M. Iglesias; M. Stoklosa; V. C. Figueiredo; K. Welding; P. R. B. de Souza Junior; A. T. Machado; L. F. L. Martins; H. Nascimento; J. Drope	10.1136/tobaccocontrol-2020-056060	2022
SL5	The cigarette market in Brazil: new evidence on illicit practices from the 2019 National Health Survey	A. S. Szklo; J. Drope	10.1136/tc-2022-057847	2023
SL6	Trends in Illicit Cigarette Use in Brazil Estimated From Legal Sales, 2012–2016	A. Szklo; R. M. Iglesias; M. Carvalho de Souza; M. Szklo; L. Maria de Almeida	10.2105/AJPH.2017.304117	2018
SL7	Extent of illicit cigarette market from single stick sales in Ghana: findings from a cross-sectional survey	A. Singh; H. Ross; F. Dobbie; A. Gallagher; T. Kinnunen; D. D. Logo; O. A. Boateng; A. Gilmore; L. Bauld; E. Owusu-Dabo	10.1136/bmjopen-2022-062476	2023
SL8	Extent of illicit cigarette sales in Nepal: findings from a retail survey	S. Shakya; A. Lamichhane; P. Karki; J. K. Gurung; P. M. Singh Pradhan	10.1136/tc-2022-057619	2023
SL9	Impact of tax increases on illicit cigarette trade in Mongolia	H. Ross; N. Vellios; T. Batmunkh; M. Enkhtsogt; L. Rossouw	10.1136/tobaccocontrol-2018-054904	2020
SL10	Illicit tobacco trade: empty pack survey in eight Argentinean cities	M. E. Pizarro; G. Giacobone; C. Shammah; M. Stoklosa	10.1136/tobaccocontrol-2020-056405	2022
SL11	Illicit Cigarette Trade in Thailand	P. Pavananunt	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3509212/	2012
SL12	Illicit cigarette consumption and government revenue loss in Vietnam: Evidence from a primary data approach	M. T. Nguyen; S. The Dao; N. Q. Nguyen; M. Bowling; H. Ross; A. D. So	10.3390/ijerph16111960	2019
SL13	Tobacco excise tax increase and illicit cigarette consumption: Evidence from Vietnam ⁴⁹	A. Nguyen; H. T. Nguyen	10.1136/tobaccocontrol-2019-055301	2020
SL14	Measuring illicit cigarette trade in Colombia	N. Maldonado; B. A. Llorente; R. M. Iglesias; D. Escobar	10.1136/tobaccocontrol-2017-053980	2018
SL15	Contributions of the analysis of discarded cigarette packages in household waste in the Brazilian city of Rio de Janeiro, Brazil, to estimate the illegal market	A. T. Machado; R. M. Iglesias; F. L. Mendes; L. F. Leite Martins; A. P. Leal Teixeira; T. M. Cavalcante; A. L. F. Menescal Conde; S. de Oliveira Cordeiro; A. R. Reis Cardoso; L. M. de Almeida; A. S. Szklo	10.1590/0102-311X00221020	2021
SL16	Analysis of the illicit tobacco market in Georgia in response to fiscal and non-fiscal tobacco control measures	M. Little; H. Ross; G. Bakhturidze; I. Kachkachishvili	10.1136/tobaccocontrol-2020-056404	2021
SL17	Illicit tobacco trade in Georgia: prevalence and perceptions	M. Little; H. Ross; G. Bakhturidze; I. Kachkachishvili	10.1136/tobaccocontrol-2018-054839	2020
SL18	Analysing the trend of illicit tobacco in the Philippines from 1998 to 2018	M. P. Lavares; H. Ross; A. Francisco; N. Doytch	10.1136/tobaccocontrol-2020-056253	2022
SL19	Measuring Malaysia's Illicit Tobacco Trade: An Excise Tax Gap Analysis	R. K. Koya; J. R. Branston; A. W. A. Gallagher	10.31389/jied.151	2022
SL20	Illicit cigarette trade in the cities of Pakistan: comparing findings between the consumer and waste recycle store surveys	A. Khan; F. Dobbie; K. Siddiqi; S. Ansaari; S. M. Abdullah; R. Iqbal; Z. Khan; S. Sohail; M. Kanaan; R. Huque; Z. Islam; M. Boeckmann; H. Ross	10.1136/tobaccocontrol-2020-056386	2022

Serial	Study Title	Authors	Article ID (DOI/Link)	Publication Year
SL21	New evidence of illicit cigarette consumption and government revenue loss in Indonesia	R. A. Kasri; A. Ahsan; N. H. Wiyono; A. R. Jacinda; D. Kusuma	10.18332/tid/142778	2021
SL22	The prevalence of illicit cigarette consumption and related factors in Turkey	B. Kaplan; A. Navas-Acien; J. E. Cohen	10.1136/tobaccocontrol-2017-053669	2018
SL23	Illicit cigarettes and hand-rolled tobacco in 18 European countries: a cross-sectional survey	L. Joossens; A. Lugo; C. La Vecchia; A. B. Gilmore; L. Clancy; S. Gallus	10.1136/tobaccocontrol-2012-050644	2014
SL24	Illicit cigarette sales in Indian cities: Findings from a retail survey	R. M. John; H. Ross	10.1136/tobaccocontrol-2017-053999	2018
SL25	Estimating the size of illicit tobacco consumption in Brazil: findings from the global adult tobacco survey	R. M. Iglesias; A. S. Szklo; M. C. Souza; L. M. de Almeida	10.1136/tobaccocontrol-2015-052465	2017
SL26	Second pack survey on the prevalence of the use of smuggled cigarettes in Tehran, 2015	G. Heydari; L. Joossens; F. Chamiani; M. R. Masjedi; M. B. Shadmehr; L. Fadaizadeh	10.1136/tobaccocontrol-2015-052588	2016
SL27	Trend of Smuggled Cigarette Consumption in Tehran in the Last Two Decades	G. Heydari; L. Joossens	10.34172/aim.2022.71	2022
SL28	Cigarette tax avoidance and evasion: Findings from the International Tobacco Control Policy Evaluation (ITC) Project	G. E. Guindon; P. Driezen; F. J. Chaloupka; G. T. Fong	10.1136/tobaccocontrol-2013-051074	2014
SL29	Estimating illicit cigarette consumption using a tax-gap approach, India	M. Goodchild; T. Valavan; P. Sinha; F. T. Tullu	10.2471/BLT.20.251447	2020
SL30	Is Illicit Cigarette Market a Threat to Tobacco Control in Ethiopia?	E. Dauchy; H. Ross	10.1093/ntr/ntac021	2022
SL31	Consumption of legal and illegal cigarettes in the Gambia	Z. Chisha; M. L. Janneh; H. Ross	10.1136/tobaccocontrol-2019-055055	2020
SL32	Magnitude of illicit cigarette trade in Malaysia: empirical evidence compared with industry studies	W. K. T. Bui; H. Ross; N. Mohamed Nor	10.1136/tobaccocontrol-2021-057210	2022
SL33	Illicit cigarette consumption and government revenue loss in Indonesia	A. Ahsan; N. H. Wiyono; D. Setyonaluri; R. Denniston; A. D. So	10.1186/s12992-014-0075-7	2014
SL34	Non-compliant packaging and illicit smokeless tobacco in Bangladesh, India and Pakistan: findings of a pack analysis	S. M. Abdullah; R. Huque; K. Siddiqi; M. Kanaan; S. Huque; S. Ullah; S. Garg; M. M. Singh; C. Deshmukh; A. L. Borle; R. Iqbal; L. Mazhar; M. Parascandola; R. Mehrotra; R. Croucher; Z. Khan	10.1136/tc-2021-057228	2022
SL35	The Illicit Cigarette Trade in Indonesia	Widya Kartika, Rahminda Muhammad Thaaariq, Dwi Rahayu Ningrum, Herni Ramdlaningrum, Luhur Fajar Martha, Setyo Budiantoro	https://tobacconomics.org/research/the-illicit-cigarette-trade-in-indonesia/	2019
SL36	The Illicit Cigarette Market in Montenegro	Tobacconomics, Health Policy Center, Institute for Health Research and Policy, University of Illinois Chicago	https://tobacconomics.org/research/the-illicit-cigarette-market-in-montenegro/	2023
SL37	The Market for Bidis, Smokeless Tobacco, and Cigarettes in India: Evidence From Semi-Urban and Rural Areas in Five States	K. Welding; M. Iacobelli; S. Saraf; K. C. Smith; N. Puntambekar; P. C. Gupta; J. E. Cohen	10.3389/ijph.2021.1604005	2021
SL38	Illicit cigarette trade in South Africa: 2002-2017	N. Vellios; C. van Walbeek; H. Ross	10.1136/tobaccocontrol-2018-054798	2019
SL39	Measuring the illicit cigarette market in Mexico: a cross validation of two methodologies	B. Saenz de Miera Juarez; L. M. Reynales-Shigematsu; M. Stoklosa; K. Welding; J. Drope	10.1136/tobaccocontrol-2019-055449	2021
SL40	The empirical analysis of cigarette tax avoidance and illicit trade in Vietnam, 1998-2010	M. T. Nguyen; R. Denniston; H. T. T. Nguyen; T. A. Hoang; H. Ross; A. D. So	10.1371/journal.pone.0087272	2014
SL41	Empirical analysis on the illicit trade of cigarettes in Vietnam	H. T. T. Nguyen; L. T. Giang; T. N. Pham	10.1136/tobaccocontrol-2019-055598	2020

Serial	Study Title	Authors	Article ID (DOI/Link)	Publication Year
SL42	Smoke signals: Monitoring illicit cigarettes and smoking behaviour in Colombia to support tobacco taxes	N. Maldonado; B. Llorente; D. Escobar; R. M. Iglesias	10.1136/tobaccocontrol-2018-054820	2020
SL43	No smoking gun: tobacco taxation and smuggling in Sierra Leone	M. Gallien; G. Occhiali	10.1136/tobaccocontrol-2021-057163	2022
SL44	Empirical Measurement of Illicit Tobacco Trade in the Philippines	V. Abola; D. Sy; R. Denniston; A. So	https://pubmed.ncbi.nlm.nih.gov/26855640/	2014
SL45	A Baseline Study on the illicit cigarette market and the resulting tax implication for Srilanka	S N Morais, S. S Colombage, C. N. Wickramasinghe	10.13140/RG.2.2.26523.41760	2018
SL46	Illicit Tobacco in Papua New Guinea	FTI Consulting	https://www.fticonsulting.com/insights/reports/illicit-tobacco-papua-new-guinea	2019
SL47	Levant Illicit Tobacco	Oxford Economics	https://www.oxfordeconomics.com/resource/levant-illicit-tobacco-2019/	2020
SL48	Asia-16 Illicit Tobacco Indicator 2014	International Tax and Investment Centre and Oxford Economics	https://www.oxfordeconomics.com/publication/open/262864	2016

Table S6: Data extraction and characteristics of independently funded studies with the quality of estimates

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL1: Vladislavjevic, 2022 <i>Country:</i> Albania, Bosnia and Herzegovina, Kosovo, Montenegro, Serbia. North Macedonia. (Smoking Tobacco)	Study Design: Cross-sectional (Survey of tobacco users) Method of Measurement: Pack observation Pack Information: -Took the pictures of last purchased tobacco pack from tobacco users. -Recorded data on tax stamps, health warnings, place of purchase and reported price per pack.	-Purchased from an illicit source. -Without the appropriate health warnings. -Without the appropriate tax stamp, or -Purchased at a price lower than 70% of the lowest price.	Measured Outcome: Share of illicit tobacco consumption. Findings: Prevalence of illicit consumption: Albania (19.4%), Bosnia and Herzegovina (35.3%), Kosovo (7.1%) Montenegro (62.6%), North Macedonia (12.3%) and Serbia (14.8%)	Moderate Risk (Score: 19.5)
SL2: van der Zee, 2020 <i>Country:</i> South Africa (Smoking Tobacco)	Study Design: Cross-sectional (Survey of tobacco users) Method of Measurement: Price Threshold Pack Information: Smokers reported their most recent cigarette purchase, specifically packaging type, number of items purchased, brand, type of outlet and the amount spent on the cigarettes.	-Identified illicit cigarettes by specifying a threshold price (covering tax and cost and attain a modest profit it is impossible to sell below the specific threshold price which is Rand 20)	Measured Outcome: Proportion of illicit purchases in the market. Findings: 2017 – Proportion 34.6%; (95%CI: 32.0-37.3) 2018 – Proportion 36.4%; (95%CI: 33.7-39.2).	Low Risk (Score: 23.25)
SL3: van der Zee, 2020 <i>Country:</i> South Africa (Smoking Tobacco)	Study Design: Cross-sectional Method of Measurement: Price Threshold Pack Information: Smokers described their most recent cigarette purchase (packaging type, number of packs purchased, and the amount they paid for the cigarettes).	-The sum of the excise tax and VAT in 2017 was Rand 16.30 per pack. -Thus, assuming reasonable production costs any cigarettes selling for Rand 20 per pack or less will be probably illicit.	Measured Outcome: Share of illicit cigarette consumption. Findings: 2017 – Proportion 30.7%; (95%CI:29.2-32.2)	Low Risk (Score: 23.75)
SL4: Szklo, 2022 <i>Country:</i> Brazil (Smoking Tobacco)	Study Design: Observational Method of Measurement: Pack Analysis and Price Threshold Pack Information: -Brand names and health warnings of the pack (discarded packs in the household garbage and littered packs). -Price paid by the smokers (reported in the telephone and face to face survey of smokers)	- Proportions of illicit cigarettes consumed were estimated based on the price paid by smokers in their last purchase and/or direct observation of brand names and health warnings. -Smokers who reported consuming cigarettes with a price less than the minimum legal level were categorized as illicit consumption. -Packs that did not have approved brand name and health warnings for the Brazilian market by the Health Regulatory Agency were illicit.	Measured Outcome: Share of illicit cigarette consumption. Findings: Share of illicit cigarette consumption in Brazil (Rio de Janeiro) with pack observation was 30.4%; (95%CI:25.6–35.7)	Moderate Risk (Score: 21.75)
SL5: Szklo, 2023 <i>Country:</i> Brazil (Smoking Tobacco)	Study Design: Cross-sectional (Survey of tobacco users) Method of Measurement: Price Threshold Pack Information: Self-reported information on cigarette brand name and price paid per pack in smokers' last purchase was used.	-A 'threshold price' (TP) was calculated adjusting the R\$ 5.00 minimum price established by law (MLP) with legal brands sold with discount and legal brands that did not pay taxes (domestic tax evasion). The TP was R\$ 4.5 per pack.	Measured Outcome: Proportion of illicit cigarette consumption, was estimated using the combination of brand and price. Findings: 'Overall-illicit' cigarette consumption was estimated as 47.1%; (95% CI: 44.2 - 49.9) for Brazil.	Low Risk (Score: 22.50)

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL6: Szklo, 2018 <i>Country:</i> Brazil (Smoking Tobacco)	Study Design: Cross-sectional (Survey of tobacco users) Method of Measurement: Gap Analysis Pack Information: Combined information on cigarette consumption from different surveys and on official legal sales to estimate total illicit cigarette consumption in Brazil.	-Comparing the purchase price and defined threshold retail price, the proportion of illicit cigarette use among smokers in Brazil in 2008 (and in 2013) was estimated.	Measured Outcome: Overall proportion of illicit cigarette consumption and its trend. Findings: Estimated overall proportion of illicit cigarette consumption in Brazil increased during 2015 to 2016 from 36.5% to 42.8%.	Moderate Risk (Score: 13.75)
SL7: Singh, 2023 <i>Country:</i> Ghana (Smoking Tobacco)	Study Design: Cross-sectional (Survey of tobacco retail shops) Method of Measurement: Pack Analysis Pack Information: Pack data included brand name, country of origin, presence of graphical and/or textual health warnings, language of the warning, pack size and compliance of these warning messages with existing packaging requirement in Ghana.	-Definition included at least any of the following attributes: 1. Absence of authentic tax stamps. 2. Absence of textual and pictorial warnings 3. Absence of the inscription 'FOR SALE IN GHANA ONLY' displayed on the side panel of the product pack 4. Health warnings not in English	Measured Outcome: Estimates of the share of illicit cigarette packs in the total cigarette sales in Ghana. Findings: Share of illicit cigarette sales in Ghana was about 20% (95%CI:18.3 - 20.7).	Moderate Risk (Score: 13.50)
SL8: Shakya, 2023 <i>Country:</i> Nepal (Smoking Tobacco)	Study Design: Cross-sectional (Survey of tobacco retail shops) Method of Measurement: Pack Analysis Pack Information: Retrieved pack features includes, excise sticker (ES), cigarette production date, producer name, address, and trademark of the licensed manufacturer or importer and amount of nicotine, Maximum Retail Price (MRP) inclusive of all taxes, graphic health warning (GHW) and language of warning message.	Illicit definition included at least one of the following attributes: -no authentic excise duty sticker -no graphic health warning -no mention of maximum retail price/ MRP' and -no production date, name, address and trademark	Measured Outcome: Share of illicit tobacco sales and its distribution in Nepal Findings: -Overall, 0.33% (95% CI:0.18-0.55) (14 Packs) of sampled packets were identified as illicit in Nepal. -0.33% (95% CI 0.18% to 0.55%) was also the tax evaded packs as they hadn't any excise tax stamp.	Moderate Risk (Score: 18.50)
SL9: Ross, 2020 <i>Country:</i> Mongolia (Smoking Tobacco)	Study Design: Observational (collected discarded cigarette packs from the ground and top of the waste bins). Method of Measurement: Pack Analysis Pack Information: Pack features retrieved were related to Mongolian tax stamp and Mongolian packaging laws (pictorial warnings: 50% on the back and front of the packs, and health warnings in the Mongolian language).	-Packs with no Mongolian tax stamp and packs with foreign tax stamp were considered as illicit. -Packs non-compliance with pictorial and language warning however contained Mongolian tax stamp was considered as legal.	Measured Outcome: Share of illicit cigarette in the market. Findings: -Round 1: 15.40%; (95%CI: 14.59% to 16.22%) -Round 2: 13.61%; (95%CI: 12.57% to 14.32%) -Round 3: 6.33%; (95%CI: 5.72% to 6.93%)	Moderate Risk (Score: 18.50)
SL10: Pizarro, 2022 <i>Country:</i> Argentina (Smoking Tobacco)	Study Design: Observational (collected discarded cigarette packs). Method of Measurement: Pack Analysis Pack Information: Domestic pack features on, brand legitimacy, warning legitimacy and tax stamp authenticity were recorded.	-Classification as licit/illicit using forensic analysis of tax stamps and packs and econometric modelling.	Measured Outcome: Prevalence of illicit tobacco trade, tax stamp counterfeiting and smuggling. Findings: Overall ITT prevalence was estimated as 13.7% in Argentina.	Low Risk (Score: 24.00)
SL11: Pavananunt, 2012 <i>Country:</i> Thailand (Smoking Tobacco)	Study Design: Secondary research Method of Measurement: Gap analysis and trade monitoring	-Gap Analysis: Illicit trade is defined as the difference between cigarettes consumed based on taxes paid for tobacco (official legal consumption) and consumption obtained from survey data (what smokers say they smoke). -Trade Monitoring: Illicit trade is defined as	Measured Outcome: Share of illicit cigarette consumption, magnitude of smuggling and revenue loss. Findings: Trade Monitoring: 10% as share of illicit consumption in Thailand between 2004 and 2006.	Serious Risk (Score: 11.00)

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
		any discrepancy between recorded exports and imports.		
SL12: Nguyen, 2019 Country: Vietnam (Smoking Tobacco)	Study Design: Cross sectional (survey of smokers) Method of Measurement: Pack Analysis Pack Information: Smokers last purchased pack was examined. Packaging, tax stamp, origin country, price, and sources of the pack, were recorded.	-The absence of any of these (a sales tax stamp for domestic packs and an import tax stamp for foreign-made packs. health warnings in Vietnamese, and information on the location of the manufacturer in Vietnamese) details or fabricated tax stamps rendered the pack as illicit.	Measured Outcome: Share of illicit cigarette consumption, magnitude of smuggling and revenue loss Findings: Share of illicit cigarette consumption in Vietnam in 2012 was 20.7%.	Low Risk (Score: 24.25)
SL13: Nguyen, 2020 Country: Vietnam (Smoking Tobacco)	Study Design: Cross sectional (survey of smokers) Method of Measurement: Pack Analysis Pack Information: -Smokers most recent purchased pack was examined. - Two main features were examined: the presence of a tax stamp, and the use of valid text and pictorial health warning labels. - Also “place of purchase” were used to distinguish between tax avoidance and evasion.	-If a cigarette pack had neither a tax stamp nor proper health warning labels and it was not bought from duty-free shops or abroad, it was classified as illicit.	Measured Outcome: Share of illicit cigarette consumption. Patterns and identify the likely determinants of the illicit consumption. Findings: Share of illicit cigarette consumption in Vietnam in 2017 was about 13.72% (95%CI:11.85-15.83).	Low Risk (Score: 27.00)
SL14: Maldonado, 2018 Country: Colombia (Smoking Tobacco)	Study Design: Cross sectional (survey of smokers) Method of Measurement: -Smokers self-report of cigarettes’ characteristics and consumption pattern and -Examination of cigarette packs in the hands of these smokers Pack Information: -Smokers who showed pack: information on brand, country of origin, health warning and the import/production statement was recorded. -Smokers who did not show packs: information on last purchase’s brand and price.	-Unauthorized cigarette pack brands were categorized as illicit. -Within the foreign packs, if Colombian health warning or import/production statement was missing they were categorized as illicit. -A price threshold (price under COP\$100 for sticks, COP\$1700 for 20-stick pack and COP\$20 000 for carton) was categorized as illicit.	Measured Outcome: Share of illicit cigarette consumption, Findings: Proportion of the consumption of cigarettes (PIC-C) identified as illicit was 3.46% (95%CI:2.59-4.33).	Moderate Risk (Score: 21.50)
SL16: Little, 2021 Country: Georgia (Smoking Tobacco)	Study Design: Cross sectional (survey of smokers) Method of Measurement: Pack Analysis Pack Information: Packs were examined for brand, price, and the presence of a Georgian tax stamp and health warning.	-Packs lacking either a health warning or tax stamp (required by law) were considered as illicit.	Measured Outcome: Share of illicit cigarette consumption Findings: In Zugdidi, the percentage of smokers with illicit packs rose from 4.6% (95%CI: 2.7-7.8) in wave 1 to 10.6% (95%CI: 7.8-14.3) in wave 2, and further to 32.2% (95%CI:26.0-39.0%).	Moderate Risk (Score: 19.25)

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL17: Little, 2020 Country: Georgia (Smoking Tobacco)	Study Design: Cross sectional (survey of smokers) Method of Measurement: Pack Analysis Pack Information: Packs were examined for tax stamps and health warnings.	-Pack is considered as illicit if either the Georgian tax stamp or the Georgian health warning was missing or unclear.	Measured Outcome: Share of illicit cigarette consumption. Findings: 1.5% of the packs were missing either the Georgian tax stamp or the Georgian health warning or it was unclear and hence illicit.	Moderate Risk (Score: 14.75)
SL18: Lavares, 2022 Country: Philippines (Smoking Tobacco)	Study Design: Secondary research Method of Measurement: Gap analysis	- Comparison of legal sales and self-reported cigarette consumption estimated from surveys were made.	Measured Outcome: Share of illicit cigarette in the market and its trend. Findings: Share of illicit cigarette in the market was 16.1% in the year 2018 in Philippines.	Moderate Risk (Score: 15.50)
SL19: Koya, 2022 Country: Malaysia (Smoking Tobacco)	Study Design: Secondary research Method of Measurement: Gap analysis	-Compared the tax revenue actually generated with estimates of the tax that should have been paid if all tobacco was purchased legally.	Measured Outcome: Share of illicit cigarettes consumed (or untaxed cigarettes). Findings: The central estimate of illicit cigarette consumption in Malaysia in 2017 was 65% (i.e. about two-thirds of cigarettes consumed were illicit, untaxed cigarettes).	Moderate Risk (Score: 17.50)
SL20: Khan, 2022 Country: Pakistan (Smoking Tobacco)	Study Design: Cross sectional (household smokers survey) Method of Measurement: Pack analysis Pack Information: Cigarette pack details - brand name, pack size, retail price inclusive of taxes printed on the pack and price paid (only in the consumer survey) were also collected.	-Absence of any one of the following characteristics rendered a cigarette pack as illicit: textual health warning (one side Urdu and one side English), graphic health warning, retail price printed on the pack, warning label that sales under 18 are prohibited and name and country of the manufacturer.	Measured Outcome: Proportion of illicit cigarette sold in Pakistan. Findings: Consumers Survey: 17.8%; (95%CI: 15.4-20.2) were identified as illicit.	Moderate Risk (Score: 18.50)
SL21: Kasri, 2021 Country: Indonesia (Smoking Tobacco)	Study Design: Secondary research Method of Measurement: Gap analysis	-Discrepancy between legal cigarette sales and domestic consumption recorded by national representative surveys was considered as illicit.	Measured Outcome: Share of illicit cigarette consumption and the government revenue loss. Findings: Share of illicit cigarette consumption in 2018 with 0% Underreporting - 19.3%;	Moderate Risk (Score: 13.50)
SL22: Kaplan, 2018 Country: Turkey (Smoking Tobacco)	Study Design: Cross sectional (household smokers survey) Method of Measurement: Pack analysis Pack Information: Examined for availability of Turkish tax stamp (TTS) on the last used cigarette pack of smokers and how much paid for the last cigarette pack was recorded.	-Packs without the TTS were considered illicit.	Measured Outcome: Extent of illicit cigarette consumption and characteristics of smokers who use illicit cigarettes. Findings: 12.1% (95%CI: 9.8-14.8) of cigarette smokers showed a cigarette pack that was illicit.	Moderate Risk (Score: 16.50)

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL23: Joossens, 2014 Country: (3 LMICs among included) - Albania, Bulgaria, Romania (Smoking Tobacco)	Study Design: Cross sectional (smokers survey) Method of Measurement: Pack analysis Pack Information: Information on pack provenance, health warnings, tax stamp (banderol) and price were collected.	-Packs with at least one of the following characteristics were considered as illicit: self-reported purchase from illicit sources, inappropriate health warning, inappropriate tax stamp, and extremely low price.	Measured Outcome: Prevalence of illicit tobacco packs (or share of illicit consumption) Findings: Share of illicit consumption in Albania (8.1%), Bulgaria (18.3%) and Romania (10.7%).	Moderate Risk (Score: 21.25)
SL24: John, 2018 Country: India (Smoking Tobacco)	Study Design: Cross-sectional (Survey of tobacco retail shops; packs collected from retailers and littered sources) Method of Measurement: Pack Analysis Pack Information: Information on brand name, pack size, maximum retail price inclusive of taxes printed on the pack, country of origin, cigarette length, presence of graphical and/or textual health warnings, language of the warning, compliance of these warning messages with existing laws and any indication of duty-free status - recorded.	-Illicit packs had at least one of the following attributes: a duty-free sign; no graphic health warnings; no textual health warnings; or no mention of 'price inclusive of all taxes' or similar text.	Measured Outcome: Share of illicit cigarette sales and packaging non-compliance Findings: Overall share of illicit cigarette packs in India was 2.73%.	Serious Risk (Score: 10.50)
SL25: Iglesias, 2017 Country: Brazil (Smoking Tobacco)	Study Design: Secondary research Method of Measurement: Price Threshold	-To estimate the volume of illicit cigarette consumption, the proportion of smokers in the GATS survey having effective purchase price of cigarettes below the 'threshold price' TP was measured and applied that proportion to the Brazilian cigarettes market size.	Measured Outcome: Share of illicit cigarette consumption Findings: Total proportion of illicit cigarette consumption in 2008 and 2016 was 16.6% (95%CI: 15.1-18.3) and 31.1% (95% CI: 28.7-33.6) respectively.	Low Risk (Score: 25.00)
SL28: Guindon, 2014 Country: (6 LMICs among included) - Bangladesh, China, Malaysia, Mauritius, Mexico, Thailand (Smoking Tobacco)	Study Design: Secondary research. Method of Measurement: Pack analysis Pack Information: -Self reported last purchase source was used to identify low or untaxed sources of cigarettes. -Self-reported packaging information ((a standard warning label, a tax stamp, security ink ...') or similar information gathered by the interviewers during face-to-face interviews (if respondents could show the packs) was used.	-Prevalence estimates for tax evasion/avoidance was based on: Mexico: "out of country", "duty-free" and "internet purchases"; Malaysia: "no tax stamp" or "security ink"; Thailand: "no standard warning label"; Mauritius: "no tax stamp" or "authentic labels"; China: "no authentic labels"; Bangladesh: "no tax stamp"	Measured Outcome: Prevalence of cigarette tax evasion/avoidance Findings: -Mexico (2011: 0.4%); Malaysia (2008: 39.7%); Thailand (2009: 2.7%); Mauritius (2008: 3.1%); China in (2010: 6.3%); Bangladesh (2010: 3.7%)	Moderate Risk (Score: 22.50)
SL29: Goodchild, 2020 Country: India (Smoking Tobacco)	Study Design: Secondary research Method of Measurement: Gap Analysis	-Illicit cigarette consumption in India was defined as the difference between total and legal consumption of cigarettes.	Measured Outcome: Estimated illicit cigarette consumption and Illicit market share Findings: -Illicit cigarette consumption was 5.1% of the market in 2009-2010 and 6.0% of the market in 2016-2017.	Moderate Risk (Score: 18.00)

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL30: Dauchy, 2022 Country: Ethiopia (Smoking Tobacco)	Study Design: Observational (Retailers survey, pack collected from retailers and street vendors, discarded packs collected from the streets, in nearby garbage bins, in open solid waste dumps, and near Khat stores or chewing areas). Method of Measurement: Pack analysis. Pack Information: Pack features, such as brand, health warning labels (HWL), HWL law compliance, the country of origin, statement that the brand could be sold in Ethiopia (for foreign brands), and a duty-free sign, flavoured cigarettes were recorded.	-All National Tobacco Enterprise (NTE) products (i.e., domestic brands) were considered as legal. Foreign packs without the statement “to be sold in Ethiopia with a special agreement with NTE” were considered as illegal.	Measured Outcome: Illicit cigarette market share, illicit cigarettes source, price and brands. Findings: -Overall, 18.9% of the collected empty packs were classified as illicit. -Street source had higher proportion of illicit packs (19.6%).	Moderate Risk (Score: 18.25)
SL31: Chisha, 2020 Country: Gambia (Smoking Tobacco)	Study Design: Cross sectional (smokers survey). Method of Measurement: Pack Observation and Price Threshold Pack Information: -Smokers last purchased pack was examined. Warnings (‘Smoking Kills’ and ‘Smoking Seriously Harms You and Others Around You’), other statements (‘Sold in The Gambia’) were retrieved. Self-reported purchase price was recorded.	-Pack that did not have all three statements (Smoking Kills’; ‘Smoking Seriously Harms You and Others Around You’; ‘Sold in The Gambia’) was considered illicit. -The threshold price was calculated as GMD28.36 per pack. Cigarette packs purchased below the minimum threshold price considered as tax evaded.	Measured Outcome: Share of illicit cigarette in the Market; Share of Tax evaded cigarettes in the Market and Share of Non-compliant Cigarette Packs Findings: -Price Threshold: Proportion of illicit cigarette consumption was 8.6% -Pack features: only 0.9% of the packs examined were found without the requisite labels for a legal cigarette pack.	Low Risk (Score: 30.25)
SL32: Bui, 2022 Country: Malaysia (Smoking Tobacco)	Study Design: Secondary Research Method of Measurement: Gap Analysis.	-Gap analysis was based on the comparison among consumption and recorded sales. Gap represented the magnitude of the illicit cigarette trade.	Measured Outcome: Proportion of illicit cigarette market and its trend Findings: The illicit cigarette market share in the total market in 2019 (0% Underreporting:38.2%; 10% Underreporting:43.8%; 20% Underreporting:48.5%; 30% Underreporting:52.5%)	Moderate Risk (Score: 19.00)
SL33: Ahsan, 2014 Country: Indonesia (Smoking Tobacco)	Study Design: -Secondary research. Method of Measurement: -Gap Analysis and Trade Monitoring.	-Applied two methods: First-survey-based estimates of consumption were compared with cigarette sales. Second-Indonesian cigarette imports were compared to the mirror cigarette exports to Indonesia. Trade discrepancies – measured for annual smuggling. Origin of illicit cigarettes- consultation of experts (Directorate General of Customs was consulted).	Measured Outcome: Share of illicit cigarette consumption; Smuggling. Findings: -Assuming 0% under-reporting: illicit consumption was 8% in 2013 -Trade discrepancy: Indonesia was a recipient of smuggled cigarettes for each year between 1995 and 2012.	Moderate Risk (Score: 19.75)

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL34: Abdullah, 2022 Country: Bangladesh, India and Pakistan (Smokeless Tobacco)	Study Design: Observational study (pack collected from retail shops). Method of Measurement: Pack analysis Pack Information: Following pack information recorded: product category, brand, country of origin, manufacturer details (name and address), price, tax and ingredient disclosure (whether printed on the pack), pack form (paper box, sachet, plastic bottle, tin can, etc) and weight (measured in grams), presence and appropriateness of PHW and THW, culture-specific colour and symbol and/or statement of health claims.	-Bangladesh and India - Illicit if it had any of the following: no MRP printed, no sale statement disclosure (only for Bangladesh), no and/or inappropriate proportion of PHW, no and/or inappropriate THW (not written in principal language) and affixing MDs (using culturally specific reference such as colour or symbol and/or words suggesting flavour or strength and/or making health claims). -Given the absence of specific regulations for smokeless tobacco in Pakistan-the proportion of packs under different descriptions were presented.	Measured Outcome: Proportion of illicit smokeless tobacco sale (based on packaging non-compliance). Findings: Overall estimate of non-compliant and hence illicit smokeless tobacco packs: Bangladesh: 92.2% (95%CI:85.8-96.4); India: 92.6% (95%CI:80.1-98.5); Pakistan: 100% (95%CI:94.4-100.0).	Moderate Risk (Score: 15.50)
SL35: Kartika, 2019 Country: Indonesia (Smoking Tobacco)	Study Design: Cross sectional study (smokers survey) Method of Measurement: Pack analysis Pack Information: Information retrieved: Missing excise tax stamp, Missing pictorial health warning, Inappropriate excise tax stamp, inappropriate pictorial health warning.	-Illicit definition: legitimacy of the excise stamp and the pictorial health warning. (Missing excise tax stamp, Missing pictorial health warning, Inappropriate excise tax stamp, Inappropriate pictorial health warning). -Packs with at least one of the four criteria were classified as illicit cigarettes.	Measured Outcome: Magnitude of illicit cigarette trade and factors that affect illicit cigarette consumption. Findings: 1.67% was the magnitude of illicit. Higher income smokers were less likely to have smoked an illicit cigarette.	Moderate Risk (Score: 13.75)
SL36: Tobacconomics, 2023 Country: Montenegro (Smoking Tobacco)	Study Design: Cross sectional (survey of smokers and littered pack collection). Method of Measurement: Pack Analysis (Littered); Smokers Survey (Pack Analysis); Tax Gap Analysis Pack Information: Packs were inspected for packaging, tax stamps, health warning label, price, brands, and place and country of purchase.	-Smokers Survey-illicit if it has at least one of the following five characteristics: illicit place of purchase; illicit brand; lack and/or inappropriate health warning label; missing and/or inappropriate tax stamp; or price that defines a pack as illicit. -Littered Pack- illicit if it has one or more of the following: appropriate tax stamp, brand legitimacy, appropriateness of warning (graphic and text), appropriateness of language of the warning, information on chemicals' quantity (tar, nicotine, and carbon monoxide) and unique identification of pack (such as date of pack production, producer, and product description).	Measured Outcome: Size and characteristics of illicit cigarette market; Factors affecting probability of buying illicit cigarettes (Smokers Survey). Findings: -Illicit Market Share: 2022 (Overall - 21.4% (95%CI:18.3-24.4); Littered: (Overall - 25.9% (95%CI:22.8-29.1) -Economically disadvantaged smokers (Unemployed, low-income, and more than 25 years old) were more prone to buying illicit products.	Low Risk (Score: 27.50)
SL37: Welding, 2021 Country: India (Smoking and Smokeless Tobacco)	Study Design: Observational study (pack purchased from retailers). Method of Measurement: Pack analysis. Pack Information: Following information recorded: brand, printed maximum retail price, price paid, tax, and health warning labels (HWLs).	-Three Health Warning Labels (HWLs): current Indian (legal), old Indian (illegal), none/foreign (illicit).	Measured Outcome: Share of illegal and illicit tobacco sale; Share of non-compliant packages with HWLs. Findings: -Cigarettes: Share of illicit: 10%; Smokeless Tobacco: Share of illegal: 43%.	Moderate Risk (Score: 15.25)
SL38: Vellios, 2019 Country: South Africa (Smoking Tobacco)	Study Design: Secondary research. Method of Measurement: Gap analysis.	-Comparison of consumption estimates (from survey data) with legitimate sales (as declared to the excise tax authority). The gap between these two was used as an indication of the size of the illicit market considering underreporting.	Measured Outcome: Size of the illicit cigarette market and its trend over time. Findings: In 2017, illicit trade was 30% (5% under-reporting) and 34% (10% under-reporting);	Moderate Risk (Score: 20.00)

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL39: de Miera Juarez, 2021 Country: Mexico (Smoking Tobacco)	Study Design: Observational study (smokers survey and discarded pack collection). Method of Measurement: Pack analysis (Littered); Smokers Survey (Self-reported brand of last purchase). Pack Information: -Littered Packs: Three pack features required law - approved pictorial health warning, approved text-only health warning and the message 'For exclusive sale in Mexico'. -Smokers Survey: Self-reported brand of the last-purchased cigarettes.	-Analysed pack features required by Mexican regulations and self-reported brands of the last purchase to determine whether cigarette packs were intended for Mexican market.	Measured Outcome: Share of packs not intended for the Mexican market; Illicit share of the total consumption of cigarettes. Findings: -Illicit share of total consumption of cigarettes: Smokers Survey - 7.6% (95%CI:6.5-8.7); Littered Pack - 8.8% (95%CI:8.2-9.4)	Low Risk (Score: 24.00)
SL40: Nguyen, 2014 Country: Vietnam (Smoking Tobacco)	Study Design: Secondary research. Method of Measurement: Gap Analysis and Trade Monitoring.	-Gap Analysis: While estimated consumption exceeded tax paid sales, it indicated consumption of illicit cigarette. -Trade Monitoring: differences between imports (recorded by Vietnam) and exports to Vietnam (recorded by trading partners) indicated net smuggling.	Measured Outcome: Share of illicit cigarettes consumption; Smuggling. Findings: -Gap Analysis: Illicit consumption as share of total consumption in 2006: (1.53%, 10% Underreporting; 8.37%, 20% Underreporting; 14.32%, 30% Underreporting). -Smuggling: Share of smuggling in domestic consumption in 2006 was 14.2%.	Moderate Risk (Score: 21.75)
SL41: Nguyen, 2020 Country: Vietnam (Smoking Tobacco)	Study Design: Secondary research. Method of Measurement: Gap Analysis.	-Discrepancy between domestic tax-paid sales of cigarettes and a survey-based estimate of consumption was the estimate of consumption of illicit cigarette.	Measured Outcome: Illicit cigarette consumption as a share of total consumption. Findings: Assuming 30% under-reporting, the magnitude of illicit cigarette ranged from 10.9% to 44.6% of total consumption from 2010 through 2016.	Moderate Risk (Score: 17.50)
SL42: Maldonado, 2020 Country: Colombia (Smoking Tobacco)	Study Design: Cross sectional (smokers survey and pack observation). Method of Measurement: Survey of tobacco users and pack analysis. Pack Information: Recorded smokers' self-reported price and characteristics of the pack (collected on examination of the smoker's cigarette pack during the interview).	-Illicit cigarettes had following features: did not have mandatory Colombia's health warnings or import/production statement, have a brand not officially registered with the Tobacco Packaging and Labelling Committee in the Ministry of Health in Colombia or, have a price that was not high enough to pay for the excise tobacco taxes.	Measured Outcome: Share of illicit cigarette consumption. Findings: In 2017: Share of illicit cigarette consumption was 6.37%; 95%CI: 5.21-7.53.	Moderate Risk (Score: 19.75)
SL43: Gallien, 2022 Country: Sierra Leone (Smoking Tobacco)	Study Design: Secondary research. Method of Measurement: Gap analysis.	-Illegal markets size was quantified as the difference between estimated total consumption and legal production or import.	Measured Outcome: Gap between total cigarette consumption and its legal import (proxy for share of smuggling). Findings: Market share of illicit cigarette/Market share of smuggling: 42.67% (2013) and 25.92% (2019).	Moderate Risk (Score: 18.50)

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL44: Abola, 2014 Country: Philippines (Smoking Tobacco)	Study Design: Secondary research. Method of Measurement: Gap analysis and Trade monitoring.	-Illicit cigarettes consumption was measured by discrepancies between survey-based estimates of cigarette consumption and cigarette removals. -Net smuggling was estimated by the differences between imports as recorded by the Philippines and exports to the Philippines as recorded by the trading partner.	Measured Outcome: Illicit cigarette consumption; Cigarette trade discrepancies as share of domestic market. Findings: -Illicit consumption (billion sticks) in 2009: (With 10% underreporting: -2.14; With 20% underreporting: -1.96; With 30% underreporting: -1.78) -Trade discrepancies (inward smuggling) as share of domestic market were 10.4% in 2009.	Moderate Risk (Score: 15.25)

Table S7: Data extraction and characteristics of undisclosed or tobacco industry-funded studies with the quality of estimates

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL15: Machado, 2021 Country: Brazil (Smoking Tobacco)	Study Design: Cross sectional (discarded cigarette packs collected from household solid waste) Method of Measurement: Pack Analysis Pack Information: Pack features related to health warnings (Content, size, and format), brand, “visibility” of a seal, produced or not by the Special Department of the Federal Revenue Service of Brazil and country of origin were retrieved.	-Packs with non-compliance for Brazilian regulation related to health warning (content, size and format) and brands not registered with Brazilian National Agency of Sanitary Monitoring (Anvisa) were considered as illicit.	Measured Outcome: Prevalence of illicit cigarette packs. Findings: Prevalence of illicit cigarette pack consumption was 26.79% (95%CI: 25.08-28.57).	Serious Risk (Score: 10.50)
SL26: Heydari, 2016 Country: Iran (Tehran) (Smoking Tobacco)	Study Design: Cross sectional (smokers survey) Method of Measurement: Pack Analysis Pack Information: Governmental pictorial warning and hologram status were recorded from the pack.	-Those with no governmental labelling were illicit. -The illicit packs were also categorised as either domestic (a Persian brand name) or foreign (a foreign brand name).	Measured Outcome: Proportion of smuggled cigarettes. Findings: 15.4% had smuggled and hence illicit cigarette packs.	Serious Risk (Score: 10.75)
SL27: Heydari, 2022 Country: Iran (Tehran) (Smoking Tobacco)	Study Design: Cross sectional (smokers survey) Method of Measurement: Pack Analysis Pack Information: -Respondents reported the price per cigarette or per pack. -Brand details and special governmental labelling were recorded.	-Illegal cigarettes had no special governmental labelling. -Detected as national cigarettes if it had a Persian name. -Detected as foreign cigarettes if it had a foreign name.	Measured Outcome: Proportion of smuggled cigarettes over time. Findings: Proportion of consumption of illicit smuggled cigarettes: 2005 (40%); 2009 (20.9%); 2015 (15.4%) and 2021 (11.1%).	Moderate Risk (Score: 18.50)
SL45: Morais, 2018 Country: Sri Lanka (Smoking Tobacco)	Study Design: Observational study Method of Measurement: Pack analysis Pack Information: Not clearly mentioned.	-Not clearly mentioned. (Only mentioned that sought support from experts and advice from law enforcement agencies).	Measured Outcome: Percentage of illicit cigarette consumed; Percentage of illicit cigarette availability in the market. Findings: -Empty Pack Survey: Percentage of illicit cigarette consumption: 10.8% -Smokers Survey: Percentage of illicit cigarette consumption: 28% smoked at least one illicit cigarette during the last week.	Serious Risk (Score: 8.00)
SL46: FTI Consulting, 2019 Country: Papua New Guinea (PNG) (Smoking Tobacco)	Study Design: Cross sectional (smokers and vendors survey). Method of Measurement: Not specifically mentioned the method of measurement for illicit. (Although discusses in detail the method of measuring consumption of tobacco and illicit tobacco).	-Definition was not clearly mentioned. However, it mentioned several factors used to determine illicit: A price point analysis –products priced at a level that is insufficient to cover supply costs and taxes. A brand analysis – to identify brands of tobacco products that are known to be illicit	Measured Outcome: Size of the illicit tobacco market (expressed as a proportion of total tobacco consumption). Findings: 32.41% of all cigarettes purchased were illicit; 16.42% of all cigarettes consumption (as % of total consumption) were illicit (cigarettes, brus, Coarse cut cigarillos).	Serious Risk (Score: 11.00)

Serial, First Author, Year, Country, Type of Tobacco	Study Design, Method of Measurement & Pack Information	Definition of Illicit	Measured Outcome & Findings	Quality of Estimates
SL47: Oxford Economics, 2020 Country: Lebanon, Jordan, Egypt (Smoking Tobacco)	Study Design: Observational (discarded pack collection). Method of Measurement: Pack analysis. Pack Information: Individual pack characteristics were used. But did not clearly list the features.	-Definition was not clearly mentioned.	Measured Outcome: Share of illicit cigarette consumption. Findings: Share of illicit consumption in 2018: Egypt: 3.9%; Jordan: 7.0%; and Lebanon: 25.9%	Serious Risk (Score: 10.00)
SL48: International Tax and Investment Center and Oxford Economics, 2016 Country: Indonesia, Thailand, Myanmar, Cambodia, Philippines, Vietnam, Pakistan, Malaysia. (Smoking Tobacco)	Study Design: Observational (discarded pack collection). Method of Measurement: Pack analysis. Pack Information: Packs were sorted by manufacturer and brand, and by domestic and nondomestic origin., individual characteristics of each pack (presence of tax stamps, graphic health warnings, other market specific pack characteristics).	-Definition was not clearly mentioned.	Measured Outcome: Share of illicit cigarette consumption. Findings: Share of illicit consumption: Cambodia: (5.0%); Indonesia: (0.1%); Malaysia: (33.7%); Myanmar: (1.3%); Pakistan: (25.2%); Philippines: (19.4%); Thailand: (20.7%); Vietnam: (33.7%).	Serious Risk (Score: 10.00)

Chapter 6-Supplementary figures

Figure S1: LMICs having studies with the estimate of the share of illicit tobacco

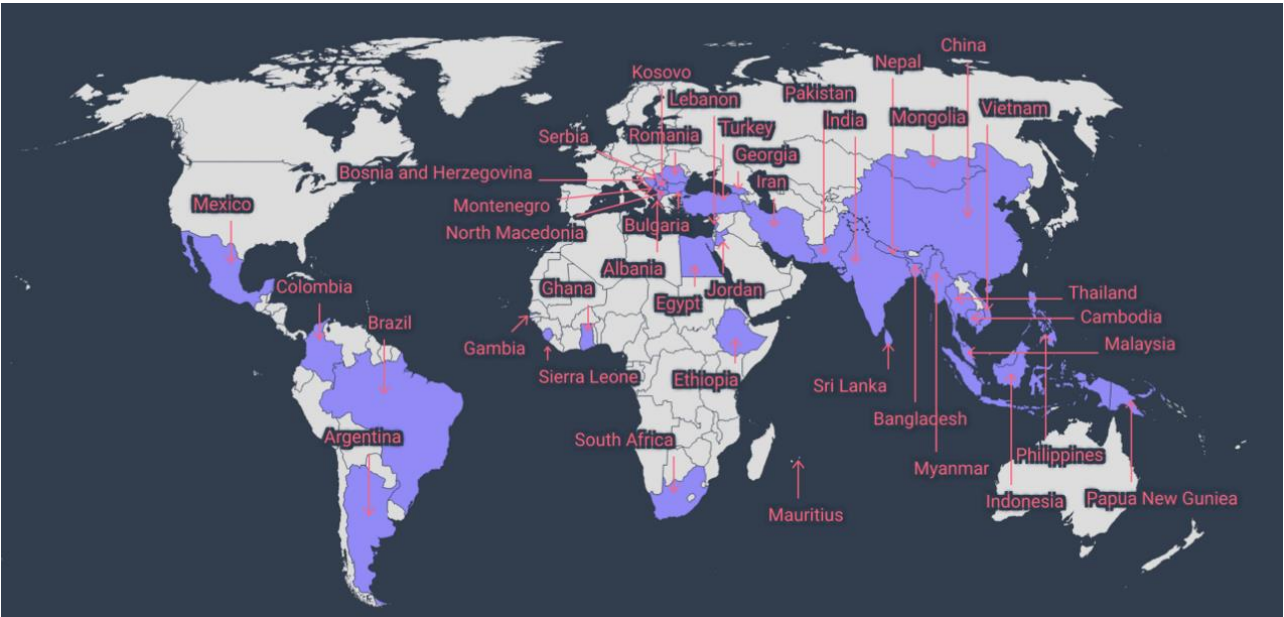


Figure S2: Random effects model showing the share of illicit smoking tobacco in LMICs with undisclosed/ industry-funded studies

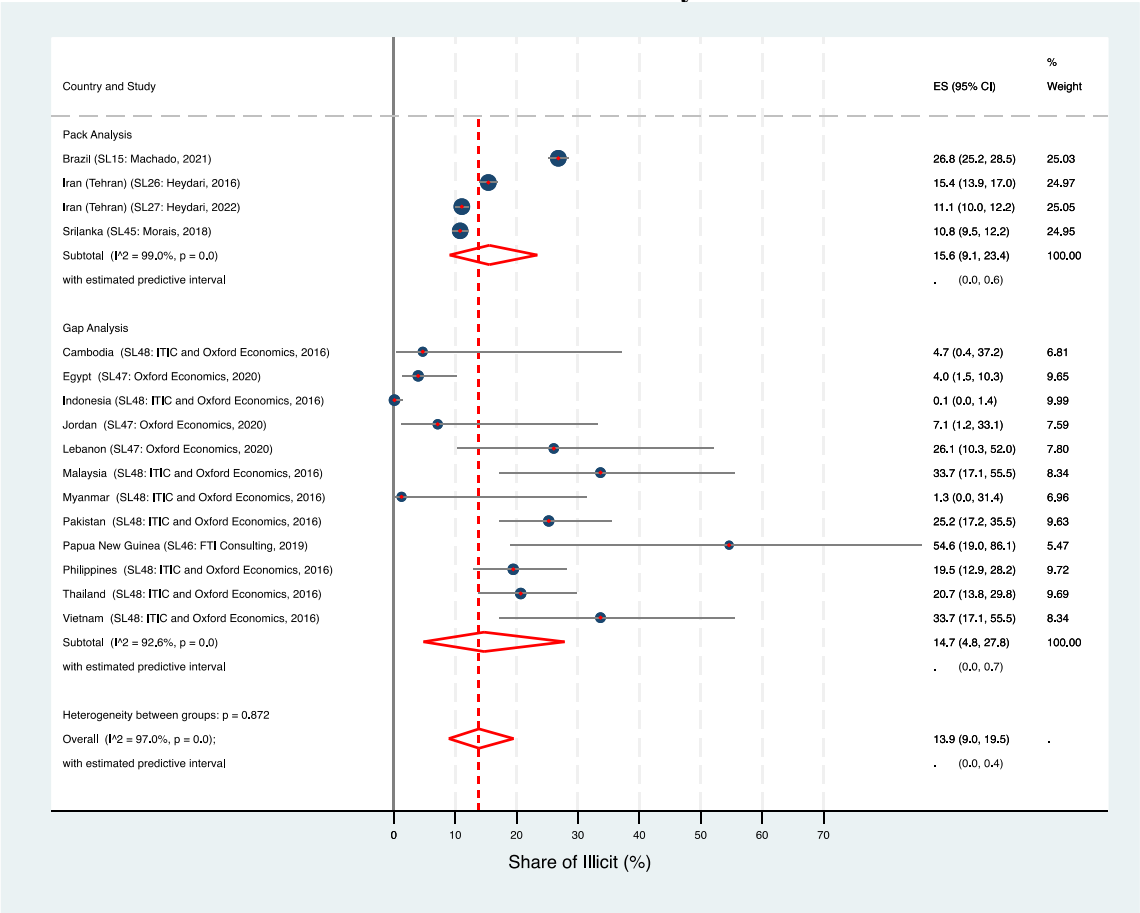


Figure S3: Funnel plot for assessment of small study effects

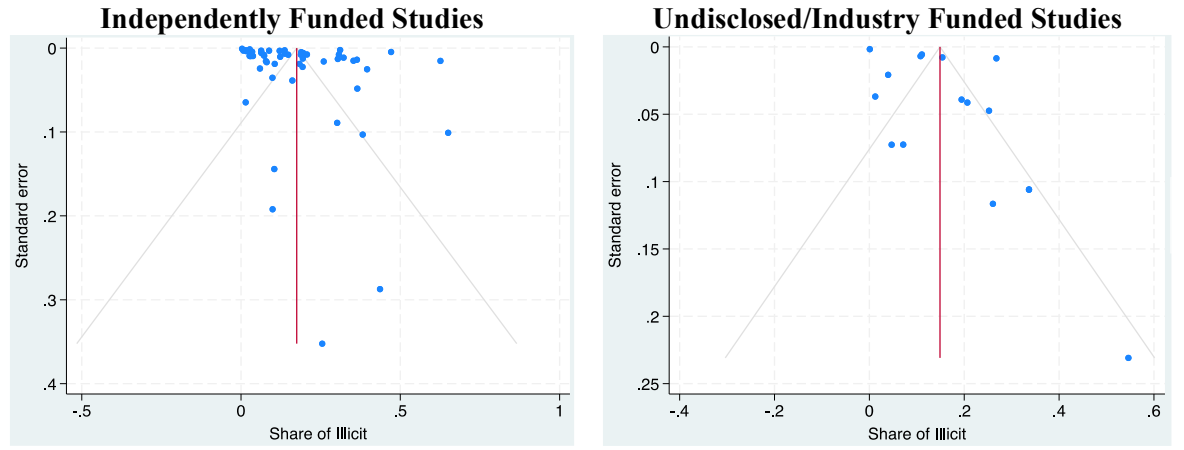
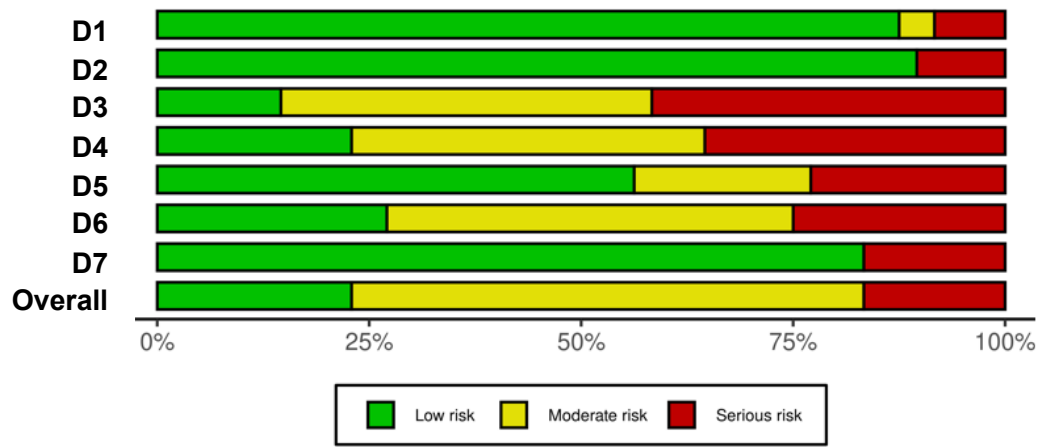


Figure S4: Overall risk of bias assessment for the quality of illicit estimates



Note: Domains – D1: Peer reviewed; D2: Funding; D3: Replicability & Theory Relevance; D4: Generalizability & Criteria Selection; D5: Definition & Identification of Illicit; D6: Results & Cross Validation of Illicit and D7: Limitation Acknowledgement

Appendix 2: Chapter 7-Supplementary File

Statistical specification of the multiple logistic regression model

- Multiple logistic regression for examining the association among tax evasion status of cigarette pack (TES), tax share in price (TSP), pack compliance (PC), price segment (PRS) and rural – urban location (UR).
- Since the outcome variable i.e. tax evasion status of cigarette pack is binary in nature, the research planned to use the logistic regression.
- Suppose the probability of a cigarette pack being tax evaded can be represented as follows:

$$P_i = E(TES = 1|TSP, PC, PRS, UR, \beta) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i)}}$$

The above representation can be rewritten as:

$$P_i = E(TES = 1|TSP, PC, PRS, UR, \beta) = \frac{e^{(\beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i)}}{1 + e^{(\beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i)}}$$

The above equation shows the cumulative logistic distribution function. If P_i is the probability of being a cigarette pack tax evaded, the probability of being tax paid would be $(1 - P_i)$ and given by as follows:

$$(1 - P_i) = E(TES = 0 | TSP, PC, PRS, UR, \beta) = \frac{1}{1 + e^{(\beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i)}}$$

Therefore, it can be written that,

$$\frac{P_i}{(1 - P_i)} = \frac{1 + e^{(\beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i)}}{1 + e^{-(\beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i)}} = e^{(\beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i)}$$

Here, $\frac{P_i}{(1 - P_i)}$ is the ratio of probabilities of a cigarette pack being tax evaded. Hence, it measures the odds ratio in favor of a cigarette pack being tax evaded. The natural log transformation of the above odds ratio will reduce it to the logit model for tax evaded cigarette packs:

$$\begin{aligned} L_i &= \ln\left(\frac{P_i}{1 - P_i}\right) = \ln(e^{(\beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i)}) \\ &= \beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i \end{aligned}$$

In stochastic format the model is written as:

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 TSP_i + \beta_2 PC_i + \beta_3 PRS_i + \beta_4 UR_i + \varepsilon_i$$

- Besides the main exposures named “Packaging compliance (PC)”, “Price Segment (PRS)”, “Tax Share in Price (TSP)”, “Urban – rural Location (UR)” the model will control for other important covariates such as, Pack Size (SP), Border -Non-Border (BNB), Administrative District (AD), Pack Source (PS) and Retail Shop Type (ST).
- Thus, functional form of the complete model with which the study intends to work can be written as follows:

$$TES = f(PC, PRS, TSP, SP, AD, UR, BNB, PS, ST)$$

- To write down the regression model in general form, assume that the outcome variable, TES, denoted by y , is stochastic and linearly related to the exposures listed as PC, PRS, TSP, SP, AD, UR, BNB, PS and ST in the vector x , in the following way:

$$y = x'\beta + \varepsilon$$

Since, y is binary in nature,

$$P_r(y_i > 0) = \Theta(x'\beta + \varepsilon_i)$$

$$\begin{aligned} P_r(TES_i > 0) = \Theta \big(& \beta_0 + \sum \beta_{1i} PC_i + \sum \beta_{2i} PRS_i + \sum \beta_{3i} TSP_i + \sum \beta_{4i} SP_i \\ & + \sum \beta_{5i} AD_i + \sum \beta_{6i} UR_i + \sum \beta_{7i} BNB_i + \sum \beta_{8i} PS_i \\ & + \sum \beta_{9i} ST_i \varepsilon_i \big) \end{aligned}$$

- Five different models of the above general regression specification were estimated in practice. The following table thematically presents the model specifications and their linearity characteristics. Green highlighted cells indicate the inclusion of variables in the specification

Dependent - Tax Evasion Status	Model - 1	Model - 2	Model - 3	Model - 4	Model - 5
Administrative Districts (AD), Urban-Rural (UR), Border and Non-border (BNB)					
Size of Pack (SP)	-				
Price Segment (PRS)	-			-	-
Pack Source (PS)/Reatil Shop Type (ST)	-				
Pack Compliance Status (PC)	-	-		-	
Tax Share in Price (TSP)	-	-	-		
Intercept					
Z (P-Value) of the coefficeint of squared predicted value	-0.33 (0.740)	2.88 (0.004)	2.59 (0.012)	3.71 (0.000)	2.84 (0.004)

Note: There was not enough evidence for nonlinear specification of Model 1 and Model 3 (at 1% level of significance).

Chapter 7-Supplementary tables

Table S8: Socio-demographics of the sampled districts

Districts	Area (Km ²)	Population	Sex Ratio	Literacy Rate
Dhaka	1464	15210851	115.45	84.68
Patuakhali	3221	1770096	95.40	76.54
Chapainawabganj	1703	1875290	93.56	71.92
Comilla	3146	6394875	87.56	76.51
Satkhira	3817	2246691	99.14	75.23
Mymensingh	4395	6097814	96.66	70.74
Thakurgaon	1782	1569529	100.47	74.30
Maulvibazar	2799	2196601	92.57	75.74
Bangladesh (Overall)	147570	169828911	98.04	74.66

Source: Bangladesh Population and Housing Census, 2022

Note: These eight districts (out of 64) cover 15.12% of the total geographic area and 22% of the total population. The socio-demographic characteristics of the selected districts closely align with national trends, with only minor variations. In demographics, most districts reflect the national median age (26 years) and gender ratio, except Dhaka, which has a lower female-to-male ratio and much higher population density. Education and literacy rates are also broadly similar, with Dhaka exceeding and Chapainawabganj lagging behind the national average (74.8%). In religion and ethnic composition, all districts maintain a Muslim-majority population, consistent with the national 91.04%, though Maulvibazar exhibits greater ethnic diversity. Overall, the differences are marginal, and these districts largely mirror the national socio-demographic landscape.

Table S9: Response rate of retailers for cigarette pack collection

District	Number of Empty Cigarette Packs		Retailers Approached	Retailers Participated	Rate (%)	Date of Pack Collection
	Retail Shop	Littered				
Dhaka	2,607	144	180	148	82.22	10th December - 17th December, 2019
Patuakhali	3,500	158	218	194	88.99	28th January - 31st January, 2020
Nawabganj	3,063	134	190	166	87.37	7th January - 10th January, 2020
Comilla	2,861	132	192	162	84.38	25th December - 28th December, 2019
Satkhira	3,183	147	188	171	90.96	21st January - 24th January, 2020
Mymensingh	2,191	135	187	156	83.42	19th December - 22nd December, 2019
Thakurgaon	3,208	156	185	173	93.51	14th January - 17th January, 2020
Maulvibazar	2,594	150	196	169	86.22	31st December - 3rd January, 2020
Total	23,207	1156	1536	1339	87.17	December, 2019 - January, 2020

Table S10: Distribution of packs over type of cigarette retailing shops

Type of Cigarette Retailing Shops	Empty Cigarette Packs		Illicit Cigarette Packs	
	n	Share (%)	n	Share (%)
Ordinary/Departmental Stores	1,941	8.36	79	6.23
Groceries	3,392	14.62	151	11.90
Tea Stalls	12,116	52.21	588	46.34
Only Tobacco Shops	3,253	14.02	249	19.62
Carts	173	0.75	4	0.32
Others (Bakery shops, Fruit and Vegetable Shops, Newspaper Store, Saloon, Stationery and Varieties Store)	2,332	10.05	198	15.60
Total	23,207	100.00	1,269	100.00

Table S11: Tax and packaging compliance of cigarette packs according to Bangladesh's tobacco control law

Illicit Aspect	Pack Feature	Compliance Indicator(s)/Rule(s) (as per Bangladesh's tobacco control law)	Pack Status
Aspect 1: Tax Evasion	Tax Stamp	Government has made it obligatory to use tax stamp or banderol on cigarette packs. Hard and Soft Pack Tax Stamp Specification: Prime Color: Sky Blue, Pink, Light Green and Light Yellow (Different Tax Stamp Color for Different Price Tier) Size: Length and Width – 45mm* 20mm Shell and Slide Pack: Prime Color: Light Blue and Pink Size: Length and Width – 140±0.5mm* 14±0.25mm Note: Authentic tax stamp contains a legitimate watermark or luminescent content that needs to glow under ultraviolet (UV) light.	Tax Paid: A pack is considered as tax paid if it contains authentic and appropriate tax stamp. Tax Evaded: A pack is considered as tax evaded if the tax stamp is not affixed and/or invalid tax stamp.
	Price Disclosure	Mandatory to print the retail price (MRP) of the goods 'on the body of the goods or on every package, sachets or cells distinctly, conspicuously and indelibly'.	Complaint packs: Packs that have all the desirable features (<i>MRP printed, contains appropriate PHW, contains appropriate THW, sale statement printed and no misleading descriptors, contains no duty-free sign</i>) is considered as complaint. Non-compliant packs: Packs with at least any one of the features, namely, <i>no mention of retail price, no and inappropriate graphic and textual health warnings, no sells declaration and mention of brand element, contains a duty-free sign</i> is considered as non-compliant.
Aspect 2: Packaging compliance	Pictorial Health Warning (PHW)	PHW Placement: 1.Health warnings shall be printed on both sides of the main display of packet, cover, carton or box of tobacco products. If the packets do not have two main sides in that case health warnings shall be printed in the upper part on the main display area. 2.Health warnings shall be printed in such a way as not to be covered up by attachment of stamp or band roll or for any other reason. PHW Element (e.g. Color): The colour pictures and health warning messages provided by the government shall be printed as it is with the size, colour, ratio etc. of the script. PHW Size: At least 50% of the total area of each main display area.	
	Textual Health Warning (THW)	THW Placement: Below the PHW. THW Element (Color and Statement): The script shall be in white letters against a black background: (a)Smoking causes throat and lung cancer; (b)Smoking causes respiratory problems; (c)Smoking causes stroke; (d)Smoking causes heart disease; (e)Second-hand smoke causes harms to the fetus; (f)Smoking causes harms to the fetus; (g)Second – hand smoking causes death THW Size: Ratio of image to text is 6:1 (Font Size 18). THW Language: Bengali.	
	Sale statement disclosure and Misleading descriptors	All packets, covers, cartons and boxes sold in Bangladesh shall carry the statement: "Sales allowed only in Bangladesh". Packets, cartons, boxes, or covers of tobacco products shall not use brand elements (such as: light, mild, low-tar, extra, ultra, etc.) to create false impression about its impact and risk on public health.	
	Duty free sign	Packs selling in the general retail shops should not contain duty free sign.	

Table S12: Definition and measurement of analytical variables

Category	Role	Variables Group	Variable Name	Definition
Outcome	Dependent	Tax Evasion Status (TES)	Tax Eavded vs. Tax Paid	A cigarette pack is tax evaded if it has no or illegitimate tax stamp
Exposure	Independent	Price Segment (PRS)	Premium	Maximum Retail Price (MRP)>123 Bangladeshi Taka (BDT)
			High	Maximum Retail Price (MRP)>93 Bangladeshi Taka (BDT)
			Medium	Maximum Retail Price (MRP)>63 Bangladeshi Taka (BDT)
			Low	Maximum Retail Price (MRP)>37 Bangladeshi Taka (BDT)
Covariates	Confounders	Pack Source (PS)	Retail Shop vs. Littered	Whether the cigarette pack was collected from retailers in shops or littered source.
		Tax Share in Price (TSP)	High (81%) vs. Low (71%)	If the total tax share in cigarette price (sum of SD, VAT and HDS) is 81% then it is categorised as "High"
		Pack Compliance (PC)	Complaint vs. Noncomplaint	A cigarette pack is compliant if it satisfies all the packaging features as per law related to PHW, THW, Price Disclosure, Sale Staement and Misleading Descriptors, Duty Free Sign.
	Mediators	Pack Size (SP)	20 Sticks vs. others	Number of cigarette sticks in a pack. "Other" category includes all cigarette packs with less than 20 sticks.
		Shop Type (ST)	Departmental stores	Large Departmental shops
			Grocery	Regular Grocery shops
			Tea Stall	Tea stalls that selles cigarettes
			Only Tobacco Shop	Retail shops that sells only tobacco
			Cart	Small carts with a fixed place
			Others	Unconventional shops that sells cigarettes: bakery, fruit retailers, cosmetics and stationery, newspaper shop, saloon and variety store.
	Competing Exposures	Administrative District (AD)	Maulvibazar, Comilla and Patuakhali vs. Others	Maulvibazar and Patuakhali are member district of the administrative division Sylhet and Barishal which respectively has second (47.4%) and third (40.4%)largest tobacco prevalence in Bangladesh. Comilla is a member district of Chittagong division which has 28..2% tobacco prevalence. Thus they are grouped together and compared with other five (Dhaka, Chapainawabganj, Thakurgaon, Satkhira and Mymensingh) districts.
		Border and Nonborder (BNB)	Border vs. Nonborder	Areas sharing border with neighbourng countires are categorised as "border area" while the others are "nonborder area".
		Urban and Rural (UR)	Urban vs. Rural	Areas within the city corporation or municipality are categorized as urban while the others which are outside are categorised as "rural".

Note: Administrative Districts (AD) are the second administrative layer (64 districts) in Bangladesh (the first layer is division where there are 8 divisions). Depending on the price slab, the National Board of Revenue (NBR) in Bangladesh categorises cigarette packs into four groups: premium, high, medium, and low. During FY 2019-20, the supplementary duty (SD) on low-priced packs was 55%, while it was the same for the other three segments at 65%. All four categories had a common health development surcharge (HDS) of 1% and a value-added tax (VAT) of 15%. Thus, the total tax incidence (total tax share in price) for low-priced packs was 71%, while that for the other three segments was 81%.

Table S13: Specificity and sensitivity of pack non-compliance in detecting tax evasion

Pack Status According to Tax Stamp (True Tax Payment Status)			
Pack Status with Packaging Features (Screening)		Tax Evaded	Tax Paid
	Non-compliant	Non-compliant & Tax Evaded - True Positive (A)	Non-compliant & Tax Paid - False Positive (B)
	Complaint	Compliant & Tax Evaded - False Negative (C)	Complaint & Tax Paid - True Negative (D)
Sensitivity & Specificity		Sensitivity = A/(A+C)	Specificity = D/(B+D)

Table S14: Distribution of packs over non-compliant categories

Pack features		Retail Shop			Littered		
		n	%	95% CI	n	%	95% CI
Illegitimate Practice with Packaging	Missing MRP (Yes)	69	0.30	[0.2-0.4]	4	0.30	[0.1-0.9]
	Sale Statement not printed and Have Misleading Descriptor (Yes)	151	0.70	[0.6-0.8]	6	0.50	[0.2-1.1]
	Presence of Duty-Free Sign (Yes)	3	0.00	[0.0-0.0]	0	0.00	[0.0-0.3*]
	Illegitimate Practice for PHW (Yes)	111	0.50	[0.4-0.6]	7	0.80	[0.4-1.5]
	Illegitimate Practice for THW (Yes)	77	0.30	[0.3-0.4]	4	0.30	[0.1-0.9]
Share of Non-compliant Packs		176	0.80	[0.1-1.4]	11	1.00	[0.4-1.8]
Illegitimate Practice with Tax Stamp	Share of Tax Evaded Packs	1,208	5.20	[4.0-6.7]	88	7.60	[5.2-10.7]

Note: 1. If any Pack had at least one of the characteristics defined as "No PHW, covering less than 50% of the principal display area, PHW not appearing both sides of pack, Contains PHW not recommended by national tobacco control cell, PHW not colourful, Inappropriate quality of PHW, PHW covering Tax Stamp" then it was considered as Illegitimate Practice for PHW. 2. If any pack had at least one of the characteristics defined as "No THW, THW not written in Bengali, THW not printed in white on black background and inappropriate PHW to THW ratio" then it was considered as Illegitimate Practice for THW. 3. Non-compliant packs have at least any one of the illegitimate practices with packaging. 4. If any pack had at least one of the characteristics defined as "No Tax Stamp" and "Invalid Tax Stamp Affixed" then it was considered as Illegitimate Practice for Tax Stamp. 5. (*) one-sided, 97.5% confidence interval.

Table S15: Share of illicit cigarettes over geographical location, border proximity and cigarette price segments

Distribution Item		Pack Source						Total (N=24,263)		
		Retail Shops (N=23,207)			Littered (N=1,156)					
		n	%	95% CI	n	%	95% CI	n	%	95% CI
Location	Urban	656	4.97	[3.4 - 7.1]	49	8.66	[4.6 - 14.6]	705	5.15	[3.5 - 7.3]
	Rural	613	6.08	[4.0 - 8.7]	45	7.63	[5.2 - 10.7]	658	6.16	[4.2 - 8.7]
Border	Border	480	6.73	[4.4 - 9.8]	32	7.90	[5.4 - 11.1]	512	6.79	[4.5 - 9.7]
	Non-border	789	4.91	[3.4 - 6.8]	62	8.26	[4.9 - 12.9]	851	5.06	[3.5 - 7.0]
Price Segments	Premium	132	2.21	[1.4 - 3.3]	15	5.60	[2.8 - 9.8]	147	2.36	[1.5 - 3.5]
	High	28	3.78	[2.0 - 6.5]	3	4.92	[0.9 - 14.5]	31	3.87	[2.0 - 6.7]
	Medium	97	4.41	[2.9 - 6.4]	8	6.40	[2.1 - 14.3]	105	4.51	[3.1 - 6.4]
	Low	936	6.58	[4.8 - 8.7]	64	9.17	[5.9 - 13.4]	1000	6.70	[5.0 - 8.8]

Table S16: Adjusted odds ratios (AOR) from multivariate tax evasion model with the packs from retail shops

Variables (Dependent: Tax Evasion Status)		Model 1				Model 2				Model 3				Model 4				Model - 5			
		AOR	P> Z	95% CI		AOR	P> Z	95% CI		AOR	P> Z	95% CI		AOR	P> Z	95% CI		AOR	P> Z	95% CI	
District (Ref: Dhaka, Thakurgaon, Nawabganj, Satkhira, Mymensingh)	Maulvibazar, Patuakhali and Comilla	2.67***	0.00	1.70	4.19	2.43***	0.00	1.64	3.59	2.48***	0.00	1.67	3.67	2.49***	0.00	1.69	3.67	2.53***	0.00	1.71	3.75
Location (Ref: Rural)	Urban	1.13	0.82	0.40	3.16	1.05	0.92	0.40	2.77	1.01	0.98	0.38	2.69	1.05	0.92	0.40	2.81	1.01	0.98	0.38	2.73
Border (Ref: Non Border Area)	Border Area	1.87	0.23	0.67	5.19	1.64	0.32	0.62	4.30	1.64	0.32	0.62	4.33	1.68	0.30	0.63	4.45	1.68	0.30	0.63	4.48
Pack Size (Ref: Less than 20 Sticks Pack)	20 Sticks Pack	-	-	-	0.07	1.22	0.29	0.85	1.75	1.28	0.18	0.89	1.84	1.16	0.43	0.81	1.65	1.21	0.29	0.85	1.73
Price Segment (Ref: Premium)	High	-	-	-	-	2.37**	0.02	1.17	4.82	2.53**	0.01	1.23	5.20	-	-	-	-	-	-	-	-
	Medium	-	-	-	-	2.16***	0.00	1.29	3.61	2.26***	0.00	1.32	3.86	-	-	-	-	-	-	-	-
	Low	-	-	-	-	3.41***	0.00	2.08	5.60	3.5***	0.00	2.09	5.87	-	-	-	-	-	-	-	-
Shop Type (Ref: Ordinary or Departmental Store)	Grocery	-	-	-	-	1.17	0.53	0.72	1.89	1.15	0.56	0.71	1.87	1.17	0.54	0.72	1.90	1.15	0.57	0.71	1.88
	Tea Stall	-	-	-	-	1.22	0.31	0.83	1.77	1.20	0.35	0.82	1.74	1.21	0.33	0.83	1.77	1.19	0.36	0.82	1.74
	Only Tobacco Shop	-	-	-	-	1.5*	0.06	0.99	2.27	1.39	0.12	0.91	2.13	1.48*	0.07	0.97	2.26	1.38	0.14	0.90	2.11
	Cart	-	-	-	-	0.49	0.28	0.14	1.76	0.50	0.29	0.14	1.81	0.50	0.27	0.15	1.72	0.51	0.29	0.15	1.76
	Others	-	-	-	-	1.99**	0.02	1.12	3.54	1.89**	0.04	1.04	3.44	1.94**	0.03	1.08	3.47	1.84*	0.05	1.01	3.37
Pack Status (Ref: Compliant)	Non-Compliant	-	-	-	-	-	-	-	-	16.06***	0.00	4.57	56.39	-	-	-	-	15.06***	0.00	4.28	52.98
Tax Incidence (Share) (Ref: High Tax (81%))	Low Tax (71%)	-	-	-	-	-	-	-	-	-	-	-	-	2.42***	0.00	1.61	3.64	2.44***	0.00	1.61	3.70
Intercept	Constant	0.03***	0.00	0.01	0.07	0.01	0.00	0.00	0.02	0.01***	0.00	0.00	0.02	0.01***	0.00	0.00	0.03	0.01***	0.00	0.00	0.03
Number of Observations		23207				23047				23047				23047				23047			
Wald Chi - Square (P - Value)		27.15*** (0.000)				81.78*** (0.000)				96.94*** (0.000)				67.19*** (0.000)				82.96*** (0.000)			
Number of Covariate Patterns		6				225				247				123				145			
Hosmer - Lemeshow Chi - Square (P - Value)		0.60 (0.437)				1.35 (0.245)				0.70 (0.402)				11.48*** (0.000)				13.66*** (0.000)			
Area Under roc Curve		0.64				0.69				0.70				0.68				0.69			
BIC		9221.36				8632.57				8522.93				8647.43				8541.78			

Note: ***, ** and * indicates the significance of odds ratios respectively at a 1%, 5%, and 10% level. Clustered robust standard errors with PSU as the cluster were used to estimate the odds ratios. Wald χ^2 statistic tests the overall significance of the models and Hosmer – Lemeshow χ^2 tests the goodness of fit for the models. BIC shows the Bayesian Information Criterion for model selection. Numbers for the area under Receiver Operating Characteristic (ROC) curve measure the diagnostic ability of the models.

Table S17: Adjusted odds ratios (AOR) from multivariate tax evasion model with sample restricted for packs with removed tax stamps

Variables (Dependent: Tax Evasion Status)		Model 1				Model 2				Model 3				Model 4				Model - 5			
		AOR	P> Z	95% CI		AOR	P> Z	95% CI		AOR	P> Z	95% CI		AOR	P> Z	95% CI		AOR	P> Z	95% CI	
District (Ref: Dhaka, Thakurgaon, Nawabganj, Satkhira, Mymensingh)	Maulvibazar, Patuakhali and Comilla	2.69***	0.00	1.74	4.14	2.49***	0.00	1.69	3.68	2.53***	0.00	1.72	3.74	2.53***	0.00	1.72	3.73	2.57***	0.00	1.75	3.79
Location (Ref: Rural)	Urban	1.01	0.99	0.42	2.86	1.08	0.87	0.42	2.80	1.04	0.94	0.40	2.70	1.08	0.87	0.42	2.81	1.04	0.94	0.40	2.72
Border (Ref: Non-Border Area)	Border Area	1.76	0.24	0.68	4.58	1.61	0.32	0.63	4.09	1.60	0.32	0.63	4.06	1.65	0.30	0.64	4.21	1.64	0.30	0.64	4.19
Pack Size (Ref: Less than 20 Sticks Pack)	20 Sticks Pack	-	-	-	-	1.18	0.36	0.83	1.68	1.24	0.23	0.87	1.76	1.13	0.50	0.79	1.60	1.18	0.36	0.83	1.67
Price Segment (Ref: Premium)	High	-	-	-	-	2.31**	0.02	1.13	4.73	2.49**	0.01	1.20	5.18	-	-	-	-	-	-	-	-
	Medium	-	-	-	-	2.09***	0.00	1.28	3.41	2.22***	0.00	1.33	3.73	-	-	-	-	-	-	-	-
	Low	-	-	-	-	3.35***	0.00	2.06	5.44	3.49***	0.00	2.10	5.81	-	-	-	-	-	-	-	-
Pack Source (Ref: Shop)	Littered	-	-	-	-	1.63***	0.00	1.17	2.26	1.62***	0.00	1.16	2.26	1.64***	0.00	1.18	2.28	1.63***	0.00	1.16	2.27
Pack Status (Ref: Compliant)	Non-Compliant	-	-	-	-	-	-	-	-	17.43***	0.00	4.75	64.03	-	-	-	-	16.01***	0.00	4.35	58.86
Tax Incidence (Share) (Ref: High Tax (81%))	Low Tax (71%)	-	-	-	-	-	-	-	-	-	-	-	-	2.40***	0.00	1.62	3.56	2.43***	0.00	1.62	3.65
Intercept	Constant	0.03***	0.00	0.01	0.07	0.01***	0.00	0.00	0.03	0.01***	0.00	0.00	0.02	0.01***	0.00	0.01	0.04	0.01***	0.00	0.01	0.03
Number of Observations		22783				22703				22703				22703				22703			
Wald χ^2 (P - Value)		30.14*** (0.000)				79.69*** (0.000)				94.70*** (0.000)				68.01*** (0.000)				85.03*** (0.000)			
Number of Covariate Patterns		6				93				108				48				62			
Hosmer - Lemeshow χ^2 (P - Value)		0.17 (0.67)				3.34* (0.06)				1.17 (0.18)				3.21* (0.073)				3.21* (0.073)			
Area Under ROC Curve		0.64				0.68				0.69				0.67				0.68			
BIC		9656.14				9057.57				8938.93				9072.86				8959.66			

Note: ***, ** and * indicates the significance of odds ratios respectively at a 1%, 5%, and 10% level. Clustered robust standard errors with PSU as the cluster were used to estimate the odds ratios. Wald χ^2 statistic tests the overall significance of the models and Hosmer – Lemeshow χ^2 tests the goodness of fit for the models. BIC shows the Bayesian Information Criterion for model selection. Numbers for the area under Receiver Operating Characteristic (ROC) curve measure the diagnostic ability of the models.

Table S18: Specificity and sensitivity of pack non-compliance in packs from retail shops

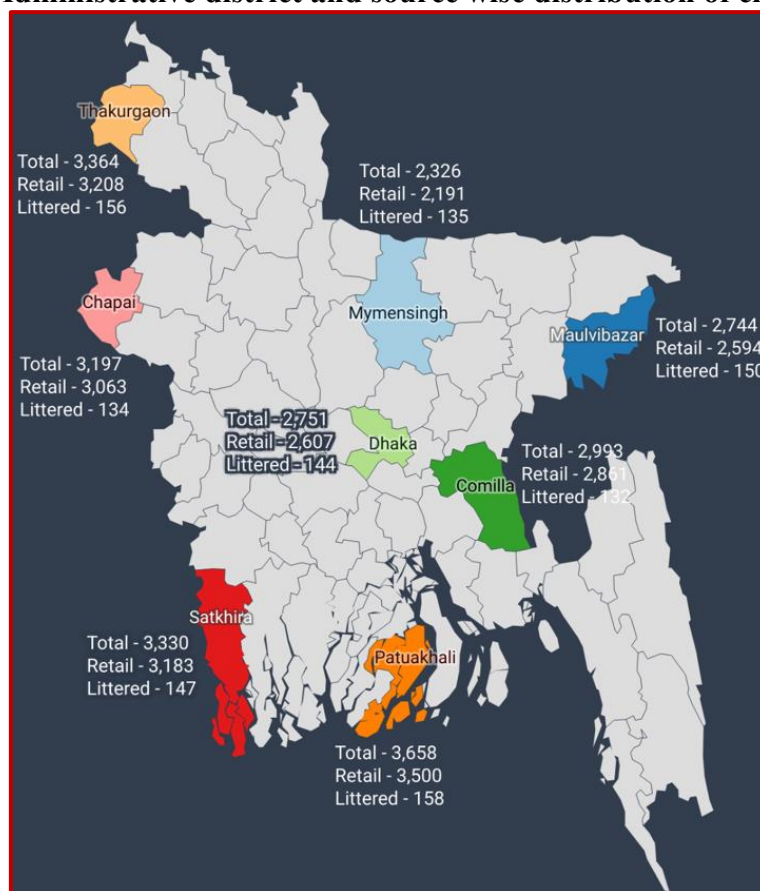
Pack Status According to Tax Stamp (True Tax Payment Status)			
Pack Status with Packaging Features (Screening)		Tax Evaded	Tax Paid
	Non-compliant	A: Non-compliant & Tax Evaded - True Positive (n=115)	B: Non-compliant but Tax Paid - False Positive (n=61)
	Compliant	C: Compliant but Tax Evaded - False Negative (n=1093)	D: Complaint & Tax Paid - True Negative (n=21938)
Sensitivity & Specificity		Sensitivity=A/(A+C)=9.52% [9.14-9.10]	Specificity = D/(B+D)=99.72% [99.66-99.79]

Table S19: Specificity and sensitivity of pack non-compliance in littered packs

Pack Status According to Tax Stamp (True Tax Payment Status)			
Pack Status with Packaging Features (Screening)		Tax Evaded	Tax Paid
	Non-compliant	A: Non-compliant & Tax Evaded - True Positive (n=5)	B: Non-compliant but Tax Paid - False Positive (n=6)
	Compliant	C: Compliant but Tax Evaded - False Negative (n=83)	D: Complaint & Tax Paid - True Negative (n=1062)
Sensitivity & Specificity		Sensitivity = A/(A+C) = 5.68% [4.35-7.02]	Specificity = D/(B+D)=99.44% [99.01-99.87]

Chapter 7-Supplementary figures

Figure S5: Administrative district and source wise distribution of cigarette packs



Appendix 3: Chapter 8-Supplementary file

Chapter 8-Supplementary tables

Table S20: Tobacco packaging compliance rules in Bangladesh against FCTC: comparison of smoking and smokeless tobacco

Pack Feature	FCTC Compliance Requirement(s) and Recommendations (Article 11 and Article 15)	Compliance Indicator(s)/Rule(s) (As per Bangladesh Law)	Smokeless Tobacco	Smoking Tobacco
Price Disclosure	No Specific Requirement	Mandatory to print the retail price (MRP) of the goods 'on the body of the goods or on every package, sachets or cells distinctly, conspicuously and indelibly'.	Applicable	Applicable
Tax Stamp and Banderole	No Specific Requirement	Government has made it obligatory to use tax stamp or banderole on Cigarette and Bidi packets. Hard and Soft Pack Tax Stamp Specification: Prime Color: Sky Blue, Pink, Light Green and Light Yellow (Different Tax Stamp Color for Different Price Tier) Size: Length and Width – 45mm* 20mm Shell and Slide Pack: Prime Color: Light Blue and Pink Size: Length and Width – 140±0.5mm* 14±0.25mm	No Specific Rule	Applicable
Pictorial Health Warning (PHW)	1.Front and Back of Principal Display Area (PDA) 2. Top of PDA 3. Opening does not damage/ conceal Health Warning Recommendation: 1. Warnings not obstructed by other markings	PHW Placement: 1.Health warnings shall be printed on both sides of the main display of packet, cover, carton or box of tobacco products. If the packets do not have two main sides in that case health warnings shall be printed in the upper part on the main display area. 2.Health warnings shall be printed in such a way as not to be covered up by attachment of stamp or band roll or for any other reason.	Applicable	Applicable
	1. Full color pictorial HW	PHW Element (e.g. Color): The color pictures and health warning messages provided by the government shall be printed as it is with the size, color, ratio etc. of the script	Applicable (NTCC Recommended)	Applicable (NTCC Recommended)
	1.50% or more but no less than 30% of the PDA 2.Text of HW bold, legible font size, style/color enhancing visibility and legibility	PHW Size: At least 50% of the total area of each main display area.	Applicable (NTCC Recommended)	Applicable (NTCC Recommended)
Textual Health Warning (THW)		THW Placement: Below the PHW	Applicable	Applicable
	1.Contrasting colors for background of text for text-based elements of warning 2. HW message addresses different issues related to tobacco use, in addition to harmful health effects (e.g., cessation, addictiveness, etc.) Recommendations: 1. Innovative messages (e.g., outcomes on environment, industry practices)	THW Element (Color and Statement): The script shall be in white letters against a black background	(a)Smoking causes throat and lung cancer; (b)Smoking causes respiratory problems; (c)Smoking causes stroke; (d)Smoking causes heart disease; (e)Second-hand smoke causes harms to the fetus;	(a) Consumption of tobacco products causes mouth and throat cancer; (b) Consumption of tobacco products causes harms to the fetus.

			(f)Smoking causes harms to the fetus; (g)Second – hand smoking causes death	
		THW Size: Ratio of image to text is 6:1 (Font Size 18)	Applicable	Applicable
	1.HW appear in the principal language or languages	THW Language: Bengali	Applicable	Applicable
Statement of Sale	No Specific Requirement	All packets, covers, cartons and boxes sold in Bangladesh shall carry the statement: “Sales allowed only in Bangladesh”	Applicable	Applicable
Misleading Descriptors	1.Packaging must not promote terms, descriptors, signs that create false impression that product is less Harmful than others. 2. Prohibit display of figures for emission yields 3. Prevent display of expiry dates The FCTC requires the Parties to take measures, within 3 years of the entry into force of the convention, to ensure that tobacco packages do not give misleading descriptions, such as "low tar", "ultra light", "mild" etc.	Packets, cartons, boxes, or covers of tobacco products shall not use brand elements (such as: light, mild, low-tar, extra, ultra, etc.) to create false impression about its impact and risk on public health.	Applicable	Applicable

Reference:

1. WHO. *WHO Framework Convention on Tobacco Control*. World Health Organization 2003.
2. National Board of Revenue. Ministry of Finance, Bangladesh. <https://nbr.gov.bd/regulations/acts/vat-acts/eng>
3. National Tobacco Control Cell. Ministry of Health and Family Welfare, Bangladesh. <https://ntcc.gov.bd/page/act-rules>

Table S21: Tobacco packaging compliance rules in India against FCTC: comparison of smoking and smokeless tobacco

Pack Feature	FCTC Compliance Requirement(s) and Recommendations (Article 11 and Article 15)	COTPA/ Indian Finance Act	Smokeless Tobacco	Smoking Tobacco
Price Disclosure	No Specific Requirement	GST (Goods and Service Tax), Compensation Cess and NCCD (National Calamity Contingency Duty) are applicable on tobacco products. The GST council fixed a statutory (exclusive) <i>ad-valorem</i> GST rate of 28% on all tobacco products with an additional compensation cess on cigarettes and SLT. This cess is also applied on value added at every stage of the supply chain, along with the GST.	Applicable	Applicable
Tax Stamp and Banderole	No Specific Requirement	Not compulsory in India	Not Applicable	Not Applicable
Pictorial Health Warning (PHW)	1.Front and Back of Principal Display Area (PDA) 2. Top of PDA 3. Opening does not damage/ conceal Health Warning Recommendation: 1. Warnings not obstructed by other markings	Section 7-8 COTPA: Pictorial and Textual Health Warnings on Tobacco packs 1. The specified health warnings shall cover at least eighty-five per cent (85%) of the principal display area of the package of which sixty per cent (60%) shall cover pictorial health warning. 2. It should be made sure that none of the elements of the specified warning are severed, covered or hidden in any manner when the package is sealed or opened 3. No messages, images or pictures that directly or indirectly promote the use or consumption of a specific tobacco brand or tobacco usage in general or any matter or statement which is inconsistent with, or detracts from, the specified health warning are inscribed on the tobacco product package. 4. No product shall be sold unless the package contains the specified health warning. Pictorial Health Warning(PHW) Placement: A pictorial representation of the ill effects of tobacco use on health shall be placed above the textual health warning.	Applicable	Applicable
	1. Full color pictorial HW	PHW Element (e.g. Color): It shall be printed with four colours with printing resolution of minimum 300 DPI (Dots per inch).	Applicable	Applicable
	1.50% or more but no less than 30% of the PDA 2.Text of HW bold, legible font size, style/color enhancing visibility and legibility	PHW Size: The size of the specified health warning on each panel of the tobacco package shall not be less than 3.5 cm (width) x 4 cm (height), so as to ensure that the warning is legible, prominent and conspicuous.	Applicable	Applicable
Textual Health Warning (THW)	1.Contrasting colors for background of text for text-based elements of warning	Textual Health Warning (THW) Placement: textual health warning and shall be positioned on the top edge of the package and in the same direction as the information on the principal display area	Applicable	Applicable

	2. HW message addresses different issues related to tobacco use, in addition to harmful health effects (e.g., cessation, addictiveness, etc.) Recommendations: 1. Innovative messages (e.g., outcomes on environment, industry practices)	1. Twenty-five per cent (25%) shall cover textual health warning and shall be positioned on the top edge of the package and in the same direction as the information on the principal display area 2. The textual health warning shall be inscribed in the language used on the pack Each health warning shall be specified in English, Hindi and any other regional languages. Appropriate language combination shall be selected to ensure that the language selected for health warning is in conformity with the language used on the package by the manufacturer or importer or packer. Provided that where the language used on a package or on its label is :- (a) English, the health warning shall be expressed in English (b) English and Indian languages, the health warning shall be expressed in English and any one of the Indian languages in which the brand name appears; (c) Hindi and other Indian languages, the health warning shall be expressed in Hindi and any one of the Indian language in which the brand name appears; (d) Any Indian language, the health warning shall be expressed in such Indian language; (e) Indian languages, the health warning shall be expressed in any two Indian languages in which the brand name appears; (f) Foreign language, the health warning shall be expressed in English; (g) Foreign and Indian languages, the health warning shall be expressed in English and any one of the Indian languages in which the brand name appears The textual health warning shall appear in not more than two languages used on the package For smoking and smokeless forms of tobacco products, the words 'TOBACCO CAUSES PAINFUL DEATH' shall appear in white font colour on a red background and the words 'QUIT TODAY CALL 1800-11-2356' shall appear in white font colour on a black background. The intensity of colour in the background of the textual health warning shall be: White: Cyan(C):0%, Magenta(M):0%, Yellow(Y):0% Key (K):0%, Red: C:0%, M:100%, Y:100% K: 0% and Black: C:0%, M:0%, Y:0% K: 100% (Colour conversion codes). The textual health warnings shall be printed with four colours with printing resolution of minimum 300 DPI (Dots per inch).² THW Size: Ratio of image to text is 6:1 (Font Size 18)	For smokeless forms tobacco products, the word warning shall appear in white font colour on a red background and words "tobacco causes mouth cancer" and "tobacco kills" shall appear in white font colour on a black background.	For smoking forms tobacco products, the word warning shall appear in white font colour on a red background and words "smoking causes throat cancer" and "smoking kills" shall appear in white font colour on a black background.
	1.HW appear in the principal language or languages	THW Language: Textual health warning shall be inscribed in the language used on the pack Provided that where the language used on a package or on its label is :- (a) English, the health warning shall be expressed in English	Applicable Applicable	Applicable Applicable

		(b) English and Indian languages, the health warning shall be expressed in English and any one of the Indian languages in which the brand name appears; (c) Hindi and other Indian languages, the health warning shall be expressed in Hindi and any one of the Indian language in which the brand name appears; (d) Any Indian language, the health warning shall be expressed in such Indian language; (e) Indian languages, the health warning shall be expressed in any two Indian languages in which the brand name appears; (f) Foreign language, the health warning shall be expressed in English; (g) Foreign and Indian languages, the health warning shall be expressed in English and any one of the Indian languages in which the brand name appears		
Statement of Sale	No Specific Requirement	Not applicable in India	Not Applicable	Not Applicable
Misleading Descriptors	1. Packaging must not promote terms, descriptors, signs that create false impression that product is less Harmful than others. 2. Prohibit display of figures for emission yields 3. Prevent display of expiry dates The FCTC requires the Parties to take measures, within 3 years of the entry into force of the convention, to ensure that tobacco packages do not give misleading descriptions, such as "low tar", "ultra light", "mild" etc.	No tobacco product package or label shall contain any information that is false, misleading, or deceptive, or that is likely or intended to create an erroneous impression about the characteristics, health effects, or health or other hazards of the tobacco product or its emissions. This prohibition includes, but is not limited to, the use of words or descriptors, whether or not part of the brand name, such as "light", "ultra light", "mild", "ultra mild", "low tar", "slim", "safer", or similar words or descriptors; any graphics associated with, or likely or intended to be associated with, such words or descriptors; and any product package design characteristics, associated with, likely or intended to be associated with, such descriptors.	Applicable	Applicable

Reference:

1. WHO. *WHO Framework Convention on Tobacco Control*. World Health Organization 2003.
2. National Tobacco Control Programme. Ministry of Health and Family Welfare, India. <https://main.mohfw.gov.in/major-programmes/other-national-health-programmes/national-tobacco-control-programme-ntcp>
3. John RM, Dauchy E, Goodchild M. Estimated impact of the GST on tobacco products in India. *Tob Control* 2019;**28**:506–12.

Table S22: Tobacco packaging compliance rules in Pakistan against FCTC: comparison of smoking and smokeless tobacco

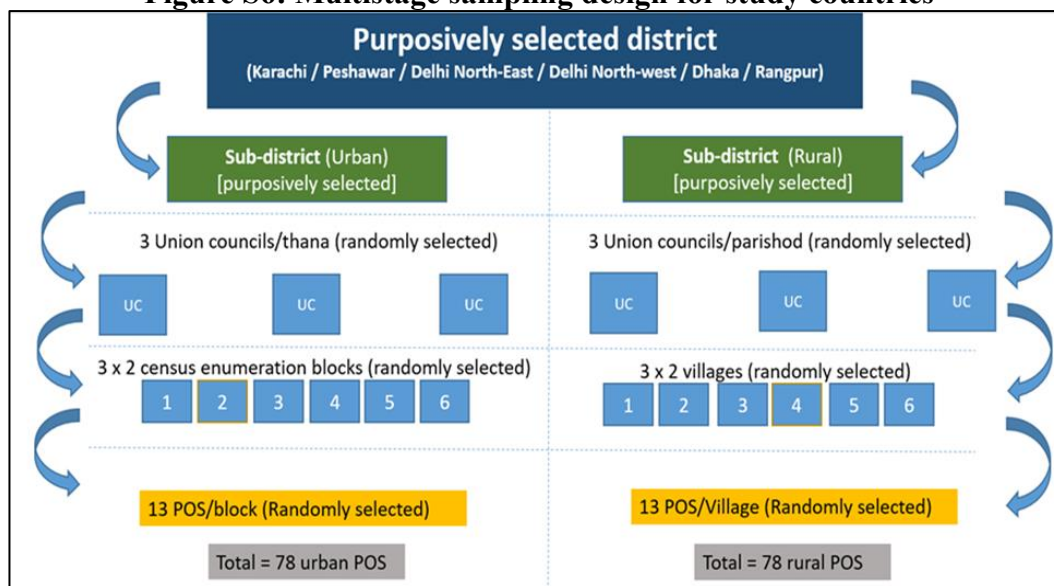
Pack Feature	FCTC Compliance Requirement(s) and Recommendations (Article 11 and Article 15)	FCTC Compliance Requirement(s) and Recommendations (Article 11 and Article 15)	Compliance Indicator(s)/Rule(s) (As per Pakistan's Law)	Smokeless Tobacco	Smoking Tobacco
Price Disclosure	No Specific Requirement	No Specific Requirement	Not Applicable	Not Applicable	Applicable
Tax Stamp and Banderole	No Specific Requirement	No Specific Requirement	Not Applicable	Not Applicable	Not Applicable
Pictorial Health Warning (PHW)	1.Front and Back of Principal Display Area (PDA) 2. Top of PDA 3. Opening does not damage/ conceal Health Warning Recommendation: 1. Warnings not obstructed by other markings	1.Front and Back of Principal Display Area (PDA) 2. Top of PDA 3. Opening does not damage/ conceal Health Warning Recommendation: 1. Warnings not obstructed by other markings	The picture and warning must be placed on the front (top) of the pack in Urdu and on the back (top) of the pack in English. Opening does not damage/ conceal Health Warning	Not Applicable	Applicable
	1. Full colour pictorial HW	1. Full colour pictorial HW	PHW Element (e.g. Color): The color pictures and health warning messages provided by the government shall be printed as it is with the size, color, ratio etc. of the script. Every year government will provide a new message for PHW to be printed on packs and will be responsible for rotation of messages	Not Applicable	Applicable
	1.50% or more but no less than 30% of the PDA 2.Text of HW bold, legible font size, style/colour enhancing visibility and legibility	1.50% or more but no less than 30% of the PDA 2.Text of HW bold, legible font size, style/colour enhancing visibility and legibility	PHW Size: 85% of the area should be covered by PHW in phase manner. At least 50% of the total area of each main display area applicable from July from 2018 At least 60% of the total area of each main display area applicable from July from 2019.	Not Applicable	Applicable
Textual Health Warning (THW)			THW Placement: Below the PHW	Not Applicable	Applicable
	1.Contrasting colours for background of text for text-based elements of warning 2. HW message addresses different issues related to tobacco use, in addition to harmful health effects (e.g., cessation, addictiveness, etc.) Recommendations: 1. Innovative messages (e.g., outcomes on environment, industry practices)	1.Contrasting colours for background of text for text-based elements of warning 2. HW message addresses different issues related to tobacco use, in addition to harmful health effects (e.g., cessation, addictiveness, etc.) Recommendations: 1. Innovative messages (e.g., outcomes on environment, industry practices)	THW Element (Color and Statement): black on white background	Not Applicable	Applicable
			THW Size: 2mm text size	Not Applicable	Applicable
	1.HW appear in the principal language or languages	1.HW appear in the principal language or languages	THW Language: Urdu on front English on the back	Not Applicable	Applicable

Statement of Sale	No Specific Requirement	No Specific Requirement	All packets, covers, cartons and boxes sold in Pakistan shall carry the statement: "Sales allowed only in Pakistan"	Not Applicable	Applicable
Misleading Descriptors	1.Packaging must not promote terms, descriptors, signs that create false impression that product is less Harmful than others. 2. Prohibit display of figures for emission yields 3. Prevent display of expiry dates The FCTC requires the Parties to take measures, within 3 years of the entry into force of the convention, to ensure that tobacco packages do not give misleading descriptions, such as "low tar", "ultra light", "mild" etc.	1.Packaging must not promote terms, descriptors, signs that create false impression that product is less 2.Harmful than others 3. Prohibit display of figures for emission yields 4. Prevent display of expiry dates	No messages, images or pictures that directly or indirectly promote the use or consumption of a specific tobacco brand or cigarette usage	Not Applicable	Applicable
	The only rule that existed for ST products in Pakistan, categorised a product as illegal if it is imported and originated from India or Israel (Import Policy Order 2020)				

Reference:

1. WHO. *WHO Framework Convention on Tobacco Control*. World Health Organization 2003.
2. Federal Board of Revenue. Federal Board of Revenue, Pakistan. <https://www.fbr.gov.pk>
3. Cell TC. Ministry of National Health Services, Regulations and Coordinations, Pakistan. <http://www.tcc.gov.pk/>
4. Import Policy Order 2020, Ministry of Commerce, Government of Pakistan, <https://www.commerce.gov.pk/wp-content/uploads/2020/09/Import-Policy-Order-25-09-2020.pdf>

Figure S6: Multistage sampling design for study countries



Source: Adapted from Khan et al. (2020)

Appendix 4: Chapter 9-Supplementary file

Participant information sheet



Improving the regulation and monitoring to control the illicit smokeless tobacco in Bangladesh: a qualitative study

Participant Information Sheet [In-depth Interview]

I am cordially inviting you to take part in the above research study. Before you decide whether to take part or not, it is important that you understand why the research is being conducted and what it would involve for you. Please take your time to read all the information in this document carefully and ask questions if anything you read is not clear or you would like more information. If you agree to take part in this study, you will be asked to sign the “Consent Form.” You will be given a copy of both the “Participant Information Sheet” and the “Consent Form” to keep.

Who am I?

I am S M Abdullah. I am a PhD researcher in the Department of Health Sciences, University of York, UK. My research primarily centres around the illicit tobacco in Low- and Middle-Income Countries in the world.

What is the purpose of this study?

Bangladesh has 22 million adult (aged 15 and above) smokeless tobacco users (GATS 2017). One out of 5 adults (prevalence 20.6%) use ST and over 90% of them take it daily. Owing to this high use, in 2017 across Bangladesh, at least 16947 lives and 403460 Disability-Adjusted Life Years were lost (Huque et. al., 2021). Bangladesh although a signatory of the WHO Framework Convention on Tobacco Control (FCTC), tobacco control law is weakly implemented for smokeless tobacco than smoking tobacco. Accordingly, the prevalence of non-compliance and hence potentially illicit smokeless tobacco products in the market was found to be above 90% (Abdullah et. al, 2022). In contrast, the percentage of illicit smoking tobacco was found to be only 5.6% (Abdullah et. al, 2023). Despite its widespread use and high disease burden little information is available regarding the monitoring and market regulation to curb illicit smokeless tobacco. Thus, this research intends to explore stakeholders’ perspectives on barriers and facilitators to improve regulation and monitoring for controlling illicit smokeless tobacco in Bangladesh.

Who is doing the study?

I, S M Abdullah, am doing this research. I am from Bangladesh and affiliated as a faculty in the Department of Economics, University of Dhaka, Bangladesh.

Currently, I am pursuing my PhD in health sciences at the Department of Health Sciences in the University of York, UK. This research is conducted as a part of the PhD research with the title “Illicit Trade of Tobacco: Experience of Low- and Middle-Income Countries, Extent for Bangladesh and Ways to Improve

Regulation”. This research is supervised by Professor Dr. Kamran Siddiqi (University of York, UK), Professor Dr. Mona Kanaan (University of York, UK), and Professor Dr. Rumana Huque (University of Dhaka, Bangladesh). My PhD research is funded by the University of Dhaka, Bangladesh through the “Bangabandhu Overseas Scholarship Program 2021-2022”.

Why have I been asked to participate?

We are talking to people, who are engaged in tobacco control activities, to understand the barriers and facilitators for improving the monitoring and regulation in the tobacco market to control illicit smokeless tobacco in Bangladesh. We have asked you to participate as you are a stakeholder and have wide experience of working in tobacco control in Bangladesh. Your understanding about the illicit smokeless tobacco in Bangladesh will help to picture the reality and advocate policy movement through informed research.

Do I have to take part?

No, you do not have to take part. Participating in the study is entirely voluntary. However, if you decide to take part, we will ask you to sign a consent form. If you participate in the interview virtually, we will record your consent verbally. You are free to withdraw from the study at any time during or even after the study, up to two weeks, and your information will be deleted.

What will be involved if I take part in this study?

We will ask you to answer a few questions about the illicit smokeless tobacco and its nature in Bangladesh, monitoring and regulation (implementation of tobacco control law) in smokeless tobacco market, and barriers and facilitators to improve monitoring and regulation to control illicit smokeless tobacco in Bangladesh. The interview should take no longer than an hour. We will interview at your convenient place and schedule. The opinions you will be sharing will be used solely in research purpose and complete anonymity will be maintained in all stages of the research. We do not anticipate any potential risk of participating in this research.

What are the advantages or benefits/disadvantages or risks of taking part?

Taking part in this study would neither directly harm nor benefit you. We do not anticipate any additional risks in participating in this study except costing some of your time (see above). However, your cooperation will help us to better understand the barriers and facilitators to improve monitoring and regulation in the smokeless tobacco market to control illicit in Bangladesh.

Can I withdraw from the study at any time?

You can withdraw from the study at any time you wish and you do not have to give a reason for withdrawing. There are no consequences due to your withdrawal. However, if you participate in the study for two weeks or longer, your data will be included in the analysis, making it impossible to withdraw your data from the study after that point.

How will the information and personal data I give be handled?

Everything that you tell us is confidential information. This means that we will not share this with anyone outside the research team. Your name and details will be kept separate from any information that you give us. This is to avoid any other person accidentally finding your details on the information that you provide. The information you provide will be stored on a password-

protected and encrypted laptop or (if on paper) inside a locked cabinet. We will then securely transfer and store the information you provide onto a secure and password-protected computer at the University of York, UK. We will keep the information for ten years and then destroy it according to the University of York's policy. All your personal data (including audio recordings) will be handled in accordance with the General Data Protection Regulation (GDPR) and the UK's Data Protection Act 2018. A description of GDPR can be found at the following website: <https://www.york.ac.uk/records-management/dp/>

What will happen to the results of the study?

The results will be used to better understand the barriers and facilitators to improve monitoring and regulation in the smokeless tobacco market to control illicit in Bangladesh. Besides fulfillment of PhD research, the findings will help advocate the future tobacco control policy movement. The results will also be published in an academic journal. You will not be identified or identifiable in any publications.

Who has reviewed and approved this study?

This PhD research has been reviewed and approved in the UK by the University of York's Health Sciences Research Governance Committee (HSRGC).

Who do I contact for more information about the study or If I have a complaint?

If you need further information about the study at any stage or have any complaint, you can contact:

Investigator:

S M Abdullah

PhD Researcher, Department of Health Sciences, University of York, UK

&

Associate Professor (On Study Leave), Department of Economics, University of Dhaka, Bangladesh

Email: abdullah.abdullah@york.ac.uk, +8801711076597

Supervisors:

Professor Dr. Kamran Siddiqi

Department of Health Sciences, University of York, UK

Email: kamran.siddiqi@york.ac.uk

Professor Dr. Mona Kanaan

Department of Health Sciences, University of York, UK

Email: mona.kanaan@york.ac.uk

Professor Dr. Rumana Huque

Department of Economics, University of Dhaka, Bangladesh

Email: rumanah14@yahoo.com

Thank you for taking the time to read this information sheet.

Participant consent form



Improving the regulation and monitoring to control the illicit smokeless tobacco in Bangladesh: a qualitative study

Participant Consent Form

	Please confirm agreement to the statements by putting a Tick Mark (✓) in the boxes below
I have read and understood the participant information sheet [date ..., version ...]	
I have had the opportunity to ask questions and discuss this study	
I have received satisfactory answers to all of my questions	
I have received enough information about the study	
I understand my participation in the study is voluntary and that I am free to withdraw from the study: - 1. Up to two weeks post interview 2. Without having to give a reason for withdrawing 3. I understand that the data already provided will still be used in the study despite withdrawal from the study unless I tell the research team not to use the data.	
I understand that my interview will be audio-recorded	
I understand that any information I provide, including personal data, will be kept confidential, stored securely and only accessed by those carrying out the study	
I understand that any information I give may be included in published documents but all information will be anonymised	
I agree to take part in this study	
Participant Signature	Date:
Name of Participant	
Researcher Signature	Date:
Name of Researcher	

In-depth interview guide

Study title

Improving the regulation and monitoring to control the illicit smokeless tobacco in Bangladesh: a qualitative study

Interviewee ID: _____
Date: _____
Researcher: _____
Gender of interviewee: _____
Age of interviewee: _____
Education of interviewee: _____
Stakeholder role of interviewee: _____
Years of experience as a tobacco control stakeholder: _____
Country: _____
Duration of interview: _____

Guide for in-depth interviews with tobacco control stakeholders

Welcome and thank you for making time for this interview.

Purpose and format of the Interview:

My name is S M Abdullah and I am a faculty member at the University of Dhaka, Bangladesh and a PhD researcher at the Department of Health Sciences, University of York, UK. My PhD is funded by the University of Dhaka, Bangladesh through the “Bangabandhu Overseas Scholarship Program 2021-22”. This study is part of my PhD titled as “Illicit trade of tobacco: experience of low and middle-income countries, extent for Bangladesh and ways to improve regulation”. The objective of this particular study is to explore the views of tobacco control stakeholders on illicit smokeless tobacco (ST) in Bangladesh on improving compliance with regulations to control illicit ST.

I would like to ask you some questions about your engagement with tobacco control in Bangladesh and your views on regulation and monitoring related to illicit ST products. In Bangladesh, affixing tax stamps in packs is not obligatory for ST. Accordingly, for the domestically produced ST we conceived the concept of “illicit” through the lens of “packaging non-compliance”. I am appreciative of you giving me time and would request as thorough responses as possible. This interview will be audio recorded so that I can concentrate fully on your responses and I will use this recording to make a transcript of the interview afterwards. If you wish to stop the interview at any time, let me know and I will stop.

Background

I would like to start with some general questions about you and your engagement with tobacco control:

[this is meant as an icebreaker, so don't spend too much time on these questions]

- Could you please give me your name, age, and affiliation?
- Can you tell me something about your engagement with tobacco control in Bangladesh?
- When and why did you get involved with the tobacco control activities?

Domain 1: Awareness about non-compliance and illicit ST in Bangladesh

We have looked at the compliance of ST and illicit cigarette markets in Bangladesh. Illicit cigarettes are 5.6% and non-compliance is only 0.8% in cigarettes. In contrast, compliance in ST is very poor (around 90% are non-compliant). We want to understand the reasons behind it and ways to address it. I would like to ask some questions about your perception and awareness related to non-compliance of ST and its nature in Bangladesh:

- Are you aware of the non-compliance of ST in Bangladesh?
[Probe on the share. Enquire about his/her perception of the extent of non-compliance you have found (90%). Do they think the share is such high or do they have a different perception?]
- To what extent do you think colleagues (other tobacco control stakeholders) are generally aware of the non-compliance of ST?
- How do you evaluate the awareness in this regard among policymakers?
- Do you perceive controlling non-compliance of ST is a priority?
[Probe on the reasoning of his/her opinion – why or why not they perceive it as a priority?]

Domain 2: Specific packaging non-compliances [related to health warning labels, price and sale statement disclosure, misleading descriptors and visible tax marker], policies and enforcement

At this stage, I am going to pick up some of the compliance issues that we have observed in ST market and would like to ask some questions and request your opinions.

Compliance Issue-Health Warning Labels: The first issue I would like to mention is related to health warning labels. In cigarette packs non-compliance with textual health warning (THW) and pictorial health warning (PHW) is only 0.3% and 0.5% respectively. In contrast that in ST 30.1% (THW) and 84.4% (PHW). Thus, compliance in ST is extremely poor in Bangladesh.

- Is this what you are expecting? What is your perspective on this?

[If the answer is “yes” then probe on the reasons behind this poor compliance, why ST manufacturers are not willing to comply with THW and PHW laws, and why are we failing to get the ST manufacturers to comply with the THW and PHW laws, while we were successful in doing so in smoking tobacco?]

- What do you think might help, and what do you think might overcome this problem?

[Note: If the answer is superficial (such as mentioning that the industry doesn’t want to put the warning, I don’t know the reason, then probe to get the participant’s perspectives. Mention that you understand that he/she might not know the exact reason, but given that they are policymakers/tobacco control advocates/researchers, you want to understand their perceptions, what might be the reasons? What do they think is going on here? What is their perspective on this issue? It could be that the participants differ from what the research has found. We need to understand the reasons behind these perceptions.]

Compliance Issue-Price and Sale Statement Disclosure: Although by law it is obligatory to print price and sale statements on ST packs, around 57% of ST packs are non-compliant with price disclosure and a whopping 73% are non-compliant with sale statement disclosure. Conversely, for cigarettes, these non-compliances were only 0.3% and 0.5% respectively.

- Is this what you are expecting? What is your perspective on this?
- What do you think might help, and what do you think might overcome this problem?

[Probe following the structure mentioned in the section Compliance Issue-Health Warning Labels]

Compliance Issue-Printing Misleading Descriptors: Another non-compliance issue is related to the printing of misleading descriptors (culturally specific references or words indicating flavour and/or strength or health claim). Although prohibitive by law, around 61% of ST packs in Bangladesh contain misleading descriptors.

- Is this what you are expecting? What is your perspective on this?
- What do you think might help, and what do you think might overcome this problem?

[Probe following the structure mentioned in the section Compliance Issue-Health Warning Labels]

Compliance Issue-Affixing Tax Marker: Considering the current law ST packs are not obliged to carry any explicit marker (tax stamp/excise sticker) as proof of their tax payment status. Accordingly, it’s hard to determine the tax evasion status of domestically produced ST products.

- Why are we failing to implement explicit fiscal markers for ST products?

- For cigarettes, the government has mechanisms e.g. tax stamps. Do you think that could be applied to ST too?

[If they say “no”, then prob them asking why not. If they say “yes” that could work here, probe, then why are we not doing it?]

Now, I would like to ask you some questions on policies and enforcement in the ST market and request your opinions.

- How comprehensive is the current tobacco control law in Bangladesh for ST?
- What are your views on the law enforcement for ST in Bangladesh?

[Probe: Is the tobacco control law implemented comprehensively for ST in Bangladesh? How good is the current regulation from the perspective of controlling non-compliance ST? To what extent the ST market is regulated for controlling non-compliance products in Bangladesh?]

- What approaches and means are used by the government for regulation and monitoring to control non-compliant ST?

[Probe: Evaluate the approaches and means used by the government]

- What do you see as the main barriers in countering the non-compliant ST in Bangladesh?

[Probe: Physical strength of National Tobacco Control Cell (NTCC), Low awareness related to tobacco control law in the other government departments (e.g. trade, agriculture, border control, food and quality control), Inadequate collaboration among the relevant government departments, Diverse packaging of ST products, Absence of fiscal market on ST products, Weak enforcement of tobacco control law for ST]

- To you what are the barriers to improving the regulation and monitoring to control non-compliant ST?

Domain 3: Supply chain control and international collaboration to curb non-compliance and illicit ST in Bangladesh

I would like to ask some questions and request your opinions about improving the tobacco control law for ST and what needs to be done to operationalize those to regulate non-compliant ST in Bangladesh:

- What potential policy amendments need to be in place to have better regulation to control the non-compliant ST?

[Probe: Is there any specific licensing required by the ST supply chain actors (manufacturers, distributors, wholesalers, retailers)? Does record keeping for supply chain actors need to be there? Does tracking and tracing of ST products need to be implemented?]

- Are you aware of any specific measures taken by the government to limit illicit ST? In terms of better implementation of regulations, what do you think might help?

[Probe: Inspection through “mobile court”. If yes then how frequent and what is the coverage.]

- To you how to improve international collaboration and monitoring and regulation to control illicit ST?

Note: Get feedback on the key points, clarify anything you are unsure of, and ask if there are any other points the interviewee would like to raise.

Thank you for your time today. This is the end of the interview. I will now turn off the recorder

Checklist for the interviews:

- One should go by the appointment given by the specific stakeholder.
- Interview outline guide should have space at the end of each section to expand notes so that nothing should be missed.
- Carry a voice recorder and a diary to note.
- Carry all documents for stakeholders like the demographic form, participant information sheet, and consent form along with the interview guide.

Ethics decision letter



DEPARTMENT OF HEALTH SCIENCES

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Prof Stephen Holland
Chair, Health Sciences Research
Governance Committee

www.york.ac.uk/healthsciences

19 July 2024

Mr S M Abdullah
University of York
Department of Health Sciences
Heslington
York
YO10 5DD

Dear Abdullah

HSRGC/2024/636/E: Regulation and monitoring of illicit smokeless tobacco

Thank you for submitting your project to the Health Sciences' Research Governance Committee. The committee considered the application at its meeting on 15 July 2024.

I am pleased to confirm that the project was approved by the committee, conditional on taking up the following feedback with your supervisors.

1. S6 of the Submission Form (SF) states that the project does not need to be approved by an in-country committee. Please double check that this is the case. If in-country ethical review is required, bear in mind that HSRGC approval is conditional on in-country approval.
2. It wasn't clear from the submission how many interviews you plan to conduct so please discuss this with your supervisors to ensure the number of interviews is appropriate to meet the research objectives.
3. Some participants will be recruited from "tobacco control stakeholder mapping" developed during the implementation of ASTRA and TCCP'. It wasn't clear whether these individual had given their consent to be recontacted about further studies. The committee appreciated that these are professionals who can decide whether to participate in your study, but pointed out that it is good practice to recontact participants in a previous study only if they have consented to this.
4. Changes to the Information Sheet (IS)
 - (i) Under 'What will be involved if I take part in this study?': (i) include the options of conducting the interviews in-person or on zoom, (ii) clarify that

zoom interviews would be recorded, and (iii) change the phrase, 'complete anonymity will be maintained' to 'confidentiality will be maintained' (the data is pseudonymised not anonymous).

- (ii) Under 'How will the information and personal data I give be handled?' after 'A description of GDPR can be found at the following website: <https://www.york.ac.uk/records-management/dp/>' add: 'The University of York's Privacy Notice for Research Participants can be found at the following website: Privacy notice - Research Participants'. Also in this section, state when Zoom recordings will be deleted.
 - (iii) Under 'Who do I contact for more information about the study or If I have a complaint?' clearly separate out contact details for (i) more information (i.e., yourself), (ii) general complaints (your supervisors), and (iii) complaints specifically about data processing (York's data protection officer and, if the participant is unsatisfied, the Information Commissioner's Office ICO).
5. On the CF, agreement to the statements is confirmed by 'putting a Tick Mark (✓) in the boxes'. The committee pointed out that it is best practice to ask for initials not ticks.
 6. The right to withdraw from the study is mentioned on the IS under 'Do I have to take part?' and 'Can I withdraw from the study at any time?', and in the fifth box of the CF. All these need to be rewritten to clarify the right to withdraw. In particular, you need to distinguish: (i) participants can withdraw from the study at any time, without giving a reason, and with no repercussions; (ii) participants can request that their data is destroyed up to two weeks after the interview. This needs to be clearly and consistently stated on both the IS and CF.
 7. The submission indicates that data will be stored on 'my personal offline laptop'. The committee requires that data is stored on the university storage facility and not a personal laptop. Likewise, the submission states data will be stored in 'My personal file store within the university's centrally managed network' but data cannot be retained in a personal area for 10 years, so you need to create a specific research folder to store the data for that length of time.
 8. Please send us the interview schedule when you have it for our records.

If you have any queries regarding the decision, or make any substantial amendments to the study, please contact me. Finally, if you intend to include this decision letter in any assessed work that will be anonymously marked, please ensure that your name is not disclosed.

Yours sincerely



Stephen Holland

Chair: HSRGC

cc: Prof Kamran Siddiqi, Prof Mona Kanaan, Prof Rumana Huque

Chapter 9-Supplementary tables

Table S23: Tobacco control stakeholders in Bangladesh

Stakeholder Groups and Organizations	Designation	Major focus of tobacco control	Website
1. Policymakers			
National Tobacco Control Cell (NTCC), Ministry of Health and Family Welfare	Director/Program Officer	Tobacco Control	www.ntcc.gov.bd
Health Economics Unit, Ministry of Health and Family Welfare	Director/Program Officer	Tobacco Control Research	www.heu.gov.bd
National Institute of Cancer Research and Hospital	Director/Faculties	Tobacco Control Research and Education	www.nicrh.gov.bd
NCDC, Ministry of Health and Family Welfare	Line Director/Deputy Project Manager	Tobacco Control Research	www.dghs.portal.gov.bd
National Board of Revenue (NBR), Ministry of Finance	Commissioner/Director	Tobacco Tax	www.nbr.gov.bd
2. Researchers			
Bureau of Economic Research, University of Dhaka	Researcher/Faculties	Economics of tobacco and tobacco taxation	www.berdu.ac.bd
Tobacco Control Research Cell, Dhaka International University	Researcher/Faculties	Tobacco Packaging and Tobacco Control Law	www.tcrediu.org
BRAC Institute of Governance and Development	Researcher/Faculties	Economics of tobacco and tobacco taxation	www.bigd.bracu.ac.bd
State University of Bangladesh	Researcher/Faculties	Tobacco and Public Health	www.sub.ac.bd
3. NGOs			
NATAB	Director/Researcher/Project Coordinator	Tobacco control law and policy advocacy	www.natabbd.org
ARK Foundation	Researcher/Project Coordinator	Tobacco Control Research	www.arkfoundationbd.org
National Heart Foundation Hospital & Research Institute	Researcher/Advocacy Officer/Program Manager	Tobacco Control Research and Education	www.nhf.org.bd
Campaign for Tobacco Free Kids (CTFK)	Consultant/Grant Manager	Tobacco tax	www.tobaccofreekids.org
Work for Better Bangladesh Trust	Executive Director/Program Manager/Project Officer	Advocacy on industry interference, Tobacco Tax	www.wbbtrust.org
PROGGA	Executive Director/Project Coordinator	Industry interference, tax advocacy	www.progga.org
Bangladesh Center for Communication Programs (BCCP)	Executive Director/Program Manager/Project Officer	Capacity development in tobacco control research	www.bangladesh-ccp.org

Stakeholder Groups and Organizations	Designation	Major focus of tobacco control	Website
UBINIG	Executive Director/Program Manager/Project Officer	Smokeless tobacco control	www.ubinig.org
AID Foundation	Executive Director/Program Officer	Tobacco Control Advocacy	www.aid-bd.org
Bangladesh Cancer Society	Secretary General/Project Director	Tobacco control and Tobacco related illness research	
Prottasha Madok birodhi Shongothon	Organizing Secretary	Tobacco Control Advocacy	
Dhaka Ahsania Mission	Executive Director/Program Officer	Tobacco Control Advocacy	www.ahsaniamission.org.bd
MANAS Bangladesh	Executive Director/Organizing Secretary	Tobacco Control Research and Advocacy	www.manasbangladesh.org
SUPRO	Project Coordinator	Tobacco Control Advocacy	www.supro.org
Unnayan Shomonnoy	Executive Director/Researcher/Program Officer	Tobacco Control Research and Advocacy	www.unsy.org
4. International Agencies			
American Cancer Society, Inc.	Director, Economic and Health Policy Research	Economics of tobacco and tobacco taxation	www.cancer.org
World Health Organisation	National Professional Officer (NCD)	Economics of tobacco and tobacco taxation	www.who.int/bangladesh
The UNION	Technical Advisor	Tobacco control law and policy advocacy	www.theunion.org
Vital Strategies	Country Manager/Head of Programs	Tobacco control law and policy advocacy	www.vitalstrategies.org
5. Advocacy Networks			
Bangladesh Anti Tobacco Alliance	Focal person	Tobacco Control Advocacy	www.bata.net.bd
Bangladesh Network for Tobacco Tax Policy		Tobacco Tax Advocacy	www.bnttp.net
Tamak Birodhi Nari Jote		Tobacco Control Advocacy, Women's Alliance	www.ubinig.org
Anti Tobacco Media Alliance (ATMA)		Media coverage and Advocacy on Tobacco Control Issues	
Health Reporters Forum		Health Related News and Information Dissemination	

Table S24: Demographic information of the participants

Coding ID	Organization	Designation of Participants	Gender	Age	Highest Educational Attainment	Tobacco Control Engagement Experience	Interview Duration	Date
1. Policymakers								
PM_01	Advisor to the Interim Government	Advisor	Female	71	Postgraduate	18	31	02-Sep-24
PM_02	National Tobacco Control Cell (NTCC), Ministry of Health and Family Welfare	Program Officer	Male	43	Postgraduate	6	44	15-Aug-24
PM_03	National Board of Revenue (NBR), Ministry of Finance	Ex - Chairman	Male	72	PhD	12	50	18-Aug-24
PM_04		Joint Commissioner	Male	42	Postgraduate	7	41	13-Sep-24
PM_05	Member of Parliament	Ex Member of Parliament	Male	42	Postgraduate	15	26	01-Aug-24
2. Researchers								
RE_01	Bureau of Economic Research, University of Dhaka	Program Manager	Male	47	Postgraduate	21	68	28-Jul-24
RE_02	Tobacco Control Research Cell, Dhaka International University	Member Secretary	Male	46	Postgraduate	14	59	27-Jul-24
3. NGOs								
NGO_01	Campaign for Tobacco Free Kids (CTFK)	Program Manager	Male	49	Postgraduate	15	39	29-Aug-24
NGO_02	Work for Better Bangladesh Trust	Program Manager	Female	45	Postgraduate	20	64	29-Jul-24
NGO_03	Bangladesh Cancer Society	President	Male	72	Postgraduate	24	28	31-Aug-24
NGO_04	Dhaka Ahsania Mission	Director	Male	57	Postgraduate	26	57	14-Aug-24
NGO_05	Unnayan Shomonnoy	Research Director	Male	37	Postgraduate	10	64	31-Jul-24
4. International Agencies								
IA_01	World Health Organisation	National Professional Officer	Male	65	Postgraduate	21	41	14-Aug-24
IA_02	The Union	Technical Advisor	Male	54	Postgraduate	25	57	27-Jul-24
IA_02	Vital Strategies	Program Coordinator	Male	45	Postgraduate	25	54	29-Jul-24
5. Advocacy Networks								
AN_01	Bangladesh Anti Tobacco Alliance	Coordinator	Male	64	Postgraduate	27	82	13-Aug-24
AN_02	Bangladesh Network for Tobacco Tax Policy	Project Officer	Male	34	Graduate	6	48	28-Jul-24
AN_03	Bangladesh Tobacco Control Research Network	General Secretary	Male	50	Postgraduate	14	49	20-Aug-24

Coding ID	Organization	Designation of Participants	Gender	Age	Highest Educational Attainment	Tobacco Control Engagement Experience	Interview Duration	Date
AN_04	Health Reporters Forum	Reporter, Electronic Media	Male	44	Postgraduate	14	74	28-Jul-24
AN_05		Reporter, Print Media	Male	35	Graduate	8	48	12-Aug-24

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