Limited Regulatory Oversight of Tobacco Retailers in an Already Disadvantaged Community: Lessons from Regional Victoria

Submitted by

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Contents

Abstract

Regional and rural areas of Victoria have higher smoking rates and lower socioeconomic status (SES), however little is known about tobacco availability and its relationship to smoking behaviour in these areas.

A cross-sectional study investigated the proportion of retailers that sell tobacco without appropriate government oversight, and described the characteristics by which they differ from those that are likely to receive inspections. Of 125 confirmed tobacco retailers, 43.2% (n=54) were trading potentially without oversight. Differences were found between listed and unlisted retailers by business and sales type, but not by other characteristics. It is difficult to identify the number of retailers operating or to determine how many receive formal oversight in the absence of a tobacco retailer licensing system.

A systematic review investigated how tobacco retailer density ('density') and smoking behaviour are measured in the literature. Density was commonly measured directly from geocoded locations and most studies captured past-month smoking.

The findings from Studies 1 and 2 informed the design of Study 3, a cross-sectional study which analysed associations between density and smoking behaviours in regional Victoria. After adjusting for possible confounders including individual and suburb-level SES, living in suburbs with greater density increased the odds of occasional smoking but not daily or experimental smoking.

A third cross-sectional study used National Drug Strategy Household Survey data to examine support for a national tobacco retailer licensing system over time and by socio-demographic characteristics. In 2016, respondents from the lowest SES areas (63.2%), those living in regional (66.2%) and remote areas (61.2%), and 60.9% of Victorians indicated support for such a system.

Together, these findings support calls for the introduction of a comprehensive tobacco retailer licensing system in Victoria to facilitate compliance with existing tobacco sales legislation and to move towards better regulation of the availability of tobacco products in Victorian communities.

Statement of Authorship

Except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis accepted for the award of any other degree or diploma. No other person's work has been used without due acknowledgement in the main text of the thesis. This thesis has not been submitted for the award of any degree or diploma in any other tertiary institution.

John Baker
Date: 9th July 2021

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List of publications, conference presentations and other presentations from this thesis

Publications

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Chapter 6:

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Chapter 7:

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Conference presentations

Baker J, Begg S, Masood M, Rahman MA, Thornton L. 'Understanding the relationships between retail tobacco availability and smoking behaviour to improve public health in Australia.' *La Trobe Rural Health School Rural Health Conference*, 2020.

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Baker J, Begg S, Masood M, Rahman MA, 'Density and Proximity of Tobacco Retailers and Smoking: A Systematic Review.' *Oceania Tobacco Control Conference*, 2019.

Other Presentations

Guest presenter at City of Greater Bendigo's Healthy Systems Network Virtual Forum (June 2021). 'Implications of failing to regulate the retail availability of tobacco: lessons from Regional Victoria.'

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Guest lecturer at La Trobe University Applied Health Research (PHE2AHR) subject (September 2019). 'Levels of support for the licensing of tobacco retailers in Australia: Findings from the National Drug Strategy Household Survey 2004-2016.'

Contributions to Jointly-authored work

The following table describes contributions to jointly-authored work that has been published (Chapter 4, Chapter 6 and Chapter 7) or will be re-submitted for publication (Chapter 5).

Chapter 4 Identifying tobacco retailers in the absence of a licensing system: lessons from Australia				
Author	Contribution to conception or design	Contributed to acquisition, analysis, or interpretation	Drafted the manuscript	Critically revised the manuscript
John Baker	30%	30%	60%	60%
Stephen Begg	30%	30%	20%	20%
Mohd Masood	20%	10%	10%	10%
Muhammad Aziz Rahman	10%	10%	5%	5%
Lukar Thornton	10%	20%	5%	5%
Chapter 5 Tobacco retailer density and smoking behaviour: how are exposure and outcome measures classified in the existing literature? A Systematic Review				
John Baker	35%	30%	60%	30%
Stephen Begg	35%	30%	30%	30%
Mohd Masood	20%	20%	5%	20%
Muhammad Aziz Rahman	10%	20%	5%	20%
Chapter 6 Tobacco retailer density and smoking behaviour in a rural Australian jurisdiction without a tobacco retailer licensing system				
John Baker	30%	30%	60%	60%
Stephen Begg	30%	30%	20%	20%
Mohd Masood	20%	10%	10%	10%
Muhammad Aziz Rahman	10%	10%	5%	5%

Lukar Thornton	10%	20%	5%	5%
Chapter 7 Levels of support for the licensing of tobacco retailers in Australia: Findings from the 2004-2016 National Drug Strategy Household Survey				
John Baker	35%	60%	60%	60%
Stephen Begg	35%	25%	25%	25%
Mohd Masood	20%	10%	10%	10%
Muhammad Aziz Rahman	10%	5%	5%	5%

Ethical approval

This work was approved by the La Trobe University Human Ethics Committee.

Chapter 4: La Trobe University Human Ethics Committee (Appendix A).

Chapter 6: La Trobe University Human Ethics Committee (Appendix A).

Chapter 7: La Trobe University Human Ethics Sub-Committee (Appendix B).

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Glossary of abbreviated terminology

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
ADA	Australian Data Archive
AIHW	Australian Institute of Health and Welfare
ALC	Active Living Census
ARIA+	Accessibility and Remoteness Index of Australia
ASGS	Australian Statistical Geography Standard
ATSI	Aboriginal and Torres Strait Islander
CATI	Computer-Assisted Telephone Interview
CI	Confidence Interval
E-cigarette	Electronic cigarette
EHO	Environmental Health Officer
FOI	Freedom of Information
GPS	Global Positioning System
HEC	Human Ethics Committee
ICC	Intraclass Correlations
IRSD	Index of Relative Socio-Economic Disadvantage
KDE	Kernel Density Estimates
Km	Kilometres
Km^2	Square-kilometres
LGA	Local Government Area
LTU	La Trobe University

NDSHS	National Drug Strategy Household Survey
NLHBI	National Heart, Lung and Blood Institute
NSW	New South Wales
NT	Northern Territory
OR	Odds Ratio
OTCC	Oceania Tobacco Control Conference
PoS	Point-of-Sale
PROSPERO	International Prospective Register of Systematic Reviews
QLD	Queensland
RTP	Research Training Program
SA	South Australia
SA1	Statistical Area One
SD	Standard Deviation
SEIFA	Socio-Economic Index for Areas
SES	Socio-Economic Status
SLA	Statistical Local Area
TAS	Tasmania
UGCoP	Uncertain Geographic Context Problem
UK	United Kingdom
US	United States of America
WA	Western Australia
WHO	World Health Organization
WHO FCTC	World Health Organization's Framework Convention on Tobacco Control
VIC	Victoria

$A	Australian Dollars

Chapter 1 Introduction

In this thesis I explore retail availability of tobacco and smoking behaviour in a regional setting of Australia. Australia has made significant progress in relation to tobacco control in recent years and now has one of the lowest smoking rates amongst countries in the Organisation for Economic Co-operation and Development.[1] Despite this, smoking rates remain high amongst some population groups, with those living outside of metropolitan areas and those from socioeconomically disadvantaged groups much more likely to smoke.[2]

These patterns are reflected in the most recent burden of disease analysis for Australia, which shows a strong socioeconomic gradient to smoking-related harm, with tobacco use contributing 11.7% to the total burden of disease in the most disadvantaged areas compared to only 6.5% in the least disadvantaged areas.[3] Generally in Australia, increasing remoteness is associated with decreasing socioeconomic status.[2] As a result, there is also an unequal distribution of tobacco harms across rurality, with tobacco use being responsible for 10.7% of the total burden of disease in remote and very remote areas of Australia compared to only 8.5% in major cities in 2015.[3]

Setting for this thesis

The setting for much of the research presented in this thesis is a regional local government municipality in the South-eastern state of Victoria. As is the case in other regional and rural municipalities, this municipality has higher smoking rates than metropolitan municipalities.[4] Research from other states of Australia would suggest that it also has greater retail tobacco availability.[5-7] However, the true extent of tobacco availability in this municipality or indeed most municipalities of Victoria is unknown as there is limited regulatory oversight of tobacco retailers and few limits on the types of businesses that are able to sell tobacco.[8, 9] This makes it difficult to say exactly how many tobacco retailers are operating or to examine how the relationship between retail availability of tobacco and smoking might vary across the state. Only one study[10] has assessed retail tobacco availability and its association with smoking behaviour in this state, but this was conducted in a metropolitan setting.

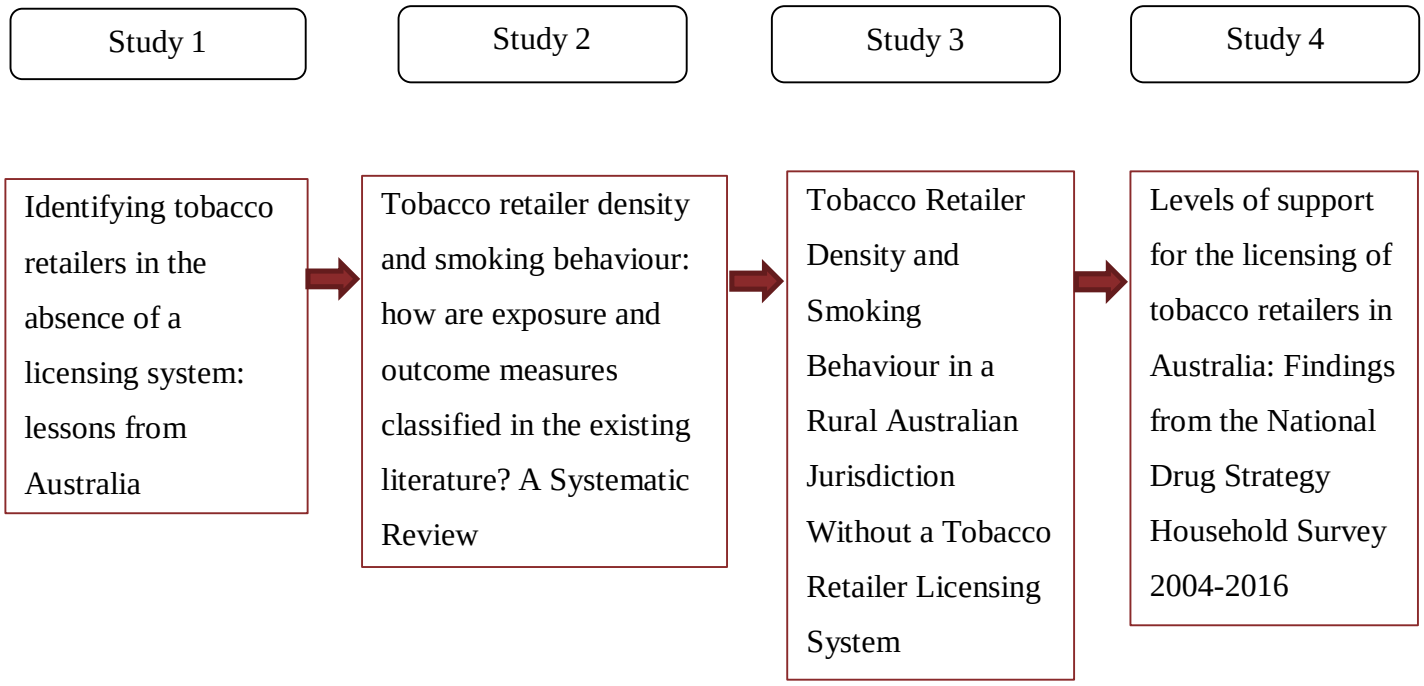
The particular municipality that is the focus of this thesis will be referred to throughout as 'Local Government X' as it requested not to be identified due to potential reputational and funding concerns. A number of practical considerations led to my focus on Local

Government X for data collection purposes, including limited time and resources, regional and rural municipalities are typically much larger in area than metropolitan municipalities, I had several connections within Local Government X, and I knew the municipality well enough to confidently undertake the necessary field work.

Thesis purpose and structure

My overarching purpose in this thesis was to explore what happens when there is limited regulatory oversight of tobacco retailers in an already disadvantaged community. My research comprised of four discrete studies, each of which adopts a different perspective on this central question. The overall structure of the thesis reflects this approach, as depicted in Figure 1.1.

Figure 1. 1 Thesis structure



Thesis aims

Each study was self-contained but was related to the other studies, as summarised below.

Study 1 (Chapter 4) was a cross-sectional study that attempted to identify all tobacco retailers operating in Local Government X. The aims of this study were to:

- Estimate the proportion of retailers that sell tobacco in the absence of appropriate local government oversight;

- Describe the characteristics by which they differ from those that can expect to receive such oversight, and;
- Explore differences in numbers of listed and unlisted retailers by several business and neighbourhood-level characteristics.

Study 2 (Chapter 5) was a systematic review to investigate methodological approaches used in the existing literature to measure tobacco retailer density and smoking behaviour. The aims of this study were to:

- Summarise different approaches to measuring tobacco retailer density and smoking behaviour, and;
- Describe how the type of measurements used may explain what we know about the relationship between tobacco retailer density and smoking behaviour.

The findings from Studies 1 and 2 informed the design of Study 3 (Chapter 6), which examined tobacco retailer density and different types of smoking behaviour in Local Government X. The aim of this cross-sectional study was:

- To determine associations between tobacco retailer density and smoking behaviours in a regional Victorian Local Government Area without a tobacco retailer licensing system in place.

Finally, Study 4 (Chapter 7) provided context to the previous studies by describing the regulation of retail tobacco availability across Australian jurisdictions and how public support for a tobacco retailer licensing system varies by a range of factors. The aims of this study were to:

- Describe the implementation of tobacco retailer licensing systems by state and territory governments in Australia, and;
- Use the National Drug Strategy Household Survey (NDSHS) to assess levels of public support for a retailer licensing system in each jurisdiction over time and by a range of socio-demographic and behavioural attributes.

The work that appears in Chapters 4, 6 and 7 has been externally peer reviewed and is available in the published literature. In accordance with La Trobe University's thesis presentation policy, this work is included as it appeared in print and has not been modified. A summary of the Australian and Victorian tobacco control landscape and additional

information relating to ethical considerations and data collection matters are included in Chapters 2 and 3, respectively.

Motivations for this research

I have had a passion for smoking prevention since I was 16 years of age, when I witnessed my grandfather suffering from a number of tobacco-related illnesses which he ultimately passed away from. My father had always discouraged my younger brother and me from smoking, and he would often leave newspaper clippings about tobacco industry behaviour at the dining table, in front of the computer, or at our bedroom doors.

This passion led me to study a Bachelor of Public Health at La Trobe University Bendigo, which is a regional Victorian campus. I worked as an Integrated Health Promotion Officer at Frankston/Mornington Peninsula Primary Care Partnership from July 2015 until June 2016, which is where I found an interest in the topic of retail tobacco availability in Victoria. The two municipalities of Frankston and Mornington shared smoking prevention and cessation amongst youth and young people as a priority health issue. I had undertaken a literature search to identify unique and engaging strategies for youth smoking prevention. Several studies focused on assessing the associations between retail tobacco availability and smoking behaviour, particularly amongst youth. I also came across a Quit Victoria report advocating for further regulation of tobacco retailers. I had assumed that strong regulations were already in place for tobacco retailers in this state.

My role at the Primary Care Partnership was coming to an end and I was going to undertake postgraduate studies back at La Trobe University Bendigo. I decided to research what happens when there is limited regulatory oversight of tobacco retailers in an already disadvantaged community of regional Victoria.

Chapter 2 Background

Preface to chapter

This chapter will provide further context on the Australian and Victorian tobacco control landscape. It will briefly describe Australia's obligations under the World Health Organization's Framework Convention on Tobacco Control, as well as Victoria's existing arrangements for monitoring and enforcing retail tobacco sales legislation both across the state and within local governments.

Australia's commitment to tobacco control

To better understand the basis of many contemporary tobacco control measures to prevent and reduce tobacco use in Australia, it is important to provide a brief description of Australia's commitment to the World Health Organization's Framework Convention on Tobacco Control (WHO FCTC), which Australia signed on to in 2003.[11]

The WHO FCTC assists governments to respond to the tobacco epidemic by providing tobacco control policy guidelines that prioritise public health and improve cooperation between countries in relation to tobacco control measures.[12] Beginning in the 1970s, both the Federal and State and Territory Governments have historically been global leaders in tobacco control, with a large number of policies implemented.[13] Since signing on to the WHO FCTC, Australia has implemented or enhanced a number of policies to prevent and reduce tobacco use.[11] Some of these policies include introducing bans on tobacco advertising and sponsorship, implementing health warnings on cigarette packaging in 1973 (with Graphic Health Warnings introduced in 2006), creating smoke-free areas (such as smoke-free workplaces and public places), regular tax increases on tobacco products, Point-of-Sale (PoS) display bans for tobacco products, and becoming the first country to introduce plain packaging for all tobacco products in 2012.[13] As part of Australia's obligations under the WHO FCTC it is also encouraged to implement legislation to regulate retail tobacco availability in the community.[14]

Regulating retail tobacco availability in Australia

An increasing body of research has looked at how retail tobacco availability can influence smoking behaviour. Greater retail availability of tobacco may influence consumption by providing easier access to tobacco products,[15] marketing (i.e. advertising of brand names

through price boards in some Australian jurisdictions),[16] exposure to other smokers,[17] the presence of tobacco retailers which has been shown to initiate cravings amongst smokers,[17] and competition from other tobacco retailers which may reduce cigarette prices, thus making tobacco products more affordable.[18, 19] Research in the Australian state of New South Wales suggests that tobacco products are more widely available than everyday consumer items such as bread and milk, further contributing to the normalisation of tobacco products in Australian society.[20]

Despite Australia's commitment to the WHO FCTC and international research identifying associations between retail tobacco availability and tobacco consumption, tobacco control policies in this country have focused largely on reducing demand for tobacco products. Much less attention has been directed towards improving legislation to regulate and reduce the sale and supply of these products. Further developments in tobacco retailer regulation have been proposed as the 'final frontier' to reduce tobacco availability and consumption in the community, and evidence indicates that addressing this component of tobacco control could assist in further decreasing smoking rates.[21-23]

Many of the tobacco demand-reduction measures outlined above are national initiatives that affect demand across the country. When it comes to state-based initiatives, Victoria has fallen behind most other Australian states and territories in developing policies to monitor and regulate retail tobacco availability in the community. It is important, therefore, to understand the existing tobacco control environment in Victoria, and to identify and describe the role of those involved in the regulation of tobacco control laws in Victoria.

Victorian tobacco control oversight

The Victorian Minister for Health and the Victorian Department of Health (formerly the Department of Health and Human Services) are responsible for overseeing the implementation and regulation of the Victorian Tobacco Act *1987* (The Act).[24] The Department of Health is also responsible for policy and strategy development, funding, and the provision of public health services in the community.[25] The Department of Health delegates much of the responsibility for monitoring and enforcement of the Public Health and Wellbeing Act 2008 and the Tobacco Act 1987 to Environmental Health Officers who typically operate within each of the 79 local governments throughout the state.[26] Environmental Health Officers are responsible for monitoring and enforcing many aspects of this legislation, including for example, inspecting and registering food retailers, tattoo

parlours, acupuncturists, hairdressing and beauty salons, undertaking incident and emergency management, preventing the spread of communicable diseases, and ensuring compliance with water, land use and built environment regulations.[27]

As part of their diverse role, Environmental Health Officers are responsible for undertaking compliance checks with tobacco retailers to ensure adherence to the relevant retail tobacco sales legislation, such as compliance with PoS display bans, health warning signage, price board regulations, and laws relating to the placement and distance of tobacco vending machines.[9, 26, 28]

Since 2000, the Department of Health has provided funding for tobacco control activities to the Municipal Association of Victoria who administer and distribute these funds to local governments.[26] In 2017-18, the Municipal Association of Victoria distributed approximately $1.2 million in funding for these activities.[26] The amount of funding provided to each local government is determined by a formula developed by the Department of Health and the Municipal Association of Victoria using an hourly rate for a mid-level Environmental Health Officer. Consultations with local governments through a working group convened by the Municipal Association of Victoria comprising a cross-section of metropolitan, regional and rural municipalities inform the formula. The number of visits required to be undertaken by each local government is also dependent on the numbers of tobacco retailers in the municipality and their level of remoteness (i.e. metropolitan or regional and rural). Service agreements with each local government detail the deliverables required and the amount of funding that will be provided once reports have been submitted to the Municipal Association of Victoria. The funding allocated to each local government is used to undertake a designated number of education visits to tobacco retailers, eating and drinking establishments (e.g. cafes, restaurants, bars and pubs or hotels) and outdoor locations (e.g. parks, playgrounds, beaches) where smoking bans are in place to ensure compliance with relevant smoke-free legislation, and to respond to public complaints about breaches to smoke-free legislation or retail tobacco sales violations.[26]

Each local government can also elect to participate in the ‘Cigarette Sales to Minors’ program, which provides additional funding to conduct underage test purchasing of tobacco at retailers. It is unclear how much funding is allocated to this program, as the Municipal Association of Victoria report does not publish a figure. In 2017-18, 56 of the 79 local governments received funding to undertake this activity.[26] Environmental Health Officers

are also responsible for overseeing underage test purchasing activities, whereby minors (those aged under 18 years) are employed and trained to attempt to purchase tobacco products from tobacco retailers.[26] Environmental Health Officers are responsible for providing formal guidance to tobacco retailers in relation to adherence to retail tobacco legislation, to identify breaches to laws, and to provide verbal or written warnings to retailers who do not comply with the relevant legislation.[9, 26] The relevant retail tobacco sales laws are also outlined in a 'Tobacco Retailer Guide'[9] which is available through the Department of Health website. Businesses that continue to breach retail tobacco sales legislation can be investigated by the Department of Health, and legal proceedings may be required against tobacco retailers who have been found to consistently breach relevant legislation.[9]

Based on the number of tobacco retailers estimated to be operating in Victoria in 2015,[29] it can be inferred that only one in every three tobacco retailers (n=2,809) are visited by an Environmental Health Officer each year.[26] It could be argued, therefore, that much of the responsibility for ensuring compliance with all retail tobacco sales legislation is delegated to tobacco retailers themselves. There is little in the available literature on whether this approach in Victoria is adequate for monitoring and regulating retail tobacco availability.

Chapter 3 Methodological considerations

Preface to chapter

This chapter will provide a summary of geographical definitions used throughout this thesis. An overview of the general methods used for each study will be described. Further context on ethical and data collection considerations that were encountered in the early stages of planning this research that were not included in the published studies will be included. The methods for Chapter 5 are provided in sufficient detail within that chapter.

Geographical definitions

Different terms are used in the literature to describe geographical areas throughout the world; it is important, therefore, to define the different geographical terms used in this thesis. The Australian Statistical Geography Standard (ASGS) defines Remoteness Areas into five categories based on a measure of relative access to services using the Accessibility and Remoteness Index of Australia (ARIA+) to measure relative remoteness.[30] ARIA+ value ranges are assigned to the five categories: Major Cities (0-0.2), Inner Regional (>0.2 and ≤2.4), Outer Regional (>2.4 and ≤5.92), Remote (>5.92 and ≤10.53) and Very Remote (>10.53).[30] The State of Victoria includes all areas of remoteness except Very Remote.

Local Government X is classified as Inner Regional according to ASGC and has been shortened to 'regional' for ease of reference throughout, while municipalities classified as Inner Regional, Outer Regional and Remote areas have been referred to collectively as 'regional and rural' or 'non-metropolitan areas'. When referring to Major Cities, the term 'metropolitan areas' has been used.

General methods for each study

Chapter 4 was a cross-sectional study that accessed an existing database of listed tobacco retailers (updated 2018). Potential unlisted tobacco retailers were added using online searches. All retailers were visited in 2019 and GPS coordinates of retailers that sold tobacco were assigned to suburbs in ArcMap. Differences in the numbers of listed and unlisted retailers by business and neighbourhood-level characteristics were explored using Chi-squared tests, t-tests and logistic regression analyses.

Chapter 5 was a Systematic Review to describe methodological approaches used to assess tobacco retailer density and smoking behaviour. Inclusion and exclusion criteria were

developed and database searches using key words were undertaken. All studies were imported into Covidence and screened by the research team. Data from those cross-sectional studies that met the inclusion criteria was extracted and comprised of the Covidence article reference number, the title, study authors, year of publication, the tobacco retailer density measure used, information on the study setting (for example whether tobacco retailer density was measured using radial buffers from near a participants' home, school or other setting), and the smoking behaviour measure(s) used. A quality assessment of each study was undertaken using the National Heart, Lung and Blood Institute's (NHLBI) Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies.[31] Studies were categorised according to the type of tobacco retailer density measure used, and smoking behaviour was re-categorised by the research team using a modified classification tool.

The study in Chapter 6 was also a cross-sectional study that utilised data collected as part of Chapter 4. GPS coordinates and sales type information of retailers that sold tobacco were recorded and attached to neighbourhood-level data on SES disadvantage and smoking prevalence using ArcMap. A community survey conducted in Local Government X provided smoking and socio-demographic data amongst adult respondents. Associations between tobacco retailer density, which was calculated as the number of retailers per km^2 based on respondents' suburb of residence, and daily, occasional and experimental smoking were assessed using multilevel logistic regression analysis. Separate models with and without covariates were performed.

Chapter 7 was a cross-sectional study that assessed national and state/territory estimates of public support for a tobacco retailer licensing system derived as proportions using NDSHS data over time from 2004 to 2016. The effect of one's jurisdiction of residence on the likelihood of supporting such an initiative in 2016 was assessed using logistic regression analysis while controlling for various socio-demographic and behavioural characteristics.

Several ethical considerations for Chapters 4, 6 and 7 that were not included in the published studies will now be described in the next section.

Ethical considerations

A number of ethical considerations that are not covered in detail in subsequent chapters will be covered here, beginning with an explanation of the process to gain access to the NDSHS data (Chapter 7) and Local Government X data (Chapters 4 and 6). Ethical considerations for the studies in Chapters 4 and 6 considerably shaped the data collection methods and limited

the scope and scale of data collected in the field for these studies. Therefore, a detailed description on the negotiations and compromises undertaken between the research team and ethics committee are provided. General definitions on the common types of tobacco retailers operating within Local Government X are also provided. Finally, a brief description of scenarios and interactions that I encountered during the data collection stage will also provide further insight into the challenges along the way. Anecdotal examples arising from these scenarios and interactions are provided at the end of Chapter 4.

NDSHS data

The Australian Data Archive (ADA) is the custodian for NDSHS data and required an application to be submitted in order to gain access to the datasets. The application included details on the years of data required (2004-2016), the questions to be analysed, what the data would be used for, and measures to ensure the data was stored securely. The data and supporting documentation were then made available through a password protected web portal. The La Trobe University Human Ethics Committee also approved for the data to be analysed (Appendix B).

Local Government X data

To access a copy of Local Government X's existing tobacco retailer database, a Freedom of Information (FOI) request was submitted and approved. Initially, the database copy provided was a PDF version, making it difficult to extract the essential data. After discussion with representatives from Local Government X regarding the purpose of the FOI and the intended use of the data, a formal data-sharing agreement was instead developed between Local Government X's Inspections Coordinator, the Executive Officer for Health Promotion within Local Government X, and La Trobe University (LTU). This agreement provided background information on the research study and deliverables from both Local Government X and LTU. Local Government X agreed to provide an accessible copy of the tobacco retailer database (updated in April 2018) and access to the Active Living Census community census datasets from 2014 and 2019. The Active Living Census datasets provided the most localised information on respondents' residential postcode, suburb, and smoking behaviour from those living in Local Government X. LTU agreed to provide Local Government X with a copy of the draft Ethics application for this project, draft copies of journal articles using the datasets, and a presentation to Local Government X on findings and recommendations from the project.

In early 2019 I was asked to provide input into the next iteration of the Active Living Census survey instrument in relation to other smoking behaviour questions, however these were not incorporated due to the limited space within the survey. The second iteration of the Active Living Census was undertaken in 2019, which was timely as data collection for the studies included in Chapters 5 and 6 were also collected during this time.

Primary data

Prior to collecting data on tobacco retailers throughout Local Government X, approval from the La Trobe University Human Ethics Committee (HEC) was sought. My proposed survey instrument was designed to capture data on the business address, the business type (e.g. supermarket, petrol station, pub etc.), the sales type (from a cigarette gantry, a vending machine or other), the operating hours of each business, whether the business displayed signage to indicate the sale of tobacco (e.g. A3/A4 health warnings, price boards, or "We sell tobacco here" signage), the price of one of the top 5 leading cigarette brands in Australia, whether any other types of tobacco products or electronic cigarettes (e-cigarettes) were sold, the position or title of the sales assistant who provided assistance, a question on the importance of selling tobacco for that business (Likert scale from 1 to 10), and permission to be contacted by the researcher to discuss participation in a future qualitative study. The sales assistant would also be informed that the business name and address would be added into a database that would be provided to Local Government X at the end of the research study.

The Ethics Committee approved this data collection approach but required a Participant Information Statement and Consent Form to be discussed and signed by the sales assistant prior to data collection. I piloted data collection at five retailers, however only one sales assistant agreed to participate. It took approximately 10 minutes for me to provide an overview of the research using the Participant Information Statement, to discuss the Consent Form, and discuss the survey instrument to address any concerns, excluding the time taken to record information when given permission. Discussions with the business representative were often disturbed by customers wanting to make purchases at the PoS, and after spending time discussing the project, the representative often stated that they needed a manager to sign the Consent Form. This increased time at the premises and involved repeating the first step. Managers at two premises stated that they needed to gain approval from head office to participate in the study, and many of the businesses that were subsequently identified as tobacco retailers operated as part of a franchise or within retail chain involved in grocery

sales, liquor sales, petrol sales and/or gaming. The informed consent approach was impractical as representatives either refused to participate on the spot or stated that they needed approval from senior management or head office before being involved, and that the approval process could take many months. As participation was voluntary, businesses could simply refuse. Despite reassurances from sales assistants and/or managers that they would follow up the issue, I did not hear from three of the five businesses that were piloted. One retail assistant also stated that they did not want to provide any information that could help their competitors.

Advice was sought from the Ethics Committee, and I proposed an alternative approach whereby I would visit retailers and simply observe whether they sold tobacco. If it was unclear whether a retailer sold tobacco, as for example some businesses have no signage or infrastructure to indicate the sale of tobacco but do in fact sell, then I would ask the sales assistant whether or not they sold tobacco. Any signage to indicate the sale of cigarettes (e.g. price board, graphic health warnings etc.) would also be recorded, along with the business name and address. I would record all information on a tablet device once I had left the premises. This approach would make the data collection much faster and more discreet, and it would avoid the need for a Participant Information Statement or Consent Form.

The Ethics Committee queried whether it was sufficient to identify tobacco retailers through the observation of mandated signage alone.[(9)] The assumption here appeared to be that all tobacco retailers would display the mandated signage. I argued that this was unlikely to be the case and that it was possible such an approach would result in several false-positive retailers (e.g. retailers who display signage or have infrastructure to indicate the sale of tobacco but do not actually sell tobacco) while false-negative retailers would not be identified (e.g. retailers who do not display signage or infrastructure but do actually sell tobacco). The Ethics Committee's main concern, as it turned out, was not data quality but that non-compliance with signage legislation was illegal and that recording this behaviour could lead to my data being subpoenaed.

In response, I proposed not to record compliance with signage legislation and not to provide any data I collected on tobacco retailers back to Local Government X. The Ethics Committee agreed to these modifications and data collection was able to proceed, although this process took many months to resolve and severely limited the richness of the data that I was ultimately allowed to collect.

Once ethics approval was granted, I set about auditing Local Government X's existing database on tobacco retailers and identifying any additional tobacco retailers that might be operating within the municipality. This involved driving approximately 900 kilometres throughout Local Government X and visiting several hundred potential retailers. A number of practical considerations needed to be addressed during this stage of the project. For example, I often had to think on my feet and act like I was a smoker to ensure the data collection was as natural as it could be, without actually purchasing tobacco products from retailers. As a result, this approach allowed for a complete enumeration of tobacco retailers to be achieved.

Common tobacco retailers in Victoria

Unlike other countries such as the U.S., there are no commercial business lists that can be purchased to identify business types that may sell tobacco in Australia. Prior to setting out into the field, I compiled a list of common business types that were included in Local Government X's database as well as other business types that I was aware of that typically sell tobacco in Victoria. This allowed me to develop a comprehensive database of business addresses to visit based on information from Local Government X's database and additional information I was able to obtain from online sources. It also assisted me in identifying opportunistically when out in the field any business I happened to come across that I had not previously identified through these other sources. Below is a list of common types of businesses that I visited in Local Government X (Table 3.1).

Table 3. 1 Common business types that sell tobacco in Local Government X

Business type	Description
Supermarkets	Generally larger retailers that sell common grocery items
Petrol stations	Usually sell petrol (gasoline) and common convenience goods and foods
Pubs and Hotels	Liquor-licensed businesses that sell alcohol and food for consumption on-premises
Takeaway liquor-licensed premises	Retailers that sell liquor for consumption off-premises, including drive-through 'bottle shops'
Tobacconists	Primarily sell tobacco products, e-cigarettes and tobacco paraphernalia but may also sell giftware
Milk bars or general stores	Small convenience retailers that offer a range of goods and foods
Newsagents	Sell newspapers, magazines, books, stationery and confectionery
Gift shops	Businesses that sell giftware and cards
Barber shops	Provide hairdressing services
Delis, cafés and diners	Sell dine-in or takeaway foods
Accommodation providers	Short or long-term accommodation in caravans, mobile homes, tents or private rooms

Vehicle use

I primarily used a La Trobe University-branded vehicle when in the field collecting data, however I operated 'undercover' as a potential customer and wore casual clothing. I regularly parked the vehicle some distance away from potential retailers to prevent raising any suspicions. When I visited drive-through bottle shops in the main township of Local Government X, I used my own private vehicle. When I asked if tobacco was sold I was often asked which cigarette brand I would like to purchase, and it was more natural to politely decline the transaction by stating that I did not need to purchase tobacco at this point and that I was just curious for next time.

The use of a La Trobe University-branded vehicle was particularly problematic during visits to small towns or secluded retailers. I often had to park the vehicle away from the main street

of townships or some distance from retailers in secluded areas and walk to the potential retailer so that the vehicle would not be identified.

Contacting potential retailers using telephone

Several potential retailers were closed as they only operate seasonally, were geographically distant and were not open at the time of attempted visits, or were only open late at night. I attempted to make telephone contact with these retailers, and some of these were accommodation providers. A brief discussion on conversations arising from some of these telephone calls are outlined at the end of Chapter 4.

Visiting potential retailers selling illicit tobacco

My supervisors and representatives from Local Government X recognised that it was highly likely that I would identify retailers selling illicit tobacco during data collection. Anecdotally, criminal gangs have been involved in the sale and supply of illicit tobacco within Local Government X, and I was warned to be particularly careful when visiting certain premises. Therefore, protocols were put in place when I was out in the field. I was in regular contact throughout the day using telephone or email with my principal supervisor, and a general plan of the areas or businesses to be visited was discussed prior to data being collected each day. If a retailer that was likely to sell illicit tobacco was to be visited, I made contact with my principal supervisor both before and after the attempted visit.

Interactions with staff or patrons

When out in the field it was often difficult to make an initial determination on whether a potential retailer sold tobacco, as there was no signage or infrastructure to indicate the sale, despite Victorian legislation requiring health warning signage if a business sells tobacco.[(9)] In these circumstances, I asked the customer service representative whether tobacco was sold. During visits to a number of potential retailers, I received several comments from staff or patrons regarding tobacco purchasing or smoking behaviour. In some circumstances, sales assistants would make comments about the price of cigarettes, ask me how long I'd smoked for, why I smoke, and what brand of cigarettes I usually smoke. Anecdotal examples of some of these conversations are provided at the end of Chapter 4.

Chapter 4 Identifying tobacco retailers in the absence of a licensing system: lessons from Australia

Except for the afterword, this chapter appears as published in:

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Abstract

Objectives: To estimate the proportion of retailers that sell tobacco in the absence of appropriate local government oversight, and to describe the characteristics by which they differ from those that can expect to receive such oversight.

Methods: A database of listed tobacco retailers was obtained from a regional Victorian local government. Potential unlisted tobacco retailers were added using online searches, and attempts to visit all retailers were undertaken. GPS coordinates and sales type information of retailers that sold tobacco were recorded and attached to neighbourhood-level data on socioeconomic disadvantage and smoking prevalence using ArcMap. Chi-squared tests, t-tests and logistic regression analyses were undertaken to explore differences in numbers of listed and unlisted retailers by business and neighbourhood-level characteristics.

Results: Of 125 confirmed tobacco retailers, 43.2% were trading potentially without government oversight. Significant differences were found between listed and unlisted retailers by primary business type ($p<.001$), and sales type ($p<.001$) but not by the other characteristics.

Conclusions: The database of tobacco retailers was inaccurate in two ways: 1) a number of listed retailers no longer operated or sold tobacco, and 2) 43.2% of businesses confirmed as selling tobacco were missing. As no form of licensing system exists in Victoria, it is difficult to identify the number of retailers operating, or to determine how many receive formal regulatory oversight. A positive licensing system is recommended to regulate the sale of tobacco and to generate a comprehensive database of retailers, similar to that which exists for food registration, gaming and liquor-licensed premises.

What this paper adds:

- This study demonstrates that without the support of any form of tobacco retailer licensing system, it is difficult for local government authorities to keep accurate records on how many tobacco retailers are currently operating.
- In the absence of such records, a large number of tobacco retailers may be operating without any apparent local government oversight of how they sell this product.
- Together, these findings demonstrate the challenges of ensuring compliance with existing tobacco sales legislation in an unlicensed environment.

Introduction

Australia has been at the forefront of tobacco control initiatives since the 1970s, however smoking is still a leading cause of preventable mortality and nearly 19,000 Australians are killed by tobacco use each year.[32] Tobacco consumption is responsible for 9.0% of the total burden of disease in Australia.[32]

Responsibility for tobacco legislation and enforcement in Australia is shared between national, state/territory and local levels of government. Tobacco retailers in all states and territories are required to comply with basic legislation such as preventing sales to minors, displaying warning signage, point-of-sale (PoS) display bans and advertising restrictions.[9] Tobacco products were sold by an estimated 29,907 to 40,000 retailers throughout the country in 2014, however not all jurisdictions have a licensing or registration system in place for tobacco retailers.[29, 33-38] Tobacco retailer licensing systems can be used to facilitate compliance with tobacco-related legislation, to regulate the number of retailers, to prevent underage sales, and to reduce tobacco availability in lower socioeconomic (SES) neighbourhoods and near schools.[39, 40]

Historically, the state of Victoria has been at the forefront of tobacco control legislation,[41] however in recent years it has fallen behind other Australian states and territories in key policy areas. For example, Queensland introduced smoke-free outdoor dining areas in 2006, while Victoria did not implement similar legislation until more than a decade later.[42] Similarly, Victoria is one of only two jurisdictions to have stopped short of implementing a licencing system for tobacco retailers.[8] The lack of any form of licensing or registration

system for the sale of tobacco is likely to be undermining effective policing of the 8,000 tobacco retailers that are estimated to be operating in this state.[29]

Previous studies have described the effects of different licensing systems in other states and territories.[5, 39] New South Wales has a 'negative' licensing system, whereby retailers are only required to register on a one-off basis without a fee. Research in New South Wales identified one unlisted retailer for every 12.6 listed retailers, and unlisted retailers were more likely to breach in-store PoS legislation.[43] In contrast, positive licensing systems, where retailers are required to register and pay an annual fee, provide a comprehensive list of retailers which can be used by authorities to facilitate education visits and enforcement to improve compliance.[5, 43] No research to date has examined the consequences of Victoria's failure to regulate the licensing of tobacco retailers. The present study is the first to address this gap in knowledge by describing the proportion of retailers that sell tobacco products in the absence of appropriate local government oversight and the characteristics by which they differ from those that can expect to receive such oversight.

Methods

The setting was a regional Local Government Area (LGA) of Victoria where there are generally higher rates of socioeconomic disadvantage relative to the rest of the state and smoking rates are higher than the state average, particularly amongst adolescents. At the request of this LGA, it will be referred to in this study as 'Local Government X'. Local Government X covers a geographically large regional area (>2,800Km^2). It comprises one large town and several smaller towns throughout the municipality, however those mandated to inspect tobacco retailers (Environmental Health Officers [EHOs]) only operate from municipal offices located within the large town.

An existing database of listed tobacco retailers (updated in April 2018) known to Local Government X was obtained using a Freedom of Information request after sensitive or personal information and enforcement-related information had been redacted. Duplicate listings were removed and a list of potential business types (e.g. petrol stations, supermarkets, milk bars, general stores, newsagencies, tobacconists, gift shops, barbers, delis, cafés, diners, accommodation, licenced liquor premises) to target using an internet-based search strategy was developed on the basis of information from the database and local knowledge. Internet searches were undertaken on a suburb-by-suburb basis between May and August 2019 using Google (examples of search terms: 'Petrol stations in *[name of town]',* 'Pubs in *[name of*

suburb]') to identify additional businesses that might potentially sell tobacco within the municipality. Google Maps (including Street View) and social media (i.e. Facebook, Instagram and Twitter) were used to establish whether these businesses were likely to be still operating. Potential retailers identified using these methods were added to the list of retailers known to Local Government X to comprise a list of businesses to be verified with a site visit. Business addresses were confirmed in Google Maps and up to 3 visits per business address were attempted between June and August 2019 by the primary researcher posing as a potential customer. If the business was open, a determination was made using either visual cues (e.g. observing signage such as a price board, a cigarette gantry or working vending machine) or verbal confirmation (e.g. asking the sales assistant) as to whether the business currently sold tobacco. For businesses that only opened seasonally, were geographically distant, or only operated at night, verbal confirmation via telephone was attempted. Other businesses identified by the researcher in the field that matched the targeted business types but that had not been previously identified through other methods were also visited and a determination was made as to whether tobacco was sold.

The coordinates of each physical business premise in which it had been confirmed that tobacco was available for purchase by the general public were recorded at the site visit and then geocoded and verified in ArcMap. Telephone or internet-based businesses, home-delivery businesses and wholesalers were excluded, as it was not possible to determine how many of these were operating and which suburbs they delivered to throughout the LGA. Each confirmed retailer was then coded according to the following attributes: primary business type (petrol station, pub, takeaway liquor outlet, supermarket, milk bar or general store, newsagency, tobacconist, gift shop or barber, deli, café or diner, or accommodation), presence of a vending machine (yes, no), straight-line distance from the central municipal offices (in kms) and the following neighbourhood-level variables: socioeconomic status, smoking prevalence and the proportion of the population under 20 years of age. Primary business type and presence of a vending machine were determined at the site visit. Straight line distance from the central municipal offices to the business address was derived in ArcMap and was included to explore whether Local Government X EHOs were more likely to include in their database tobacco retailers that were geographically closer to the municipal offices.

Neighbourhood-level socioeconomic status was based on the 2016 ABS Index of Relative Socio-Economic Disadvantage (IRSD)[44] score of the Statistical Area Level 1 (SA1) within which the business was located. A low score indicates a high level of disadvantage, and a high score indicates a low level of disadvantage. Neighbourhood-level smoking prevalence was obtained from a community survey conducted in 2019 by Local Government X. Only respondents who provided their suburb of residence, age and smoking behaviour were included (N=10,043). Responses to the smoking behaviour question were weighted using the sampling weight variable as recommended by the data custodians to provide accurate prevalence estimates at the suburb level. Respondents aged 18 years and over were asked whether they were a current smoker, an ex-smoker or a never smoker. Suburb-level smoking prevalence was derived from the proportion of respondents who answered that they currently smoked. One retailer was located in a suburb that did not receive any responses to the community survey and was therefore excluded from multivariate analyses. Neighbourhood-level estimates of the proportion of the population under 20 years of age were based on population counts at the SA1 level from the 2016 census.[45]

Differences in the numbers of listed and unlisted tobacco retailers across these attributes were explored using chi-squared statistics, t-tests and logistic regression in Stata. A penalized maximum likelihood estimation developed by Firth was used instead of ordinary logistic regression because of its ability to cope with potentially separated datasets (i.e. datasets in which a variable perfectly predicts every outcome in the sample).[46]

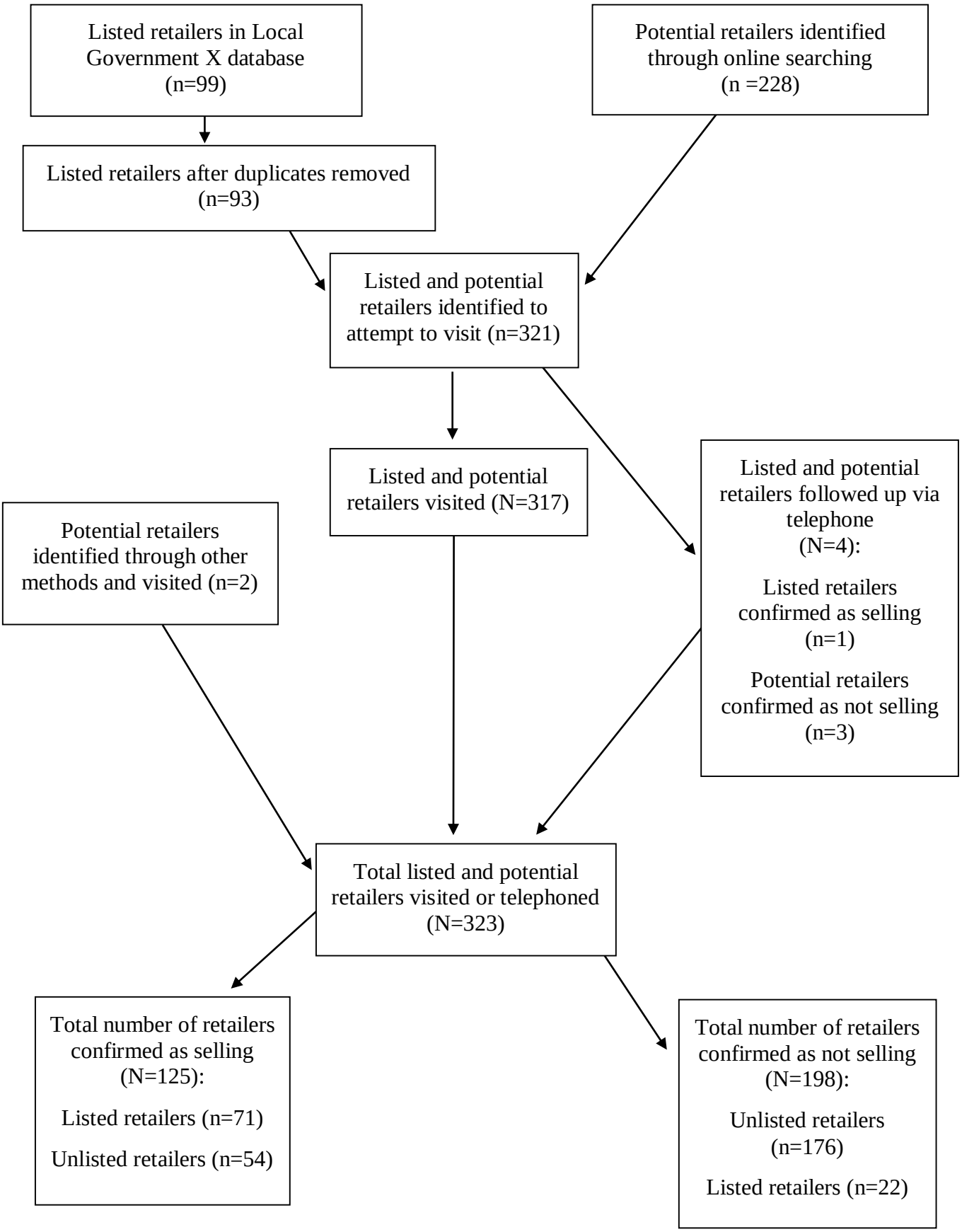
Results

In total, 99 retailers were listed in the original database provided by Local Government X. After duplicate listings were removed, 93 retailers remained (Figure 4.1). A further 230 potential retailers were identified through online searches. In total, 323 retailers were identified to visit. Four of these retailers were subsequently telephoned by the researcher to determine whether tobacco was sold, and two potential retailers were identified during field visits to other retailers.

Of the 93 unique tobacco retailers in the original database provided by Local Government X, 9 had closed and 13 no longer sold tobacco (n=22, 23.6% in total), leaving 71 businesses selling tobacco products with apparent oversight from local authorities. An additional 54 unlisted tobacco retailers were identified through a combination of internet searching and site

visits, resulting in a total of 125 confirmed tobacco retailers in the municipality, 43.2% of which were trading potentially without such oversight.

Figure 4. 1 Tobacco retailer identification flow chart



Chi-squared statistics revealed significant differences in the numbers of listed and unlisted retailers by business type (p<.001) and presence of a vending machine (p<.001, Table 4.1). All supermarkets (n=17), milk bars or general stores (n=11), delis, cafés or diners (n=3) and accommodation providers (n=2) that sold tobacco were known to Local Government X, while none of the takeaway liquor outlets (n=24) or pubs (n=24) were included in the original database (Table 4.1). Similarly, none of the businesses with a vending machine (n=16) were included in the original database, and all but one of these was a pub. No other attribute in the analysis distinguished between listed and unlisted retailers in a significant way (Table 4.1).

Table 4. 1 Listed and unlisted tobacco retailers by selected characteristics

	Listed	Unlisted	Total	p-value[a]
Total	71	54	125	
Primary business type, n (%)				<0.01
Petrol station	29 (40.8)	2 (3.7)	31 (24.8)	
Pub	0 (0)	24 (44.4)	24 (19.2)	
Takeaway liquor outlet	0 (0)	24 (44.4)	24 (19.2)	
Supermarket	17 (23.9)	0 (0)	17 (13.6)	
Milk Bar/general store	11 (15.5)	0 (0)	11 (8.8)	
Newsagency	6 (8.5)	1 (1.9)	7 (5.6)	
Tobacconist/gift shop/barber	3 (4.2)	3 (5.6)	6 (4.8)	
Deli/café/diner	3 (4.2)	0 (0)	3 (2.4)	
Accommodation	2 (2.8)	0 (0)	2 (1.6)	
Vending machine present, n (%)				<0.01
No	71 (100)	38 (70.4)	109 (87.2)	
Yes	0 (0)	16 (29.6)	16 (12.8)	
IRSD[b] score, m±sd	950.7±82.2	949.4±72	950.1±77.6	0.93
Distance from municipal offices (km)[c], m±sd	11±15.2	7.1±11	9.3±13.6	0.12
Proportion current smokers (%)[d], m±sd	11.3±4.8	10.9±4.3	11.1±4.6	0.68
Proportion of population under 20 (%)[b], m±sd	22.8±5.8	21.5±5.5	22.2±5.7	0.22

[a]Chi-squared statistic for categorical variables or t-test for continuous variables. [b]Based on SA1 of each retailer. One listed retailer was located in an SA1 without an IRSD score or resident population. [c]Straight-line distance. [d]Based on suburb of each retailer. One listed retailer was located in a suburb that did not receive any responses to the community survey.

Without adjusting for covariates, pubs (Crude OR 578.20, CI 26.49 – 12621.84), takeaway liquor outlets (Crude OR 578.20, CI 26.49 – 12621.84), and tobacconists, gift shops or barbers (Crude OR 11.80, CI 1.65 – 84.21) were significantly more likely than petrol stations to be unlisted (Table 4.2). Retailers with a vending machine were also significantly more likely to be unlisted (Crude OR 61.29, CI 3.58 – 1049.63) compared to those without. No other variable in the bivariate analyses distinguished between listed and unlisted retailers in a significant way (Table 4.2).

When taking into account the included covariates, pubs (Adjusted OR 157.46, CI 05.52 – 4489.02), takeaway liquor outlets (Adjusted OR 511.64, CI 20.60 – 12709.55) and tobacconists, gift shops or barbers (Adjusted OR 13.05, CI 1.54 – 110.72) were still significantly more likely than petrol stations to be unlisted, however vending machine presence and the likelihood of being unlisted was no longer significant. This was because all 16 of the retailers with vending machines were liquor-licensed premises. No other variable in the multivariate analyses distinguished between listed and unlisted retailers in a significant way (Table 4.2).

Table 4. 2 Odds ratios of unlisted tobacco retailers

	Odds Ratio (OR) for being unlisted (versus listed)	
	Crude OR (95% CI)	Adjusted OR (95% CI)
Primary business type		
Petrol station	ref.	ref.
Pub	578.20 (26.49 – 12621.84)	157.46 (05.52 – 4489.02)
Takeaway liquor outlet	578.20 (26.49 – 12621.84)	511.64 (20.60 – 12709.55)
Supermarket	0.34 (0.02 – 7.43)	0.36 (0.02 – 7.55)
Milk Bar/general store	0.51 (0.02 –11.52)	0.56 (0.02 – 12.70)
Newsagency	2.72 (0.30 – 24.46)	2.50 (0.27 – 23.32)
Tobacconist/gift shop/barber	11.80 (1.65 – 84.21)	13.05 (1.54 – 110.72)
Deli/café/diner	1.69 (0.07 – 42.71)	2.97 (0.07 – 121.19)
Accommodation	2.36 (0.09 – 63.95)	1.32 (0.01 – 137.20)
p value	<0.001	<0.001
Vending machine present	61.29 (3.58 –1049.63)	1.97 (0.03 – 133.63)
p value	0.005	0.752
IRSD score[a]	1.00 (1.00 – 1.00)[d]	1.00 (0.99 –1.01)
p value	0.922	0.969
Distance from municipal offices (km)[c]	0.98 (0.95 – 1.01)	1.03 (0.97 – 1.08)
p value	0.143	0.345
Proportion current smokers (%)[b]	0.98 (0.91 – 1.06)	0.99 (0.77 – 1.28)
p value	0.681	0.939
Proportion of population under 20 (%)[a]	0.96 (0.90 – 1.03)	1.02 (0.83 – 1.26)
p value	0.233	0.841

[a]Based on SA1 of each retailer. One listed retailer was located in an SA1 without an IRSD score or a resident population. [b]Based on suburb of each retailer. One listed retailer was located in a suburb that did not receive any responses to the community survey. [c]Straight-line distance. [d]Confidence Interval without rounding (0.995 – 1.004).

Discussion

This study found that an existing database of tobacco retailers from a regional local government in Victoria with relatively high smoking rates was inaccurate in two ways. Firstly, 23.6% of listed retailers no longer operated or sold tobacco. Secondly, 43.2% of businesses confirmed as currently selling tobacco were missing from this database. This is equivalent to one unlisted retailer for every 1.3 listed retailers. As no form of tobacco retailer licensing system is in place in Victoria, this problem is likely to be common to many municipalities across the state, making it difficult to accurately identify the number of retailers operating, or to determine how many retailers are receiving proper oversight by local authorities.

Recent research in New South Wales, where a negative licensing system is in place, identified one unlisted tobacco retailer for every 12.6 registered retailers (7.93%).[43] Whilst the current study was unable to look at adherence to tobacco retail legislation, the New South Wales study found that tobacco retailers in more disadvantaged areas were more likely to be in breach of in-store regulations than those operating in less disadvantaged areas, and that unlisted retailers are less likely to comply with tobacco retailer legislation. It is possible, therefore, that many of the unlisted retailers identified in the present study are in breach of these regulations as well.[43]

A key finding of the current study was that certain business types (i.e. pubs and takeaway liquor outlets) were not in the original tobacco retailer database maintained by Local Government X and obtained through a Freedom of Information request. It is likely that most of these businesses are known to local or state authorities through other regulatory mechanisms (e.g. food inspections or liquor and / or gaming audits). However, Local Government X advised that it gives highest priority to compliance with food handling practices when visiting these premises because of the immediate risks to public health in the event of a foodborne outbreak, and that tobacco-specific education is given much less of a priority due to time and funding constraints.

Local Government X also explained that the absence of liquor-licensed premises in the original database is because liquor-licensing legislation does not allow for minors to visit such businesses unaccompanied by a responsible adult. In their view, this limits the type of premises in which they can reliably undertake underage test-purchasing for tobacco products, as the presence of an EHO (as the “responsible adult”) while the minor attempts a test-

purchase at a liquor-licensed premises could contaminate the result. Greater coordination between those in Victoria mandated to enforce tobacco legislation compliance (i.e. EHOs and state health authorities) and those charged with enforcing liquor and gaming laws (i.e. state gaming and liquor authorities and the police) to allow for underage test-purchasing of tobacco products in liquor-licensed premises might be one way to overcome such constraints (perceived or otherwise). Another might be not to involve minors in test-purchasing at liquor-licensed premises. An Australian study in the related field of alcohol research, for example, found that despite legislation prohibiting the sale of alcohol to minors, 60% of adult participants perceived by a panel of professionals to look under the minimum purchasing age of 18 years ('confederate-purchasers') were nevertheless able to purchase liquor from takeaway liquor outlets.[47] Such an approach to the test-purchasing of tobacco in Victorian liquor-licensed premises would remove any requirement for test-purchasers be accompanied by another person.

There is a large body of research in Australia and elsewhere to suggest that the introduction of a licensing system for tobacco retailers in Victoria could improve retailer compliance with tobacco legislation and reduce sales to minors.[39, 40, 48] Firstly, it would result in a much more accurate record of tobacco retailers (including retailers with multiple points-of-sale)[49] than currently exists and, if coupled with an appropriate licensing fee, a more sustainable funding stream for local governments to undertake regular education visits, compliance checks and underage test purchasing.[49] More importantly, however, it may also influence the number of tobacco retailers and points-of-sale within retailers. Research in South Australia, for example, observed a 27% decrease in the number of tobacco retailers renewing their licences between 2007 and 2009 when the cost of a licence increased from $A12.90 to $A200.00.[39] One option would be to set licence fees using a sliding scale based on the number of employees or the annual turnover of each business. Certain business types, such as supermarkets, would therefore have the highest licensing fees, as these business types made up approximately 55% of all tobacco sales in Australia in 2017.[50] However, the constitutional validity of such an approach needs to be investigated further.

Currently, New South Wales, Western Australia and the Australian Capital Territory are the only jurisdictions in Australia that provide publicly searchable databases of tobacco retailers.[51-53] If other states and territories were to follow suit, this would provide a more accurate picture of the tobacco retailing landscape in this country and allow researchers and

governments to determine where further research or policy development is needed. Victoria already has a publicly available database for gaming and liquor-licensed premises, which can be searched by licence type and location using interactive maps.[54] A similar tool for tobacco retailers would greatly assist tobacco control in the state.

In Victoria, liquor retailers, gaming operators, and those selling food must register or apply for a licence and pay an application fee as well as an annual renewal fee to conduct their business. For a hypothetical pub to sell liquor in Local Government X, for example, an application fee would cost approximately $A480, registration to serve food (Class 2) would cost approximately $A1,059 and a gaming licence application to operate poker machines on the premises would cost approximately $A2,289. However, this pub would not be required to apply for a licence to sell tobacco either at the PoS or through a vending machine, or necessarily be subjected to regular compliance testing with respect to the relevant legislation.

This study is not without limitations. The absence of a significant association between a retailer being included in the existing database and SES and smoking may be because there was insufficient variation in these variables in Local Government X. As there are few restrictions on the types of retailers that can sell tobacco products in Victoria, a large number of potential retailers had to be physically visited or contacted via telephone to determine whether or not they sold tobacco.[50] Due to time and logistical constraints, it is possible that not all existing retailers were identified by this approach; several potential retailers were closed during repeat visits (e.g. venues that only host a limited number of events per year) and some retailers may only operate seasonally. It is also possible that the existing database from Local Government X was updated between its provision and the site visits. A further limitation is the possibility that businesses with signage and/or a cigarette gantry to indicate the sale of tobacco were misclassified during the site visit as a tobacco retailer when they did not actually sell tobacco anymore (a false-positive error), or retailers that did not have any signage or infrastructure to indicate the sale of tobacco were misclassified as not a tobacco retailer when they actually did sell tobacco (a false-negative error).

It is also important to note that multiple PoS for individual retailers were not recorded in the original database. For example, a takeaway liquor retailer may have a ‘drive-through’ where customers can purchase tobacco whilst being served in their vehicle (concierge PoS), or they can walk into the premises to purchase tobacco (secondary PoS). Treating individual points-of-sale as the unit of analysis in this way would have provided a more accurate picture of

tobacco availability in the municipality. Telephone or internet-based businesses, home-delivery services and wholesalers were also excluded, thus the number of retailers identified in this study does not represent the true availability of tobacco in the community of interest.

Explicitly not collected in this study based on advice from the Ethics committee was information on retailer compliance with tobacco-related legislation, such as adherence to health warning signage and display regulations. Collection of this information would have greatly enhanced the scope of the study to include whether certain business types were more likely to break retailing laws. It is strongly hoped that future research in Victoria is able to address ethical considerations in ways that allow this issue to be examined.

Finally, the results from this study cannot necessarily be generalised to other municipalities as there are large variations in populations and geographical sizes across the state. Each LGA receives different levels of funding to undertake tobacco control activities, and some may have alternative approaches towards identifying and recording tobacco retailers.

Conclusions

The results of this study show that a large proportion of tobacco retailers are not being accurately identified and recorded in the regional Victorian Local Government Area assessed in the study. As the existing funding model in this state only allows for a limited number of visits to listed tobacco retailers each year, it is vital to improve the accuracy of tobacco retailer databases. The introduction of a comprehensive, positive tobacco retailer licensing system would help to properly monitor and regulate the sale of tobacco products in this state, as already occurs in the gaming, food preparation and liquor retailing industries.

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Ethics approval

The La Trobe University Human Ethics Committee approved this project (ref HEC18115).

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Afterword

Several practical challenges presented themselves during the data collection phase of this study. For example, I often had to make up a story as to why I was asking whether a business sold tobacco or I would have to pretend to be a smoker. It was unlikely that some of these businesses would sell tobacco, but as I wanted to be as thorough as possible, I contacted them nonetheless.

In one instance, I visited an accommodation provider in a small township and asked the customer service representative if tobacco was sold on the premises. The person responded by asking "Cigarettes? *Why* would *we* sell cigarettes? What are you *really* doing?" to which I simply stated that I was looking to purchase tobacco and that I had stayed at similar accommodation providers in the past that sold tobacco.

During telephone calls to accommodation providers, I was asked which room or caravan I was calling from, and I would respond by stating that I was not staying at the accommodation at the time but was planning to stay there in the near future and needed to know whether cigarettes could be purchased, or I stated that I was staying near the accommodation provider and needed to purchase cigarettes.

Although this research did not actively seek out illicit tobacco retailers, I was offered illicit tobacco at a number of premises, to which I responded that I did not need to buy it at this point and that I was simply curious for next time. At one retailer I was offered a carton of illicit cigarettes (approximately 6 x 25 cigarettes) from a black plastic bag under the counter for $100.00. I said that I wanted to purchase a particular brand of cigarettes. Another retailer offered both illicit 'loose' tobacco and branded cigarettes in 'white', 'gold' and 'blue' variants, not in plain packaging. Again, I stated that I would purchase at a later date.

I also received comments from staff or patrons on how expensive cigarettes are, questioning why I smoked, including several judgemental comments such as "They're for *yourself*? Why do *you* smoke?", or providing advice on where to purchase tobacco at a cheaper price than what their business was offering ("They're really expensive here, try the servo [service station or petrol station] down the road."). Another potential retailer who did not sell tobacco

told me that “The service station is about $8.00 more expensive than the supermarket just here [pointing towards the direction] just across the road, so go there.”

In one instance, I was offered a cigarette by a patron at a liquor licensed premises, to which I responded thanking them for the offer but that I was actually trying to quit and should not be looking to purchase anyway. I also visited a retailer whereby I was required to plug the cigarette vending machine into the power socket to confirm that it worked, as the staff member was using the power socket to operate an electric heater at the time!

In a number of cases at liquor licensed premises, tobacco was sold from behind the bar or from a vending machine which did not appear to be located within sight of a PoS location as required by Victorian legislation.[(9)] For example, I visited a potential retailer and I was told by a staff member that the business had a cigarette vending machine. It was located in an outdoor smoking area approximately 25 metres away from the nearest PoS in an outdoor smoking area. Another retailer displayed no signage to indicate the sale of tobacco, however they had tobacco products stocked behind a small black curtain behind the bar, while another retailer had tobacco products stocked in a cupboard underneath the bar with no signage to indicate the sale of these products. This made it difficult to identify potential retailers, and meant that I often had to ask staff whether the business sold tobacco, and then create a reason as to why I did not need to purchase at this stage.

It took a lot of time to visit all potential retailers throughout Local Government X but I really enjoyed collecting data for this research. It certainly required the use of some improvisational skills at times, and most staff or patrons were easy to engage with. For most retailers, it was a simple process to determine whether they sold tobacco, as there was a cabinet and/or price board and usually a form of signage displayed (e.g. health warning signage, “We don’t sell to U/18’s” or “We sell tobacco here”). In nearly all instances, I verbally confirmed with the staff member or customer service representative nonetheless.

Chapter 5 Tobacco retailer density and smoking behaviour: how are exposure and outcome measures classified in the existing literature? A Systematic Review

Preface

This chapter systematically reviews the existing evidence on the association between tobacco retailer density and smoking behaviour from the perspective of classifying and summarising how these variables have been operationalised in the literature. Findings from this chapter were used to inform variable selection in the study presented in Chapter 6, although it should be noted that the available data ultimately determined the design of that study. The work presented in this chapter has been submitted to a journal for review but it was rejected with reviewer comments. An updated manuscript is being prepared for re-submission to a different journal and the draft version is provided below.

Introduction

The distribution of tobacco retailers has been identified as the new frontier in tobacco control.[40] The retail availability of tobacco is likely to influence smoking behaviour[55, 56] and exposure to tobacco retailers may influence perceptions about the ease of purchasing cigarettes, the prevalence of smoking, and the personal health consequences of such behaviour amongst young people.[57, 58] It may also normalise the use of tobacco products[59] and encourage tobacco use by providing greater access to tobacco products, marketing (i.e. advertising brand names through price boards), and exposure to other smokers. Greater availability of tobacco products may impact on pricing, with increased competition from retailers possibly lowering cigarette prices.[18] Traditional market theories suggest that the increased availability of consumer goods results in improved consumer awareness, provides greater purchasing opportunities, and contributes to increased sales.[60, 61]

The distribution of tobacco retailers is typically operationalised in the growing body of research in this area in terms of two related concepts, tobacco retailer density and tobacco retailer proximity. Most studies focus on tobacco retailer density, which is broadly defined as the number of tobacco retailers within a defined area.[62] Several studies have also examined tobacco retailer proximity, which is typically operationalised as the nearest features to a specific origin, such as the most proximal tobacco retailer from a home.[63]

A number of systematic reviews[15, 62, 64, 65] and a meta-analysis[55] have attempted to assess associations between tobacco retailer density and smoking behaviour in studies focusing on both youth and adults. These reviews have documented statistically significant associations, particularly density around participants' homes and activity spaces.

A narrative review of nine studies on tobacco retailer density and tobacco retailer proximity and adolescent smoking amongst licensed tobacco retailers in North America found associations between those factors and lifetime smoking (two studies), past 12-month smoking (one study), past 30-day smoking (eight studies), as well as susceptibility to smoking (two studies).[62] A meta-analysis of 11 studies on the relationship between tobacco retailer density and adolescent smoking found significantly higher rates of smoking with greater tobacco retailer density around homes, but not schools, however this study only included one smoking outcome measure (past-month smoking) and only focused on youth.[55] A systematic methodological review of 20 studies on the associations between tobacco retailer density, tobacco retailer proximity and smoking amongst young people aged 12-25 years, found positive associations in two studies and a negative association in one study in the four studies identified as having high methodological quality.[64]

Since the current systematic review was commenced, two other systematic reviews have been published that discuss the results for studies looking at tobacco retailer density and tobacco retailer proximity and smoking behaviour. One of those systematic reviews[15] summarised associations between tobacco retailer density and tobacco retailer proximity to homes, schools and communities, and smoking behaviours across 35 studies focusing on those aged 18 years and younger. It found that the existing literature supported a positive association between tobacco retailer density and smoking behaviours near youths' homes, regardless of the tobacco retailer density measure used, while one study included for review found an association between tobacco retailer density around activity spaces and smoking behaviour, but associations were not found between tobacco retailer proximity and smoking behaviour.

The second systematic review assessed geographic measures of tobacco retailer density and tobacco retailer proximity and smoking behaviour across 40 studies.[65] It found nearly half of tobacco retailer density studies measured retailer counts within an area, while more than 80% of included studies that measured tobacco retailer proximity did so through measuring length distances using the street network. Greater tobacco retailer density was generally associated with higher smoking prevalence, increased smoking initiation, and lower cessation outcomes.

Tobacco retailer proximity measures were only associated with cessation outcomes, with closer proximity to retailers associated with reduced cessation rates and quitting outcomes amongst current smokers.

Substantial differences in the way both exposure and outcome measures are defined have made it difficult to compare and meta-analyse the existing literature.[64] The review by Marsh et al.[15] stated that inconsistent associations between tobacco retailer density and smoking behaviour may be as a result of the outcome variables used, and highlighted various ways that outcome measures are classified and defined, but did not investigate this further. To date, only one meta-analysis[55] has been published focusing on associations between tobacco retailer density and smoking behaviour, and the authors from that study note that inconsistencies in results may be as a consequence of study factors, including smoking outcomes, and that there was a lack of consistency in how past-month smoking behaviour was defined in the literature.

Although it is important to ensure both exposure and outcome measures are clearly defined and captured in the tobacco retailer density literature, no reviews to date have focused on examining how the outcome measure (smoking behaviour) has been classified or defined and how this might affect results. This review sought to address the gap by examining the existing evidence on associations between tobacco retailer density and smoking behaviour from the perspective of summarising how these variables have been measured in the literature, and to describe how the measurements used may affect the results. A descriptive approach was adopted with the aim of addressing the following questions: 1) what approaches to measure tobacco retailer density and smoking behaviour have researchers adopted in this field of research? and 2) what potential gaps in the evidence base have developed as a result of these approaches?

Methods

Literature search strategy

The systematic review was registered with PROSPERO (no. CRD42017082385). Minor changes to the aims of the study but not the search strategy were recorded in PROSPERO after the review commenced in response to two new published reviews that had similar aims. PRISMA-P guidelines were also used to assist the review process. Search terms using keyword and text searches only included ‘Outlet density AND smoking’, ‘Retail density AND smoking’, ‘Smoking AND convenience store’, ‘Smoking OR tobacco AND density’,

‘Tobacco outlet density AND smoking’, and ‘Tobacco retailer density AND smoking’ (Appendix C).

CINAHL, Cochrane, Medline, ProQuest, PsycArticles, PscyINFO, PubMed, Scopus, SocINDEX, and Web of Science databases were used. Literature searches were undertaken between March and April 2018. Searches were not limited by country, language, date or peer-review status.

All studies identified in database searches were imported into Covidence software and duplicate studies were identified and removed (Figure 1).[66] Titles and abstracts were screened independently by two researchers (SB and MM) and conflicts were resolved by a third researcher (MAR). The included full text articles were divided into two sections and reviewed by author pairs (SB & JB reviewed 61 articles and MM & MAR reviewed 60 articles). Conflicts were sent to a representative of the other team (JB & MM) for final review. The reasons for exclusion were recorded in Covidence. The researchers were not blinded to the titles, study authors or institutions.

Inclusion and exclusion criteria

Cross-sectional studies examining tobacco retailer density and the experimentation, uptake and continuation of smoking behaviour were included for review. Smoking behaviour was defined as cigarette and electronic cigarette (e-cigarette) use but not other forms of tobacco use (e.g. smokeless tobacco, chewing tobacco, snus, dip, shisha, hookah etc.). Cigarettes were included in this definition as cigarette consumption is increasing in many countries (particularly in low- and middle-income countries), cigarettes are popular amongst youth, and smoking-related questions commonly focus on the use of these products.[67, 68] E-cigarettes were included as the use of these products is an emerging public health concern across many countries and these devices may lead to cigarette use amongst youth.[69-71]

Studies were excluded if they did not provide details on the study population(s), a definition of how tobacco retailer density was measured (for example whether density was measured through circular buffers at set distances), or a definition of smoking behaviour. Studies were also excluded if smoking behaviour was only estimated, broadly captured or not captured at all. For example, studies by Chaiton et al.[72] and Pearce et al.[73] did not provide details on the type(s) of smoking behaviour being measured (e.g. current or past-month smoking). Other exclusion criteria were: systematic reviews or meta-analyses, longitudinal studies, studies focusing only on cessation and studies where a full-text article was unavailable. Longitudinal

studies were excluded as they largely focused only on cessation and relapse rather than experimentation, uptake and continuation.

Data extraction

Extracted data included the Covidence article reference number, the title, study authors, year of publication, the tobacco retailer density measure used and the smoking behaviour definition(s) used. The setting for the study was another attribute of interest. This included participants' home, school, or activity space for example. Activity spaces are defined as all of the locations an individual personally experiences as a result of their daily activities,[74] and consist of the locations and the routes that a person has travelled to or visited.[75]

Studies that measured distances in miles were converted into kilometres (km). All extracted information from each included study was extracted independently by two researchers (JB & SB) using an Excel template. The two researchers (JB & SB) then validated the extracted data through discussion to ensure accuracy and consistency, and any discrepancies were resolved.

Quality assessment

The quality of the included studies was assessed using the National Heart, Lung and Blood Institute's (NHLBI) Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies.[31] The studies were divided into two sections and classified by author pairs: SB and JB assessed 19 articles and MM & MAR reviewed 17 articles (Appendix D). Disagreements on the overall quality rating (Good/Fair/Poor) were resolved through discussion, and if agreement could not be made then conflicts were sent to a representative of the other team (JB and MM) for a final decision.

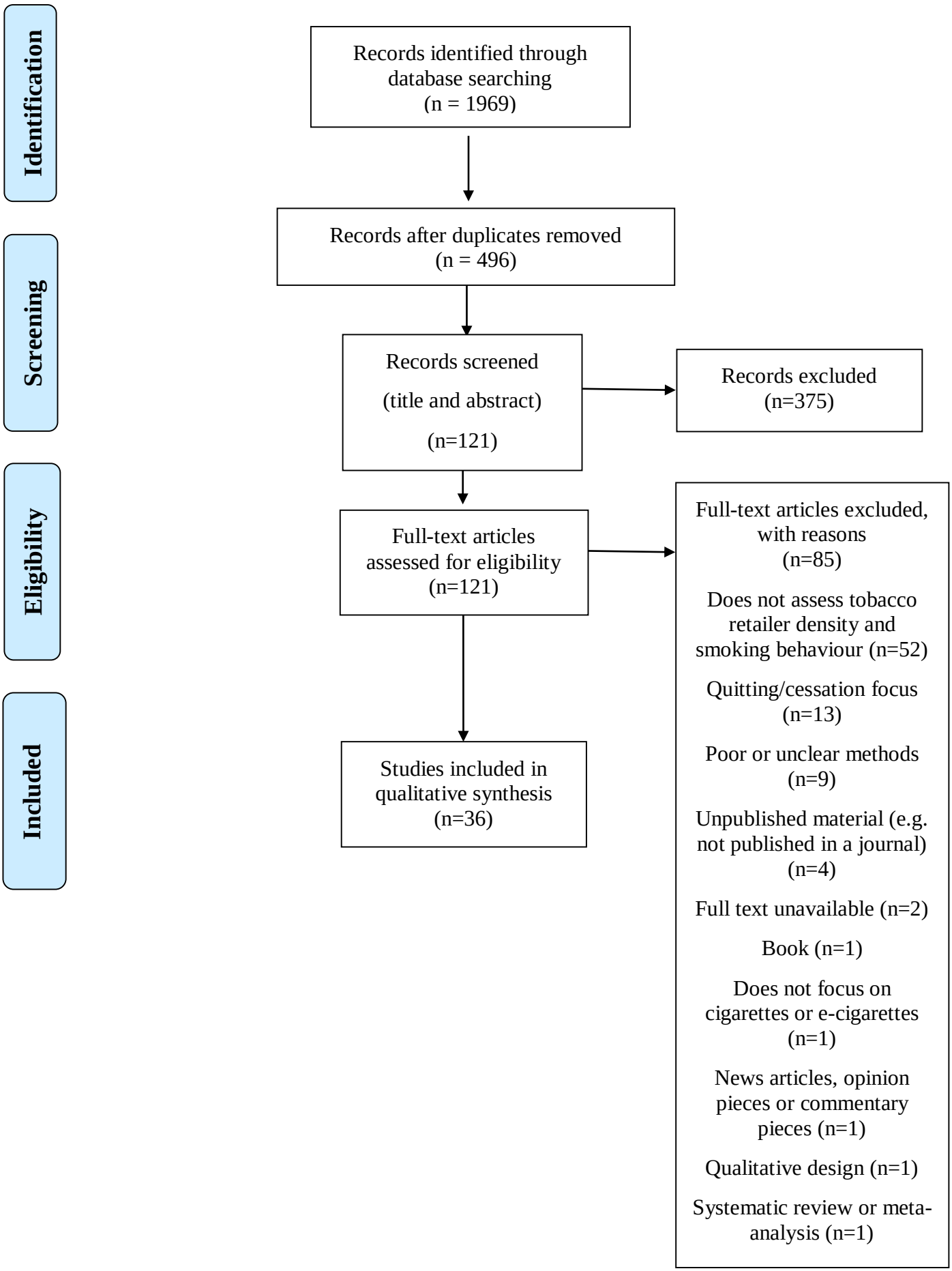
Smoking behaviour measures

To assist with classifying the studies after data extraction and during the process of study synthesis, the research team developed a modified version of smoking measures classification proposed by Mayhew, Flay & Mott.[76] To ensure consistency, two members of the research team (SB & MM) each reviewed 12 (33% each or 66% of total) randomly selected articles to apply the smoking behaviour categories. These were then compared to the smoking behaviour categories applied by the primary researcher (JB) to those articles, with high sensitivity and specificity found. Any discrepancies were discussed and clarified between the researchers.

Results

In total, 1,969 articles were identified through database searches and imported into Covidence (Figure 5.1).[66] Following removal of duplicates, 496 articles were included. A total of 121 articles were selected after reviewing titles and abstracts. Full-text articles were then assessed for eligibility and 85 studies were excluded for the following reasons: The study did not assess tobacco retailer density and smoking behaviour (n=52); the study primarily focused on quitting or cessation (n=13); the methods were poor or unclear (n=9); the study was unpublished (n=4); full text of the article was unavailable (n=2); the literature was from a book (n=1); the study did not focus on cigarettes or e-cigarettes (n=1); the article was a news article, opinion piece or commentary piece (n=1); the study utilised a qualitative design (n=1); and the literature was a systematic review or meta-analysis (n=1). This left a final sample of 36 studies for inclusion.

Figure 5. 1 Tobacco retailer density and smoking behaviour: Systematic Review flow chart



Overview of studies

The 36 studies included were published between 2005 and 2017 (Appendix D). Of those, 26 were assessed as 'Good quality', whilst 10 were rated as 'Fair quality'. Three studies focused on e-cigarette retailer density and smoking behaviour, one focused on assessing both e-cigarette use and combustible use, and 32 studies focused on combustible cigarette retailer density and smoking behaviour.

The studies were undertaken in the United States (n=21), Canada (n=6), Australia (n=3), the United Kingdom (n=3), New Zealand (n=2) and one study was undertaken in India (n=1). The smallest participant sample size was 274[77] whilst the largest sample size was 70,427.[78] Twenty-two studies collected data from specific age groups (e.g. 13-18 years) and 12 of the 36 studies collected data from school students (e.g. middle and high school grades). One study did not report sample characteristics[77] and one study stated that 'Adults' participated, without providing an age range.[79]

Smoking behaviour measures

There are several differences between the smoking measures classification proposed by Mayhew et al. and the classification used in the current study (Table 5.1). As this systematic review only focused on studies assessing existing smoking behaviour, the 'Non-smoking-contemplation and preparation stages' were removed. 'Quit/Stopped/Ex-smoker' were added as some included studies asked participants whether they had previously smoked but had not smoked on any day in the past month.

The smoking category 'Tried' was merged into 'Ever-tried' and the timeframe (one year) was removed, as most included studies did not place limits on this. Mayhew et al.'s 'Experimenter' stage was dissolved, as the definition of 'Smokes occasionally on an experimental basis' and the associated measurements were quite prescriptive and did not fit with the broader smoking behaviours measured in the included studies. To better fit the smoking-related questions assessed in the included studies, Mayhew et al.'s 'Regular' and 'Established/daily smoker' stages were separated by recency of smoking behaviour. To do this, the following categories were created: 'Past-year smoking', 'Past-month smoking', and 'Current smoking'. For the past-year and past-month stages, the existing cigarette consumption threshold was reworded from 'Smoked more than once' to 'Smoked at least one cigarette.'

‘Current smoking’ intensity was defined as any current smoking behaviour or any smoking in the past week. These descriptions formed the ‘Intensity’ category. Indicators of total lifetime cigarette consumption (+/- 100 cigarettes) were also removed as most included studies did not assess this.

During adaption of the stages of smoking onset classification, further context was provided in relation to the frequency of smoking behaviour. Smoking frequency for all stages (except ever-tried and quit) were defined as ‘Daily/nearly daily/some days/occasionally’. This created a better fit for studies where, for example, they asked participants whether they had smoked in the past month, and if so, on how many days they smoked.

For some studies, the language used to describe a certain smoking behaviour stage differed to the definition used in the current study. Smoking questions were reviewed for each study and allocated to the appropriate stage(s). For example, studies that defined ‘Current smoking’ as any smoking over the past 30 days were reclassified into ‘Past-month’ smoking, as this better reflected the period of time that smoking behaviour was assessed.

Through classifying studies according to smoking intensity, recency, and frequency, studies could be accurately allocated to the appropriate smoking stage(s). The smoking questions asked by researchers typically only tapped into one of these dimensions, so limited information was provided. Generally, if the smoking related question and/or answer provided a timeframe, this could then be used to categorise the smoking measure used.

Studies measuring only one type of smoking behaviour (e.g. past-month smoking) were classified according to that smoking behaviour and grouped with other studies that measured the same smoking stage. Studies that measured several smoking behaviours were grouped accordingly (e.g. ever-tried and past-month smoking), with many permutations identified.

Table 5. 1 Tobacco retailer density and smoking behaviour: Smoking measures adapted from Mayhew, Flay, & Mott

Stage	Intensity	Recency	Frequency
Ever-tried	Tried a puff or two or smoked one or two cigarettes	Any time	Tried a puff or two or smoked one or two cigarettes then stopped OR can be categorised to one of the stages below if question asked about further smoking
Current smoking	Indicates any current smoking behaviour	Present time or past week use	Daily/nearly daily/some days/occasionally
Past-month smoking	Smoked at least one cigarette in past month	Past month (30 days)	Daily/nearly daily/some days/occasionally within past month
Past-year smoking	Smoked at least one cigarette in past year	Any use in past year	Daily/nearly daily/some days/occasionally within past year
Quit/Stopped/ Ex-smoker	Has not smoked a cigarette in past month	No use in past month	Previously classified as a current, past-year or past-month smoker but has not smoked on any day in past month

Smoking measures extracted from included studies

Smoking behaviour measures varied widely across the included studies, and numerous terms were used in the literature to describe smoking behaviours (Table 5.2). Each study was grouped according to its reclassified smoking behaviour, and the following categories were identified: Ever-tried and Past-month (n=4), Ever-tried only (n=2), Past-month and current (n=1), Past-month only (n=15), Current only (n=9), Past-year only (n=2), Ever-tried, Past-year and Past-month (n=1), and Ever-tried and Current (n=2). Past-month only smoking behaviour was the most commonly measured smoking behaviour after re-classification, with 15 studies assessing this type of smoking. There was much consistency in the definition of 'Ever-tried' smoking across the included studies, with most studies describing this type of smoking as 'One or more times' or 'Ever tried/used'.

A number of studies used definitions for different smoking behaviours that did not appear to be overtly distinct from one another. For example, McCarthy et al.[80] defined both 'Established smoking' and 'Experimental smoking' as 'Smoking at least one cigarette in the past 30 days', however only those who indicated smoking more than 100 cigarettes in their lifetime were classified as 'Established smokers'. Both of these smoking behaviour types

were classified as 'Past-month smoking' as this better reflected the time period that respondents were asked to recall smoking behaviour.

Table 5. 2 Smoking behaviour descriptions recategorised

Smoking behaviour(s) assessed	Definition of smoking behaviour terms (summarised)	Recategorised smoking behaviour	Authors
Ever-tried and Past-month (n=4)			
Lifetime use	One or more times in life	Ever-tried	*Bostean et al. (2016)*[81]
Current	One or more times in the past 30 days	Past-month	
Ever use	Ever used	Ever-tried	*Giovenco et al. (2016)*[82]
Past month	Number of days used in past 30 days	Past-month	
Lifetime/Ever use combined	Number of cigarettes smoked in lifetime	Ever-tried	Adams et al. (2013)[83]
Current	Number of days smoked in past 30 days	Past-month	
Ever use	Ever tried once or twice	Ever-tried	Mistry et al. (2015)[84]
Current	Any smoking in the past 30 days	Past-month	
Ever-tried only (n=2)			
Lifetime use	One or more times	Ever-tried	*Bostean et al. (2017)*[85]
Experimental/Daily combined	Smoked at least a few puffs of a cigarette on 2 or more days in the past month	Ever-tried	Lovato et al. (2007)[86]
Past-month and Current (n=1)			
Past month	Smoked in the last four weeks	Past-month	Scully et al. (2013)[10]
Past week	Number of cigarettes smoked on each of the last seven days (if any)	Current	
Past-month only (n=15)			
Past month	Number of days smoked in past 30 days	Past-month	Davis et al. (2015)[87]
Current	Any smoking in the past 30 days,	Past-month	Henriksen et al. (2008)[88]

	number of cigarettes smoked in the past 30 days, number of days smoked, number of cigarettes per day		
Daily[af^]	Smoked every day or almost every day in past 30 days	Past-month	Chan et al. (2011)[89]
Occasional[a]	Smoked some days or only 1 or 2 days in past 30 days	Past-month	
Current: Daily and Occasional combined[a]	Smoked ≥1 cigarette per day in past 30 days/ Smoked ≥1 cigarette in past 30 days	Past-month	Kaai et al. (2013)[90]
Experimental	Smoked in past 30 days	Past-month	
Past month	Number of days smoked in past 30 days	Past-month	Lipperman-Kreda et al. (2014)[19]
Established[a]	Smoked ≥1 cigarette in past 30 days, Average number of cigarettes on smoking days	Past-month	McCarthy et al. (2009)[91]
Experimental	Smoked ≥1 cigarette in past 30 days, Average number of cigarettes on smoking days	Past-month	
Current[a]	Any smoking in the past 30 days	Past-month	Marsh et al. (2016)[92]
Experimental	Any smoking in the past 30 days	Past-month	
Converted non-daily	Previously smoked every day but now smoke non-daily, Days smoked in past 30 days, Cigarettes per day on days smoked	Past-month	Kirchner et al. (2017)[93]
Native non-daily	Only smoke non-daily, Days smoked in past 30 days, Cigarettes per day on days smoked	Past-month	
Current	Any smoking in the past 30 days	Past-month	Brown et al. (2016)[94]
Current[a]	Smoking at least once a month	Past-month	Marsh et al. (2013)[95]
Occasional	Smoked ≥ once in past month but not everyday or almost everyday, no. of cigarettes usually smoked in a typical day of smoking, how often they smoke during the school day, how often they smoke on weekends	Past-month	Leatherdale et al. (2007)[96]

Regular	Smoked everyday or almost everyday in past month, no. of cigarettes usually smoked in a typical day of smoking, how often they smoke during the school day, how often they smoke on weekends	Past-month	
Current	Smoked ≥1 day in past 30 days; Smoked on at least 20 days in the past 30 days; and number of cigarettes per day	Past-month	Loomis et al. (2012)
Current	Any smoking in the past 30 days	Past-month	Novak et al. (2006)[97]
Ever tried/Current combined	Ever tried (including a puff) and current smokers who reported any smoking in past 30 days	Past-month	Schleicher et al. (2016)[58]
Ever tried	Number of cigarettes smoked in lifetime, number of days smoked in past 30 days	Past-month	Adachi-Mejia et al. (2012)[98]
Current only (n=9)			
Daily	Average number of cigarettes per day	Current	Chuang et al. (2005)[99]
Smoker	Daily or occasional smoking	Current	Barnes et al. (2016)[100]
Current	Currently smoke daily or occasionally	Current	Shareck et al. (2016)[101]
Current	Smoke every day or some days	Current	Hosler, A (2009)[77]
Current	Currently smoking	Current	Li et al. (2009)[102]
Smoking prevalence[a]	Smoke every day or some days	Current	Reid et al. (2005)[79]
Smoking prevalence[a]	Smoke every day or some days	Current	Peterson et al. (2005)[103]
Current	Daily or occasional smoking	Current	Marashi-Pour et al. (2015)[104]
Current	Smoke at all currently	Current	Pearce et al. (2016)[105]
Past-year only (n=2)			
Smoker	Smoked >1 cigarette in past 12 months	Past-year	Larsen et al. (2017)[106]

Past 6 month	Initiation of cigarette use in the past 6 months	Past-year	Cantrell et al. (2016)[56]
Ever-tried, Past-year and Past-month (n=1)			
Ever tried	Ever smoked whole cigarette	Ever-tried	Lipperman-Kreda et al. (2012)[107]
Past year	Smoking frequency in past 12 months	Past-year	
Past month	Smoking frequency in past 30 days	Past-month	
Ever-tried and Current (n=2)			
Ever tried[b]	Tried, once or twice, sometimes use (more than once a month) or use often (more than once a week) combined	Ever-tried	*Best et al. (2016)*[108]
Current	Current smoker	Current	
Ever tried	Tried smoking during lifetime	Ever-tried	Shortt et al. (2016)[109]
Current	Smoke at all currently	Current	

[a]Respondents reported smoking at least 100 cigarettes in lifetime, Italics refers to studies focusing on e-cigarette use only, [b]Refers to studies that focus on e-cigarette use and combustible cigarette use.

Tobacco Retailer Density measurements

Of the 36 studies included, tobacco retailer density could be classified into two broad groups: those that measured tobacco retailer density directly from specific geocoded locations, and those that utilised Kernel Density Estimates (KDE) (Table 5.3). KDE is used to create a continuous density surface of the intensity of exposure that takes into account the number of tobacco retailers within the kernel, and weighting them by their proximity from the point of measurement (e.g. from homes or schools).[63, 110]

Thirteen studies assessed tobacco retailer density using circular buffers from geocoded locations (e.g. home or school), with radii ranging from 0.4km to 1.6km in size. The most common measure was a 0.8km (1/2 a mile) radii from schools, with 4 studies using this. The majority of studies analysed direct tobacco retailer density from geocoded locations, including schools (n=16), homes (n=3), or both (n=1), and one study assessed tobacco retailer density from homes and activity spaces. Density within activity spaces for the included study were defined as the mean number of, or proximity to, tobacco retailers across regular activity

locations (e.g. studying, working, grocery shopping, physical activity, leisure activity and two other activities) selected by respondents.[111]

Eight studies directly assessed tobacco retailer density through generating network service areas represented as polygons around geocoded locations including homes, schools and activity spaces using the street network or footpaths to measure a specified distance. These distances ranged from 0.1km to 1.6km.

Four studies assessed direct tobacco retailer density per population (e.g. per 1,000 people to per 10,000 people) using neighbourhoods, cities or counties as the defined geographical area. Five studies assessed direct tobacco retailer density through the number of tobacco retailers per-km of roadway (e.g. per-1.6km to per-50km).

Six studies assessed tobacco retailer density using Kernel Density Estimates (KDE). Three studies measured the number of retailers per population using KDE, two studies measured the number of retailers per-km^2 using KDE, and one study measured the number of retailers per postcode using KDE.

Table 5. 3 Methods for measuring Tobacco Retailer Density

No. of retailers using circular buffers (n=13)		
Geocoded location	**Distance**	**Authors**
School	0.4km	*Bostean et al. (2016)* [81]
School	0.4km, 0.8km and 1.6km	*Bostean et al. (2017)* [85]
School	0.5km	Scully et al. (2013)[10]
School	0.8km	Davis et al. (2015)[87]; *Giovenco et al. (2016)*^ [82]; Adams et al. (2013)[83]; Henriksen et al. (2008)[88]
School	1km	Lovato et al. (2007)[86]; Chan et al. (2011)[89]; Kaai et al. (2013)[90]
Home, School	1.2km and 1.6km	Lipperman-Kreda et al. (2014)[19]
School	1.6km	McCarthy et al. (2009)[91]

Home	1.6km	Chuang et al. (2005)[99]
No. of retailers using polygons (n=8)		
Geocoded location	**Buffer size**	**Authors**
School	0.1km, 0.2km, 0.3km, 0.4km, 0.5km	Mistry et al. (2015)[84]
Home	0.4km	Brown et al. (2016)[94]
Home, Activity Space	0.5km	Shareck et al. (2016)[101]
School	0.5km and 1km	Marsh et al. (2013)[95]; Marsh et al. (2016)[92]
Home	1.6km	Barnes et al. (2016)[100]
School	1.6km	Larsen et al. (2017)[106]
School	Six-block radius	Leatherdale et al. (2007)[96]
No. of retailers per population (n=4)		
Area	**Per population**	**Authors**
County	Per 1,000 youth	Loomis et al. (2012)[78]
City	Sample of 2,116 young people from 178 Census tracts within 80 neighbourhood clusters	Novak et al. (2006)[97]
City	Per 10,000 people	Lipperman-Kreda et al. (2012)[107]
Census blocks	Per 10,000 people	Hosler, A (2009)[77]
No. of retailers per km of roadway (n=5)		
Area	**Per km of roadway**	**Authors**
Neighbourhood planning districts	Per 1.6km of roadway	Li et al. (2009)[102]
Neighbourhood (census tract)	Per 10 kilometres of roadway	Cantrell et al. (2016)[56]
County	Per 50 kilometres of roadway	Reid et al. (2005)[79]
County	Divided by kilometres of roadway	Peterson et al. (2005)[103]

Home, School	No. of retailers within each roadway network buffer divided by the land area (square miles)	Schleicher et al. (2016)[58]
No. of retailers per population using KDE (n=3)		
Area	**Per population using KDE**	**Authors**
Home	Individual measure of proximity-weighted retailer density within 800m radius of geocoded location for each postcode	*Best et al. (2016)*[b] [108]
Home	No. of retailers per 1,000 people using adaptive bandwidth KDE	Adachi-Mejia et al. (2012)[98]
School, Neighbourhood (postal area)	KDE per 1,000 people; median retailer density around schools	Marashi-Pour et al. (2015)[104]
No. of retailers per-km^2 using KDE (n=2)		
Area	**Per km^2 using KDE**	**Authors**
Home, School	Proximity-weighted retailers per-km^2 for each postcode using KDE	Shortt et al. (2016)[109]
Neighbourhood (postcode)	Proximity-weighted retailers per-km^2 for each postcode using KDE	Pearce et al. (2016)[105]
No. of retailers per postcode using KDE (n=1)		
Area	**Per postcode using KDE**	**Authors**
Neighbourhood	KDE to predict retailers and linked to participants' residential ZIP code	Kirchner et al. (2017)[93]

Italics refers to studies focusing on e-cigarette use only, [b]Refers to studies that focus on e-cigarette use and combustible cigarette use.

Discussion

This systematic review described the methods used in the existing literature to capture and measure tobacco retailer density and smoking behaviour. The methods for measuring tobacco retailer density varied across the literature, however the most common approach assessed tobacco retailer density directly through applying circular buffers at varying distances from specific geocoded locations such as homes or schools using GIS software (n=13). Smoking

behaviour was also described in many different ways, however once reclassified by the researchers, past-month smoking behaviour was most frequently captured (n=15).

Smoking behaviour

It was evident in the literature that measuring smoking behaviour was complex and often inconsistent,[76] making it difficult to interpret which smoking behaviours were being assessed. The studies included in this systematic review used a wide range of smoking descriptors, such as experimentation, occasional, non-daily, regular, and daily smoking. For example several studies described 'Current smoking' as 'Any smoking in the past 30 days', while other studies described 'Current smoking' as 'Currently smoke daily or occasionally', with the former considered to reflect 'Past-month smoking' and the latter correctly describing 'Current smoking' once re-classified in the current review.

The most common way that studies measured smoking behaviour was past-month smoking. Self-reported smoking behaviour was the most common data collection method used in the included studies, but this behaviour could have been under-reported due to potential social desirability bias[112] or due to recall decay, particularly if respondents were asked to remember their smoking behaviour over a long period of time (e.g. on how many days in the past 30 days respondents smoked and the average number of cigarettes smoked on those days). It is also worth noting that ever smoking is unlikely to be an accurate measure when examining associations between tobacco retailer density and smoking behaviour, as a respondent might be 25 years of age and tried smoking once at the age of 15 which could have occurred in a different geographical area. Therefore it is recommended that future research only collects data on past 30 day smoking and/or current smoking behaviour.

Consistent approaches towards capturing and classifying different smoking behaviours are important so that comparisons across different geographical areas and amongst different socio-demographic populations can be undertaken. Possible reasons for methodological inconsistencies in capturing smoking behaviour include gaps in the literature to provide clear guidance on best-practice approaches when exploring outcome measures. Although previous research on tobacco retailer density and smoking behaviour has acknowledged these inconsistencies, best-practice solutions are limited and have not been widely adopted in the literature, therefore this aspect may have been overlooked. A guide for surveys that include questions focusing on tobacco use was developed by the Global Adult Tobacco Survey Collaborative Group in 2011,[113] however many of the survey instruments used to collect

data in the included studies may not have utilised this resource when developing smoking-focused questions. This resource could be adopted in future research assessing tobacco retailer density and smoking behaviour.

The modified smoking measures classification tool may not identify subtle differences in wording across various types of smoking behaviour within studies, such as capturing the number of days a participant has smoked. For example the study by Chan et al.[89] defined daily smoking as 'smoking every day or almost every day in the past 30 days' and defined occasional smoking as 'smoking some days or only 1 or 2 days in the past 30 days', however both of these smoking behaviours were reclassified as past-month smoking in the current review as the modified smoking measures classification tool focuses on the recency of smoking behaviour, not the number of days smoked. Therefore the modified smoking measures classification tool is useful for broadly classifying studies according to the timeframe that smoking behaviour occurred, and provides a platform for summarising and sorting these outcome measures, which is a strength. The application of the modified smoking measures classification tool developed for this study would likely allow a much more precise comparison between tobacco retailer density and different smoking behaviours in future systematic reviews and meta-analyses.

Tobacco retailer density

Most included studies focused on assessing tobacco retailer density and smoking behaviour from participants' homes or schools primarily using circular buffers at varying distances, however there are limitations with this approach. Reasons for using varying buffer sizes included practical constraints,[10] the buffer distance was approximately a 10 minute walk from school,[83] or the distance was assumed to be the outer limit that most students would walk or cycle regularly to school.[80] Although the use of circular buffers is a simple and reliable method for measuring tobacco retailer density, studies that measured tobacco retailer density using this approach did not take into account the built environment, which could increase the true travel time or distance to retailers. For example, a participants' home or school could be geographically close to several tobacco retailers using circular buffers; however buildings, fences, highways, waterways or other physical features might prevent direct travel to those retailers, thus increasing the true distance and/or travel time.

Therefore studies that measured density using network service areas (e.g. the street network or footpaths) represented as polygons around geocoded locations appear to be a more valid

and reliable measure of tobacco retailer density, as they take the physical environment into account. Valiente et al.[65] recommend that tobacco retailer density is measured through both length-distance and travel time using the street network and footpaths and weighted by the size of an area, population, or road length, or measured using KDE.[65]

The Uncertain Geographic Context Problem (UGCoP) also represents an inherent limitation in the definition of exposure measures used to analyse the real influence of the environment on population health, and nearly all included studies did not capture data on the time and duration that participants spent within defined areas (e.g. homes or schools) and the length of time spent exposed to tobacco retailers whilst in these areas.[114, 115] Studies focusing beyond participants' home and school environments would likely add value to this field of research and provide a better understanding of how regular interactions with tobacco retailers in the broader environment (i.e. activity spaces) may influence smoking behaviours.[116]

Few studies included in this systematic review assessed possible associations between tobacco retailer density within daily activity spaces and smoking behaviour. Studies focusing only on home or school environments may not take into account adolescents' increased autonomy, mobility and social networks that extend beyond these two settings.[117, 118] Only one study in the current systematic review analysed tobacco retailer density and smoking around homes and activity spaces.[101] The inability of most studies included in the current review to collect data on respondents' movements across activity spaces may be due to the complex technical nature of tracking participants over an extended period of time and over geographically large areas.[114] However smartphone technologies allow real-time data to be easily captured from participants, providing much more detailed information on individuals' interactions with tobacco retailers in the broader environment during day-to-day activities, instead of relying on self-report data.[114, 119]

The included literature also highlighted differences in measuring tobacco retailer density across varying geographical areas, such as urban, regional and rural districts.[77] It has been suggested[98] that tobacco retailer density measures in non-metropolitan areas might need to be adjusted to take into account lower population densities and greater travel distances to tobacco retailers. Although this systematic review did not compare studies by metropolitan or non-metropolitan locations, most studies focused on metropolitan areas, with only two studies[77, 87] analysing associations between tobacco retailer density and smoking behaviour in non-metropolitan settings. Existing research suggests that tobacco retailer density may be

greater in non-metropolitan areas,[5, 120] therefore it is important for future research to explore associations between tobacco retailer density and smoking behaviour in these areas.

Previous research has also identified mixed sensitivity when auditing existing tobacco retailer databases, such as those generated through licensing or registration systems or through commercial sources.[43, 121, 122] It is recommended that future studies attempt to verify all tobacco retailers in existing databases and to identify other potential tobacco retailers operating through field visits within defined geographical areas prior to collecting data on smoking behaviour.[122] This may increase the accuracy of tobacco retailer density and provide a more precise representation of the true exposure to tobacco retailers amongst participants.

The current systematic review did not include longitudinal studies. Longitudinal studies are important to determine whether causal relationships exist between tobacco retailer density, smoking behaviour and cessation amongst both youth and adults, and to identify protective factors that might reduce or prevent associations between tobacco availability and smoking behaviour. Currently it is unclear whether tobacco retailer density has a particular effect on certain types of smoking behaviour, however longitudinal or cohort studies could examine these relationships over time. A recent systematic review[15] included one longitudinal study and found a positive association between tobacco retailer density and smoking.

As our study highlights, and as Marsh et al. also point out, it is possible that inconsistencies with how the outcome measure is defined may play a role in the reported associations between tobacco retailer density and smoking behaviour. The results from existing systematic reviews and meta-analyses should therefore be interpreted with caution and future systematic reviews would be strengthened by a more consistent approach to measuring tobacco retailer density and smoking behaviour in the literature.

Studies were not grouped by country or location and were not categorised according to existing tobacco retail policy approaches, such as minimum pricing legislation, PoS display bans, tobacco advertising bans, tobacco retailer licensing systems or minimum-distance laws. Jurisdictions have taken different approaches to retail tobacco sales legislation and these factors may play important roles in the promotion and normalisation of tobacco products in the community (through advertising, for example).[10] It is also important to recognise that much of the existing tobacco retailer density literature tends to focus on determining whether tobacco retailer density (and/or tobacco retailer proximity) contributes to smoking behaviour,

however it would be appropriate for future research to determine whether certain types of tobacco retailer density (and/or tobacco retailer proximity) policies may prevent smoking behaviour and/or improve smoking cessation outcomes for existing smokers who are attempting to quit.

Conclusions

In conclusion, tobacco retailer density and smoking behaviour were defined and measured in the existing literature using different terms and descriptors. After classification, 'direct' tobacco retailer density using circular buffers at varying distances was the most common approach. It is recommended that tobacco retailer density is measured through length-distance (i.e. generating polygons) and travel time using the street network and footpaths and weighted by the size of an area, population, road length, or using KDE. Future research should also focus on measuring exposure to tobacco retailers in broader activity spaces beyond homes and schools to gain a better understanding of associations between tobacco retailer density and smoking behaviour throughout daily life. After reclassification, past-month smoking was the most common smoking type measured in the literature. The consistent application of a smoking measures classification tool, such as the one developed for this systematic review, would enable better comparisons between studies that assess tobacco retailer density and smoking behaviour. The findings from this systematic review highlight the need for future tobacco retailer density studies to capture, measure and classify exposure measures accurately, and to capture the outcome measures in a manner that makes them comparable with other studies.

Chapter 6 Tobacco retailer density and smoking behaviour in a rural Australian jurisdiction without a tobacco retailer licensing system

Preface

In this chapter, I present an analysis of the association between tobacco retailer density and smoking behaviour in Local Government X. Chapter 4 described the considerable effort I went to in order to identify and geocode the precise location of all tobacco retailers in the municipality. However, time and resource constraints meant I was unable to devote the same attention to measuring smoking behaviour. Instead, I had to rely on data from the Active Living Census (ALC) which was commissioned by Local Government X to assess a range of lifestyle behaviours across a representative sample of the municipality. This led to two important practical limitations to the data I had to analyse. First, only one question was asked about smoking, which meant I was unable to determine the smoking behaviour of respondents with the degree of accuracy I would have liked. Second, the ALC only collected information on the suburb and postcode of each respondents' area of residence, not their actual address. This meant that suburb of residence was the smallest geographic unit for which tobacco retailer density could be measured for each respondent in this study.

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Abstract

Introduction: An emerging body of research has developed around tobacco retailer density and its contribution to smoking behaviour. This cross-sectional study aimed to determine the association between tobacco retailer density and smoking behaviour in a rural Australian jurisdiction without a tobacco retailer licensing system in place.

Methods: A local government database (updated 2018) of listed tobacco retailers (n=93) was accessed and potential unlisted tobacco retailers (n=230) were added using online searches. All retailers (n=323) were visited in 2019 and GPS coordinates of retailers that sold tobacco

(n=125) were assigned to suburbs in ArcMap. A community survey conducted in the Local Government Area provided smoking and socio-demographic data amongst adult respondents (n=8981). Associations between tobacco retailer density (calculated as the number of retailers per km^2 based on respondents' suburb of residence) and daily, occasional and experimental smoking were assessed using multilevel logistic regression analysis. Separate models with and without covariates were undertaken.

Results: Without adjusting for possible confounders, living in suburbs with greater retailer density did not increase the odds of daily smoking (OR = 1.01, 95% CI 0.92- 1.12), occasional smoking (OR = 1.05, 95% CI 0.94 - 1.18), or experimental smoking (OR = 0.98, 95% 0.92- 1.05). However after adjustment, living in suburbs with greater retailer density increased the odds of occasional smoking behaviour (adjusted OR = 1.37, 95% CI 1.10 - 1.71) but not daily or experimental smoking.

Conclusions: This study found a significant positive association between tobacco retailer density and the likelihood of occasional smoking in a rural Australian jurisdiction without a tobacco retailer licensing system in place. The findings strengthen calls for the introduction of a comprehensive, positive tobacco retailer licensing system to provide a framework for improving compliance with legislation and to reduce the overall availability of tobacco products in the community.

Introduction

Tobacco smoking directly causes seven million deaths globally each year, while a further 1.2 million people die from exposure to second-hand smoke.[123] Current consumption patterns estimate that 400 million adults will die from smoking-related illnesses globally by 2050, and smoking will kill approximately 1 billion people by the end of the 21st century.[124] Despite this tobacco products continue to be sold alongside everyday consumer products via an estimated 14 million points of sale (PoS) globally.[125] In response an emerging body of research has developed around the retail availability of tobacco products and its contribution to a range of smoking behaviours including experimentation, uptake and continuation, and the undermining of cessation attempts amongst existing smokers who want to quit.

This literature has focused primarily on tobacco retailer density and how this might influence smoking behaviour. Researchers have taken different approaches to the measurement of density, with some measuring the frequency of tobacco retailers located within circular buffers[10, 19, 87] or polygons (using the street network or footpaths)[84, 94, 101] at specified

distances from geocoded locations (e.g. from participants' homes). Other studies utilise Kernel Density Estimates (KDE) to generate continuous surface maps to model tobacco retailer density,[98, 104, 108] while others still have calculated the number of tobacco retailers within a defined area such as a census tract.[126] Several systematic reviews[15, 62, 64, 65] and a meta-analysis[55] have documented statistically significant associations between tobacco retailer density and smoking behaviour amongst both youth and adults, particularly around participants' homes and activity spaces.

In Australia researchers have explored associations between tobacco retailer density and socio-demographic characteristics at the neighbourhood level, with several studies finding inverse correlations between density and socio-economic status (SES),[5, 104] particularly in rural areas.[6, 7] Other Australian research has explored tobacco retailer density and smoking behaviour, with increased density associated with smoking behaviour.[10, 104] These studies tend to be undertaken in states or territories that have a tobacco retailer licensing or registration system in place, such as New South Wales, Tasmania and Western Australia.[5, 8] Access to existing tobacco retailer databases generated through licensing or registration systems greatly facilitates such research and leads to greater accuracy when enumerating tobacco retailers.[38, 121] Victoria is one of only two jurisdictions in Australia that currently does not have any type of licensing or registration for tobacco retailers,[8] making it difficult for researchers and policymakers to precisely map where the estimated 8000 tobacco retailers are located within this state.[29] It also raises questions around whether smoking behaviour is influenced by the mostly unregulated retail availability of tobacco products in this jurisdiction.

To date only one study has attempted to assess associations between tobacco retailer density and smoking behaviour in Victoria, and this only examined certain business types within a 500 metre radius of schools in a metropolitan student population.[10] Nevertheless the results indicated that tobacco retailer density was associated with a significant increase in the number of cigarettes smoked during the previous seven days amongst students who indicated past-month smoking behaviour, but not past-month smoking in the larger sample.

Thus while previous research provides qualified evidence of an association between tobacco retailer density and smoking, at least in some settings in Australia, and a socio-economic and geographical gradient in tobacco availability,[6] no studies to date have examined tobacco retailer density and its association with smoking behaviour in a rural and regional Victorian

setting, where the rates of smoking and socioeconomic disadvantage are generally higher than metropolitan areas.[4, 127] The purpose of this study was to determine the association between tobacco retailer density and smoking behaviour in a rural and regional population of Victoria.

Methods

This cross-sectional study was undertaken in a regional Local Government Area (LGA) in the State of Victoria, which, to preserve its identity, will be referred to as 'Local Government X'. In Victoria there are 48 regional and rural LGAs, representing approximately 1.6 million people.[128, 129] Local Government X was one of six LGAs that participated in the Healthy Heart of Victoria Active Living Census (ALC).[130] Data collection for the ALC was conducted by an independent third party via an online survey and hardcopy questionnaire booklet between May and July 2019. A census-style approach was taken with respect to sampling, with all households in the region (n=224947 residents) being invited to participate and an overall response rate of 10.9% (n=24541). Microdata from the ALC was provided by Local Government X under a data sharing agreement.

Smoking behaviour

Respondents to the ALC aged 18 years and over were asked only one question in relation to smoking: "Which of the following best describes your smoking status?", with possible responses including "smoke daily", "smoke occasionally", "don't smoke now but used to", "tried a few times but never smoked regularly" or "never smoked". Responses were re-categorised in this analysis into dichotomous outcome variables (yes/no) for each of the following outcomes of interest: "Daily smoker", "Occasional smoker", and "Experimental smoker" (tried a few times but never smoked regularly). Respondents under the age of 18 years were not asked about their smoking behaviour.

Individual-level covariates

Other ALC variables included in the analysis as individual-level covariates were age (18 to 34, 35 to 49, 50 to 69 and 70 years and over), sex (male or female), self-reported health status (poor, fair, good, very good or excellent), self-reported financial position (very poor/poor, just getting along, reasonably comfortable or very comfortable/prosperous), self-reported education level (bachelor or higher, completed Year 12, or did not complete Year 12), self-reported alcohol consumption (daily, less than daily or does not drink), and whether or not respondents identified as an Aboriginal or Torres Strait Islander.

Only ALC respondents who provided valid responses to each of the above questions and who also indicated that their suburb of residence was a valid suburb of Local Government X were included in the analysis. A total of 1845 respondents (17.0%) aged 18 years and over were excluded due to missing values.

Tobacco retailer density

Suburb of residence was the most specific geographic identifier in the ALC; tobacco retailer density was therefore determined at the suburb level by dividing the number of confirmed tobacco retailers in a respondent's suburb of residence (as enumerated below) by the geographic area of that suburb in square kilometres (km^2). Suburbs in this context are officially gazetted boundaries of suburbs in cities and larger towns, and localities elsewhere.[131] In Victoria, there were approximately 2672 suburbs in 2016.[44] The geographic area of each suburb was determined in ArcMap.

An existing database maintained by Local Government X of known tobacco retailers within the municipality (updated in April 2018) was obtained via a Freedom of Information request after sensitive or personal information and enforcement-related information had been redacted. Duplicate listings were removed and internet searches were undertaken between May and August 2019 to identify additional businesses that might also sell tobacco within the municipality. All businesses from the original database, (n=93), and from internet sources, (n=230) were visited between June and August 2019 by the primary researcher who posed as a potential customer. Visual cues (e.g. observing signage such as a price board, a cigarette gantry or working vending machine) or verbal confirmation (e.g. asking the sales assistant) were used to determine whether a business currently sold tobacco. For businesses that only opened seasonally, were geographically distant, or only operated at night, verbal confirmation was attempted via telephone. Four of these retailers were subsequently telephoned by the researcher to determine whether tobacco was sold, and two potential retailers were identified during field visits to other retailers.

A positive assessment was made at a physical premises in which tobacco could be purchased by the general public either at a staffed PoS or through a working vending machine. Excluded from this definition were telephone or internet-based businesses, home-delivery businesses and wholesalers. The exact coordinates of each business confirmed as a tobacco retailer were recorded on site and its suburb was determined in ArcMap. Further details on these methods are available elsewhere.[122]

Suburb-level socioeconomic status

Suburb-level socioeconomic status was derived from the 2016 Australian Bureau of Statistics Index of Relative Socio-Economic Disadvantage (IRSD).[44] Raw IRSD scores were recategorized into quintiles such that there were equal numbers of suburbs in each quintile. Respondents were assigned an IRSD quintile on the basis of their suburb of residence.

Data analysis

Means and standard deviations for tobacco retailer density and frequencies and percentages for each of the covariates were used for descriptive analyses. Given the census-style sampling approach of the ALC, Intraclass Correlations (ICC) were used to assess the extent of clustering of each outcome of interest (daily smoker, occasional smoker and experimental smoker) within households (using the household ID of respondents) and suburbs (using their suburb of residence). The likelihood of each outcome dependent on tobacco retailer density was assessed using single- or multi-level logistic regression analysis, as appropriate. Separate models for each outcome were conducted without and with covariates (Models 1 and 2, respectively). All analyses were conducted using Stata (V15.1).

Results

A total of 8981 respondents were included in the analysis, including 536 daily smokers, 234 occasional smokers and 949 experimental smokers (Table 6.1). Means and standard deviations for tobacco retailer density are reported across the different smoking behaviours, while numbers and percentages are reported for the remaining categorical variables.

Table 6. 1 Tobacco retailer density and sociodemographic and behavioural attributes of respondents

	Daily smoker	Occasional smoker	Experimental smoker	Ex and Never smoker	Total
	n=536	n=234	n=949	n=7262	n=8981
No. of tobacco retailers per km^2, mean (sd)	1.00 (1.28)	1.08 (1.40)	0.98 (1.33)	0.99 (1.39)	0.99 (1.38)
Suburb-level IRSD[a] quintile, n (%)					
Most disadvantaged	217 (40.4)	74 (31.6)	215 (22.6)	1912 (26.3)	2418 (26.9)
Q2	113 (21.0)	44 (18.8)	221 (23.2)	1350 (18.5)	1728 (19.2)
Q3	85 (15.8)	37 (15.8)	172 (18.1)	1341 (18.4)	1635 (18.2)
Q4	70 (13.0)	45 (19.2)	180 (18.9)	1438 (19.8)	1733 (19.3)
Least disadvantaged	51 (9.5)	34 (14.5)	161 (16.9)	1221 (16.8)	1467 (16.3)
Health status, n (%)					
Excellent	16 (2.9%)	24 (10.2%)	127 (13.3%)	867 (11.9%)	1034 (11.5%)
Very good	117 (21.8%)	75 (32.0%)	378 (39.8%)	2648 (36.6%)	3218 (35.8%)
Good	240 (44.7%)	95 (40.6%)	316 (33.3%)	2544 (35.0%)	3195 (35.5%)
Fair	117 (21.8%)	34 (14.5%)	106 (11.1%)	952 (13.1%)	1209 (13.4%)
Poor	46 (8.5%)	6 (2.5%)	22 (2.3%)	251 (3.4%)	325 (3.6%)
Age (years), n (%)					
18-34	127 (23.6%)	88 (37.6%)	353 (37.2%)	1418 (19.5%)	1986 (22.1%)
35-49	159 (29.6%)	70 (29.9%)	247 (26.0%)	1658 (22.8%)	2134 (23.7%)
50-69	221 (41.2%)	63 (26.9%)	275 (28.9%)	2826 (38.9%)	3385 (37.6%)
70 years and over	29 (5.4%)	13 (5.5%)	74 (7.8%)	1360 (18.7%)	1476 (16.4%)
Sex, n (%)					
Male	243 (45.3%)	119 (50.8%)	399 (42.4%)	3082 (42.4%)	3843 (42.7%)
Female	293 (54.6%)	115 (49.1%)	550 (57.9%)	4180 (57.5%)	5138 (57.2%)
Financial position, n (%)					
Prosperous/Very comfortable	42 (7.8%)	32 (13.6%)	178 (18.7%)	1325 (18.2%)	1577 (17.5%)
Reasonably comfortable	235 (43.8%)	118 (50.4%)	544 (57.3%)	4151 (57.1%)	5048 (56.2%)
Just getting along	215 (40.1%)	73 (31.2%)	204 (21.5%)	1608 (22.1%)	2100 (23.3%)
Poor/Very poor	44 (8.2%)	11 (4.7%)	23 (2.4%)	178 (2.4%)	256 (2.8%)

Education level, n (%)					
Bachelor or higher	135 (25.1%)	75 (32.0%)	497 (52.3%)	3252 (44.7%)	3959 (44.0%)
Completed Year 12	215 (40.1%)	107 (45.7%)	313 (32.9%)	2489 (34.2%)	3124 (34.7%)
Did not complete Year 12	186 (34.7%)	52 (22.2%)	139 (14.6%)	1521 (20.9%)	1898 (21.1%)
Alcohol consumption, n (%)					
Daily	84 (15.6%)	22 (9.4%)	55 (5.8%)	528 (7.2%)	689 (7.6%)
Less than daily	361 (67.3%)	194 (82.9%)	805 (84.8%)	5292 (72.8%)	6652 (74.0%)
Does not drink	91 (16.9%)	18 (7.6%)	89 (9.3%)	1442 (19.8%)	1640 (18.2%)
ATSI status, n (%)					
Aboriginal or Torres Strait Islander	17 (3.1%)	4 (1.7%)	13 (1.3%)	56 (0.7%)	90 (1.0%)
Does not identify as ATSI	519 (96.8%)	230 (98.2%)	936 (98.6%)	7206 (99.2%)	8891 (99.0%)

[a]Index of Relative Socioeconomic Disadvantage. ATSI: Aboriginal or Torres Strait Islander. Daily smoker: Smoke daily; Occasional smoker: Smoke occasionally; Experimental smoker: Tried a few times but never smoked regularly; Ex and Never smoker: Don't smoke now but used to and Never smoked, combined.

Clustering was observed for each outcome of interest (daily smoking, occasional smoking and experimental smoking) within households (ICC of 0.60, 0.54 and 0.40, respectively) but not suburbs (ICC of 0.07, 0.02 and 0.01, respectively). Multilevel logistic regression clustering on households was therefore used in subsequent analyses. None of the associations between tobacco retailer density and two of the outcomes of interest (daily smoking and experimental smoking) were statistically significant in either the bivariate or multivariate models (Model 1 and Model 2 in Table 6.2, respectively). However the insignificant association between tobacco retailer density and occasional smoking in the bivariate model (Model 1, Table 6.2: OR = 1.05, 95% CI 0.94 - 1.18) became statistically significant after adjusting for covariates (Model 2, Table 6.2: AOR = 1.37, 95% CI 1.10 - 1.71), suggesting a degree of confounding between tobacco retailer density and occasional smoking that was not apparent with the other outcomes.

The associations between the outcomes of interest and the covariates were mostly in expected directions (Model 2, Table 6.2). For example the odds of reporting daily smoking behaviour significantly increased with decreasing self-reported health status and financial position, while the odds of reporting occasional or experimental smoking behaviour decreased with age, with those aged 70 years and over much less likely than 18 to 35 year-olds to report any

of the smoking behaviours. Similarly the odds of reporting daily or occasional smoking behaviour increased as level of education decreased, although the reverse association was observed for experiential smoking. Females were less likely than males to report occasional smoking, abstainers were less likely than drinkers to report any of the smoking behaviours, and those who did not identify as Aboriginal or Torres Strait Islander were less likely to report daily smoking than those who did.

Table 6. 2 Tobacco retailer density, sociodemographic and behavioural attributes of respondents and the likelihood of different smoking behaviours

	Outcome 1: Daily smoker^		**Outcome 2: Occasional smoker~**		**Outcome 3: Experimental smoker+**	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Model 1: Unadjusted ORs						
No. of tobacco retailers per km^2	1.01	(0.92- 1.12)	1.05	(0.94 - 1.18)	0. 98	(0.92- 1.05)
Model 2: Adjusted ORs						
No. of tobacco retailers per km^2	1.08	(0.93 - 1.26)	1.37*	(1.10 - 1.71)	0.98	(0.89 - 1.08)
IRSD						
Most disadvantaged	Ref		Ref		Ref	
2	0.73	(0.50 - 1.07)	0.68	(0.41 - 1.15)	1.33*	(1.02 - 1.73)
3	0.53*	(0.30 - 0.94)	0.29*	(0.12 - 0.71)	1.10	(0.75 - 1.60)
4	0.44*	(0.29 - 0.68)	0.97	(0.58- 1.63)	1.11	(0.84 - 1.46)
Least disadvantaged	0.35*	(0.21 - 0.56)	0.86	(0.48 - 1.53)	1.14	(0.85 - 1.52)
Health status						
Excellent	Ref		Ref		Ref	
Very good	2.54	(1.32 - 4.91)	0.99	(0.55 - 1.78)	0.99	(0.75 - 1.30)
Good	5.97*	(3.08 - 11.56)	1.26	(0.70 - 2.26)	0.86	(0.65 - 1.15)
Fair	7.80*	(3.84 - 15.83)	1.18	(0.59 - 2.38)	0.87	(0.61 - 1.23)
Poor	11.55*	(5.09 - 26.20)	0.69	(0.22 - 2.15)	0.71	(0.40 - 1.28)
Age (years)						
18-34	Ref		Ref		Ref	
35-49	1.41	(0.98 - 2.03)	0.64	(0.41 - 0.99)	0.55*	(0.44 - 0.69)
50-69	0.92	(0.66 - 1.29)	0.31*	(0.19 - 0.48)	0.36*	(0.29 - 0.46)
70 years and over	0.14*	(0.08 - 0.26)	0.12*	(0.05 - 0.26)	0.23*	(0.16 - 0.32)

Sex						
Male	Ref		Ref		Ref	
Female	0.93	(0.73 - 1.18)	0.65*	(0.47 - 0.90)	1.00	(0.85 - 1.18)
Financial position						
Prosperous/Very comfortable	Ref		Ref		Ref	
Reasonably comfortable	1.41	(0.88 - 2.27)	1.03	(0.61 - 1.74)	0.96	(0.76 - 1.23)
Just getting along	3.04*	(1.82 – 5.08)	1.59	(0.88 - 2.87)	0.93	(0.69 - 1.24)
Poor/Very poor	4.58*	(2.19 – 9.56)	2.68	(0.98 - 7.31)	0.99	(0.54 - 1.81)
Education level						
Bachelor or higher	Ref		Ref		Ref	
Completed Year 12	2.08*	(1.51 - 2.84)	1.97*	(1.33 - 2.91)	0.77*	(0.64 - 0.94)
Did not complete Year 12	2.86*	(2.01 - 4.06)	1.82*	(1.12 - 2.95)	0.68*	(0.53 - 0.87)
Alcohol consumption						
Daily	Ref		Ref		Ref	
Less than daily	0.25*	(0.16 - 0.37)	0.75	(0.41 - 1.37)	1.23	(0.86 - 1.75)
Does not drink	0. 18*	(0.11 - 0.30)	0.25*	(0.11 - 0.55)	0.53*	(0.35 - 0.82)
ATSI status						
Aboriginal or Torres Strait Islander	Ref		Ref		Ref	
Does not identify as ATSI	0.29*	(0.11- 0.73)	1.22	(0.28 - 5.21)	0.64	(0.30 - 1.38)

[a]Index of Relative Socioeconomic Disadvantage. ATSI: Aboriginal or Torres Strait Islander. Daily smoker: smokes daily. Occasional smoker: smokes occasionally. Experimental smoker: tried a few times but never smoked regularly. ^Daily smokers vs all other respondents. ~Occasional smokers vs all other respondents. +Experimental smokers vs all other respondents. *p<0.05.

Discussion

This study was conducted in a regional area of Victoria, which is characterised by higher than average rates of smoking, particularly amongst adolescents, and greater levels of socioeconomic disadvantage.[127, 132] It found that tobacco retailer density was associated with occasional smoking behaviour, but not daily or experimental smoking behaviours. This finding is consistent with studies focusing on adults in other settings, which have found significant, positive associations between tobacco retailer density and current or occasional smoking behaviour.[93, 105]

The findings are also consistent with research involving a similarly disadvantaged population of regional New South Wales[34] which found that nearly three-quarters of ‘current smokers’

(defined as daily, weekly or occasional smokers) reported having a tobacco retailer within walking distance of home, and that younger 'current smokers' were significantly more likely to report the presence of a tobacco retailer nearby. Research in a rural population of the United States[77] also identified an association between 'current smokers' (defined as daily or occasional smoking) and the retail availability of tobacco.

There is also evidence in the literature of a strong association between tobacco retailer density and suburb-level socioeconomic status. Research in Western Australia, for example, has found that suburbs and towns with low socioeconomic status have more than four times the number of tobacco retailers, compared to high socioeconomic status suburbs in both metropolitan and regional areas.[6] Similar research in Tasmania found a disproportionate concentration of tobacco retailers in regional and remote areas and in low socioeconomic areas.[5] This is consistent with the finding that the tobacco industry actively targets poorer communities to market and sell its products.[133, 134]

A possible explanation for reported associations between tobacco retailer density and smoking behaviour therefore, is that smokers tend to live in lower socioeconomic suburbs and lower socioeconomic suburbs tend to have higher tobacco availability. A key strength of the present study is that both individual-level and suburb-level socioeconomic status were controlled for in the analysis thus allowing for the association between tobacco retailer density and smoking behaviour to be observed independently from these factors. Interestingly, in this sample it was only after controlling for these and the other covariates that the association between tobacco retailer density and occasional smoking became significant, suggesting a degree of confounding in the bivariate analysis for this outcome.

A further strength of this study is that it relied on a robust method for enumerating tobacco retailers and hence tobacco retailer density in an environment without a tobacco retailer licencing system in place. This involved physically visiting or contacting (via telephone) a large number of potential retailers, which was both time and resource intensive. It is possible that false-positive or false-negative attributions may have occurred during the site visits; for example retailers may have had visual cues to indicate the sale of tobacco (e.g. signage or a cigarette gantry), but no longer sold tobacco, while other retailers may not have had any visual cues to indicate the sale of tobacco but did actually sell. However this misattribution was unlikely to have been systematic or result in bias.

The main limitation of the present study was that it relied on secondary data to measure smoking behaviour. As respondents' precise residential location was not collected in the ALC, an individual's exposure to tobacco retailers could only be determined by which suburb they lived in. Previous studies have accessed individual participants' geocoded location (e.g. participants' home, school or both), which allows for a more precise measure of the availability of tobacco and its association with smoking behaviours. It is possible that the lack of geographic specificity in the present study diluted the strength of the association between tobacco retailer density and smoking reported here. The ALC also restricted the single smoking behaviour question to respondents aged 18 years and over. Given previous research indicates most people who experiment with smoking do so before the age of 18,[135] the prevalence of experimental smoking is likely to be under-represented in the ALC. One recommendation arising from the present study therefore is that more precise geographic identifiers and more detailed questions about smoking behaviours at all ages be considered in future iterations of the ALC.

Other limitations of the present study include the cross-sectional nature of the study design, which means that causation between exposures and outcomes cannot be inferred from this analysis, and the relatively small numbers of respondents who reported daily, occasional or experimental smoking overall, meaning that the results should be interpreted with caution.

A number of jurisdictions both within Australia and internationally have implemented legislation to allow for the licensing of tobacco retailers. A 'positive' tobacco retailer licensing system requires retailers to register with a government authority by paying an annual fee and is the foundation of a robust framework for ensuring compliance with existing tobacco sales legislation through the creation of accurate databases of active retailers in a given area and the generation of revenue for regular compliance checks, education visits and underage test purchasing activities.[136] A key objective of improved compliance is to reduce the likelihood of sales to minors and prevent experimentation and initiation in this group.[136, 137] A recent study in regional Victoria found that in the absence of a licensing system a large proportion of tobacco retailers is likely to be operating without formal oversight from local authorities whose responsibility it is to ensure compliance.[122]

The other main advantage of a positive tobacco retailer licensing system is that it provides a mechanism for regulating tobacco availability in a community by influencing how many retailers there are and where they are allowed to operate. A study in South Australia, for

example, found a 23.7% decrease in licence uptake and renewal simply by increasing the licensing fee from $A12.00 per year to $A200.00 per year.[39] San Francisco has gone a step further by implementing legislation to cap the number of tobacco retailer licences available per suburb, and to prohibit retailers from selling tobacco within 150m of a school or another retailer.[138, 139] This legislation will gradually reduce the total number of retailers from approximately 1001 to 495 retailers in that city. A key recommendation from the present study therefore is that jurisdictions, including the state of Victoria, adopt international best practice by introducing comprehensive positive tobacco retailer licensing systems to improve retailer compliance with existing tobacco sales legislation and to work towards reducing tobacco availability in the community.

Conclusions

The current study found a significant positive association between tobacco retailer density and the likelihood of occasional smoking in a regional population of Victoria without a tobacco retailer licensing system in place. The findings strengthen calls for the introduction of a comprehensive, positive tobacco retailer licensing system to provide a framework for improving tobacco retailer compliance with legislation and reducing the overall retail availability of tobacco products in the community.

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Conflicts of interest

The authors have each completed and submitted an ICMJE form for disclosure of potential conflicts of interest. The authors declare that they have no competing interests, financial or otherwise, related to the current work. J. Baker reports that he was provided with a scholarship, professional supervision, assistance with the design of the study, data analysis

and interpretation, access to resources such as a computer and printing equipment, library resources and other expertise, and article processing charges by La Trobe University, Bendigo. Furthermore, he reports that he was provided with a scholarship by Australian Government Research Training Program (RTP) Scholarship.

Ethical Approval and Informed Consent

The La Trobe University Human Ethics Committee approved this project (ref HEC18115). Participation in the community survey provided by Local Government X was voluntary and respondents could decline to participate or withdraw from the survey at any time. Respondents were also informed that the data could be analyzed and published by external researchers.

Provenance and peer review

Not commissioned; externally peer reviewed.

Chapter 7 Levels of support for the licensing of tobacco retailers in Australia: Findings from the 2004-2016 National Drug Strategy Household Survey

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Abstract

Assessing public opinion towards tobacco policies is important, particularly when determining the possible direction of future public health policies. The aim of this study was to describe the implementation of tobacco retailer licensing systems by state and territory governments in Australia, and to use the National Drug Strategy Household Survey (NDSHS) to assess levels of public support for a retailer licensing system in each jurisdiction over time and by a range of socio-demographic and behavioural attributes. National and state/territory estimates of public support for a tobacco retailer licensing system were derived as proportions using NDSHS data from 2004 to 2016. The effect of one's jurisdiction of residence on the likelihood of supporting such an initiative in 2016 was assessed using logistic regression while controlling for various socio-demographic and behavioural characteristics. Public support for a tobacco retailer licensing system ranged from a high of 67.2% (95% CI 66.5% – 67.9%) nationally in 2007 and declined to 59.5% (95% CI 58.9% – 60.2%) in 2016. In 2016, support was greatest amongst those from Tasmania, those aged 50 years and older, females, those from the least disadvantaged areas, those living in major cities, never-smokers and never-drinkers. After adjusting for the socio-demographic and behavioural attributes of respondents, those from Queensland were significantly less likely to support a licensing system (adjusted OR = 0.85, 95% CI 0.77 – 0.94) compared to those from other jurisdictions, while those from Tasmania were significantly more likely to support a licensing system compared to those from other jurisdictions (adjusted OR = 1.29 , 95% CI 1.09 – 1.52). A clear majority of the public support a tobacco retailer licensing system, regardless of whether or not such a system is already in place in their jurisdiction of

residence. Tobacco control initiatives other than a retailer licensing system may explain some of the residual variations in support observed between jurisdictions.

Key Words: Tobacco, public opinion, licensing, National drug strategy household survey, Retail, Tobacco policy

Background

Despite Australia being at the forefront of tobacco control initiatives globally since the 1970s, recent data[32] suggests that declines in national daily smoking rates are starting to slow, and further gains may be increasingly hard to achieve. Meanwhile, smoking is still a leading cause of preventable mortality, with 20 933 or 13.3% of deaths in 2015 caused by tobacco use.[32] Tobacco also remains responsible for 9.0% of the total burden of disease in Australia due its role in causing a range of chronic diseases, including heart disease, stroke, cancer, diabetes, emphysema and renal disease.[32]

Contributing to the persistence of smoking as a public health problem is the fact that tobacco products are sold alongside many other everyday consumer items by an estimated 29907 (2014) to 40000 (2014) tobacco retailers across Australia.[29, 33-37] Research in New South Wales (NSW), for example, indicated that there were five times as many tobacco retailers compared to pharmacies, and eight times as many tobacco retailers as there are Australia Post outlets in 2012.[20]

Licensing or registration is mandatory across all jurisdictions of Australia for a number of occupations where public health or safety is a concern, including electricians, civil engineers, dentists, pharmacists, doctors, alcohol retailers, food handlers and gaming operators, however, this is not the case for tobacco retailers.[140, 141] Several researchers have suggested that licensing tobacco retailers can have a beneficial impact on population health when used to regulate the number of retailers, to prevent underage sales, to improve compliance with existing legislation, and as a means to reduce density and proximity in lower socioeconomic (SES) neighbourhoods and near schools.[39, 40]

A number of jurisdictions globally have implemented licensing systems for tobacco retailers, including Singapore, Hungary, France, Finland, New York State, California and San Francisco.[40, 142-145] San Francisco has limited the number of retailer licenses to 45 per suburb, and the sale of tobacco within approximately 150m (500ft) of a school or another retailer is prohibited.[138, 145] In 2013, Hungary implemented legislation to only allow the sale

of tobacco from Government-licensed or designated retailers (called National Tobacco Shops) to reduce youth smoking. It was anticipated that the number of retailers legally allowed to sell tobacco would reduce from 42000 to approximately 7000 retailers.[144]

In Australia, the regulation of tobacco retailers is a state and territory government responsibility, with six out of the eight state and territory jurisdictions having adopted a licensing or registration system for this sector to date.[38] However, the literature about these systems and public attitudes towards them is surprisingly limited. The National Drug Strategy Household Survey (NDSHS) regularly collects data on the personal use of licit and illicit drugs, as well as attitudes and perceptions of drug use and policy in the community.[146, 147] Although this survey has been used to assess attitudes towards alcohol policies previously, to date it has not been used to assess attitudes towards tobacco-related policies.[148-150] The aim of this study was therefore twofold: 1) to describe the implementation of tobacco retailer licensing systems by state and territory governments in Australia, and 2) to use the NDSHS to measure levels of public support for a retailer licensing system in each jurisdiction in Australia over time and by a range of socio-demographic and behavioural characteristics.

Methods

Implementation of licensing for tobacco retailers

Relevant legislation was reviewed to determine the implementation year and annual cost (in Australian Dollars, $A) for existing tobacco retailer licensing systems in each state and territory jurisdiction. This information was supplemented by a submission to the recent Queensland (QLD) Government Inquiry into Tobacco Licensing Arrangements.[38]

Public support for licensing of tobacco retailers

The NDSHS is a triennial nationally representative survey of those aged 12 years and older about issues relating to alcohol and drug use in Australia.[146] Participants are selected through stratified, multistage random sampling of households, with a response rate for the most recent survey of 51.1%.[151] For the 2004, 2007 and 2010 surveys, respondents aged 14 years and older were asked the question, “Thinking now about the problems associated with tobacco use, to what extent would you support or oppose measures such as implementing a licensing scheme for tobacco retailers?” This question was modified in the 2013 and 2016 surveys to “…to what extent would you support or oppose measures such as implementing a *national* licensing scheme for tobacco retailers?” (emphasis added). Response options ranged from “Strongly oppose” to “Strongly support” and included “Don’t know enough to say”.[147]

National and state/territory estimates of public support for a tobacco retailer licensing system between 2004 and 2016 were derived as proportions ("strongly support" and "support" over all responses) using the recommended weighting technique.[146] Ninety-five percent Confidence Intervals (CIs) were calculated using $1.96 \times \sqrt{((\hat{p}(1-\hat{p}))/n)}$, where $\hat{p}$ was the weighted sample proportion and n was the unweighted sample size. The effect of one's jurisdiction of residence on the likelihood of supporting such an initiative ("strongly support" and "support" versus "strongly oppose", "oppose" and "neither support nor oppose") were assessed using logistic regression analysis in SPSS. The following socio-demographic and behavioural attributes were included as possible confounders: age (14–17 years, 18–29 years, 30–49 years, 50 years and over), sex, SES of area of residence (measured in quintiles from most disadvantaged to least disadvantaged using Australian Bureau of Statistics Socio-Economic Indices for Areas [SEIFA] scores), remoteness of area of residence (major cities, inner regional, outer regional/remote/very remote), smoking status (daily smoker, current occasional smoker, ex-smoker, never-smoker) and alcohol use (daily drinker, weekly drinker, less than weekly drinker, ex-drinker for greater than 12 months, never-drinker). Due to differences in the way in which these attributes are recorded in the NDSHS over time, logistic regression analysis was only attempted using a subsample from 2016. The subsample was summarised in terms of unweighted numbers and proportions for each of the attributes, with differences between supporters and others being assessed using chi-square tests.

Results

Implementation of licensing for tobacco retailers

Details about existing tobacco retailer licensing systems in Australia are summarised in Table 7.1. All Australian states and territories required tobacco wholesalers and retailers to pay a fee based on the percentage of the value of tobacco products sold until this regulatory approach was declared constitutionally invalid in 1997. South Australia (SA) was the first jurisdiction to reintroduce a constitutionally valid licensing system in 1998, followed by the Australian Capital Territory (ACT) and Tasmania (TAS) in 2000, the Northern Territory (NT) in 2003, Western Australia (WA) in 2007 and NSW in 2009. Five of the eight jurisdictions (ACT, SA, NT, WA and TAS) have a "positive" licensing system where tobacco retailers are required to apply for registration and pay an annual fee, ranging from $A242.00 (2019-20) in the NT to $A1161.54 in TAS (2019). TAS also requires personal vaporiser retailers (e.g. sellers of electronic cigarettes) to register and pay an annual fee of $A583.20.

WA requires indirect sellers, where the seller and the customer are not in the same location (e.g. sale by fax, telephone or mail order, or via the internet), to also apply for a licence. Two jurisdictions require wholesalers to apply for registration and to pay an annual fee, ranging from $A360.00 in the ACT (2016) to $A715.00 in WA (2019). NSW currently has a "negative" licensing system whereby retailers are simply required to notify the government on a one-off basis if they sell tobacco. No annual fee is payable. Victoria (VIC) and QLD do not have any type of retailer licensing system in place. The QLD Government held an inquiry into tobacco retailer licensing in 2016, but legislation has not been introduced at this stage.[38]

Table 7. 1 Tobacco retailer licensing system by State and Territory in Australia

State/Territory	Licensing system type	Annual cost of licence ($A)	Implementation year
South Australia (SA)	Positive	$A297.00 (2019)[152]	1998[153]
Australian Capital Territory (ACT)	Positive	Retail: $A540.00 (2017-18)[154] Wholesale: $A360.00 (2016)[38]	2000[155]
Tasmania (TAS)	Positive	Tobacco products only: $A1161.54^ (2019) Tobacco products and personal vaporiser products^: $A1161.54 (2019) Personal vaporiser products^ only: $A583.20 (2019)[156]	2000[157]
Northern Territory (NT)	Positive	$A242.00 (2019-20)[158]	2003[159]
Western Australia (WA)	Positive	Retail: $A286.00 Indirect: $A289.00 Wholesale: $A715.00 (2019)[160]	2007[161]
New South Wales (NSW)	Negative	No fee	2009[162]
Queensland (QLD)	No licensing system	Not applicable	Not applicable[38]
Victoria (VIC)	No licensing system	Not applicable	Not applicable[9]

^ Personal vaporiser products include electronic cigarettes (E-cigarettes). Note: Currency is in Australian Dollars ($A).

Support for licensing of tobacco retailers

Public support for a tobacco retailer licensing system has remained above 50% since 2004, when the question was first asked in the NDSHS, ranging from a high of 67.2% (95% CI 66.5% – 67.9%) nationally in 2007 and declining to 59.5% (95% CI 58.9% – 60.2%) in 2016 (Supplementary Table 7.1). The highest level of support in a jurisdiction was 70.2% (95% CI

67.3% – 73.1%) for TAS in 2004; the lowest was 56.1% (95% CI 53.0% – 59.2%) for the NT in 2013, the year the new wording of the question was introduced. Support in the two jurisdictions currently without a tobacco retailer licensing system ranged from a high of 68.2% (95% CI 66.7% – 69.7%) in 2007 and declining to 60.9% (95% CI 59.6% – 62.2%) in 2016 for VIC, and from a high of 66.5% (95% CI 65.0% – 68.1%) in 2007 declining to 56.4% (95% CI 54.8% – 58.0%) in 2016 for QLD.

Table 7.2 summarises the unweighted subsample used in the logistic regression analysis. The distribution of levels of support for a tobacco retailer licensing system in 2016 were found to be different across categories of jurisdiction of residence, age, sex, smoking status and alcohol consumption but not SEIFA quintile or remoteness. In this subsample, support was greatest amongst those from TAS (69.1%), those aged 50 years and older (68.5%), females (68.9%), those from the least disadvantaged areas (70.6%), those living in major cities (68.1%), never-smokers (75.3%), and never-drinkers. Conversely, support was lowest amongst those from the NT (60.7%), those aged between 18 and 29 years (63.0%), males (64.1%), those from the most disadvantaged areas (63.2%), those living in outer regional, remote or very remote areas (61.2%), daily smokers (32.5%), and daily drinkers (57.9%). Support was below 50% only amongst daily and current occasional smokers.

Table 7. 2 Socio-demographic and behavioural attributes of NDSHS respondents in 2016 and support for the implementation of a tobacco retailer licensing system

	Supporters (N=13431)	%	**Others**[a] (N=6712)	%	p value[b]
Jurisdiction of residence					
NSW	3564	67.9	1684	32.1	< 0.001
VIC	3243	68.3	1508	31.7	
QLD	2024	62.7	1206	37.3	
WA	1529	67.1	749	32.9	
SA	1239	66.4	626	33.6	
TAS	647	69.1	290	30.9	
ACT	608	68.8	276	31.2	
NT	577	60.7	373	39.3	
Age (years)					
14-17	405	66.1	208	33.9	< 0.001
18-29	1661	63.0	976	37.0	
30-49	4323	65.4	2290	34.6	
50 years and over	7042	68.5	3238	31.5	
Sex					
Female	7479	68.9	3382	31.1	<0.001
Male	5952	64.1	3330	35.9	
SEIFA Quintile					
1 (Most disadvantaged)	2380	63.2	1388	36.8	0.085
2	2663	65.6	1398	34.4	
3	2624	66.2	1339	33.8	
4	2827	67.5	1363	32.5	
5 (Least disadvantaged)	2937	70.6	1224	29.4	
Remoteness					
Major Cities	9046	68.1	4245	31.9	0.017
Inner regional	2553	66.2	1305	33.8	
Outer regional/Remote/Very remote	1832	61.2	1162	38.8	
Smoking status					
Daily smoker	807	32.5	1673	67.5	<0.001
Current occasional smoker	214	40.5	314	59.5	
Ex-smoker	3663	66.4	1854	33.6	
Never-smoker	8747	75.3	2871	24.7	
Alcohol consumption					
Daily drinker	820	57.9	597	42.1	<0.001
Weekly	4970	63.5	2857	36.5	
Less than weekly	4774	67.8	2267	32.2	
Ex-drinker (>12 months)	1263	69.7	550	30.3	
Never-drinker (full glass)	1604	78.4	441	21.6	

Note: Numbers are unweighted. SEIFA: Socio-Economic Index for Areas. [a] Includes Oppose, Strongly Oppose and Neither Support nor Oppose. Excludes those who answered "Don't know enough to say" (n=2157).[b] Derived from Pearson's chi-square tests for categorical variables.

Without controlling for the different socio-demographic and behavioural attributes of respondents, those living in QLD (unadjusted OR = 0.79, 95% CI 0.72 – 0.86) and the NT (unadjusted OR = 0.73, 95% CI 0.63 – 0.84) were significantly less likely to support a licensing system than those living in other jurisdictions (Model 1, Table 7.3). However, once the different socio-demographic and behavioural attributes of respondents were taken into account (Model 2, Table 7.3), those from QLD were significantly less likely to support a licensing system (adjusted OR = 0.85, 95% CI 0.77 – 0.94) compared to those from other jurisdictions, while respondents from TAS were significantly more likely to support a licensing system compared to those from other jurisdictions (adjusted OR = 1.29, 95% CI 1.09 – 1.52).

Table 7. 3 Support for the implementation of a tobacco retailer licensing system by socio-demographic and behavioural attributes of NDSHS respondents in 2016

	Odds Ratio (OR)	**95% C.I.**	**p value**
Model 1: Unadjusted ORs			
Jurisdiction of residence			<0.001
NSW	1.00		
VIC	1.01	(0.93 – 1.10)	0.710
QLD	0.79	(0.72 – 0.86)	<0.001
WA	0.96	(0.86 – 1.07)	0.500
SA	0.93	(0.83 – 1.04)	0.242
TAS	1.05	(0.90 – 1.22)	0.491
ACT	1.04	(0.89 – 1.21)	0.609
NT	0.73	(0.63 – 0.84)	<0.001
Model 2: Adjusted ORs			
Jurisdiction of residence			<0.001
NSW	1.00		
VIC	1.04	(0.95 – 1.13)	0.393
QLD	0.85	(0.77 – 0.94)	0.002
WA	0.97	(0.87 – 1.09)	0.687
SA	0.92	(0.82 – 1.04)	0.223
TAS	1.29	(1.09 – 1.52)	0.003
ACT	0.98	(0.83 – 1.16)	0.856
NT	0.98	(0.81 – 1.18)	0.858
Age (years)			< 0.001
14-17	1.00		
18-29	1.50	(1.22 – 1.83)	<0.001
30-49	1.88	(1.55 – 2.29)	<0.001
50 years and over	2.10	(1.73 – 2.54)	<0.001
Sex			
Females	1.00		
Males	0.89	(0.83 – 0.95)	<0.001

SEIFA Quintile			0.085
1 (Most disadvantaged)	1.00		
2	1.06	(0.96 – 1.17)	0.251
3	1.05	(0.95 – 1.16)	0.295
4	1.09	(0.99 – 1.21)	0.072
5 (Least disadvantaged)	1.16	(1.04 – 1.29)	0.006
Remoteness			0.17
Major Cities	1.00		
Inner regional	0.97	(0.88 – 1.06)	0.509
Outer regional/Remote/Very remote	0.85	(0.76 – 0.95)	0.004
Smoking status			< 0.001
Daily smoker	1.00		
Current occasional smoker	1.50	(1.23 – 1.82)	<0.001
Ex-smoker	3.94	(3.55 – 4.36)	<0.001
Never-smoker	5.92	(5.37 – 6.53)	<0.001
Alcohol status			< 0.001
Daily drinker	1.00		
Weekly	1.05	(0.92 – 1.19)	0.435
Less than weekly	1.25	(1.10 – 1.42)	0.001
Ex-drinker (>12 months)	1.39	(1.19 – 1.62)	<0.001
Never-drinker (full glass)	1.82	(1.54 – 2.16)	<0.001

SEIFA: Socio-Economic Index for Areas.

Discussion

This study has described the implementation of different tobacco retailer licensing systems by Australian state and territory governments in recent years and has assessed levels of support for such policies over time and by various socio-demographic and behavioural attributes of respondents. The findings indicate that despite an inconsistent approach to this issue by governments, a clear majority of the public are supportive of a tobacco retailer licensing system, regardless of whether or not such a system is already in place in their jurisdiction of residence. While there is variation between jurisdictions in levels of support, this variation is attenuated in the case of QLD, which has no licensing system, or disappears altogether in the

case of NT, which has a positive licensing system, when the different socio-demographic and behavioural attributes of the respective populations are taken into account. Levels of support in TAS on the other hand, which also has a positive licensing system, become significantly higher after controlling for these factors. Tobacco control initiatives by state and territory governments other than a retailer licensing system may explain some of these residual variations.

The study also revealed majority support for the licensing of tobacco retailers across nearly all categories of the socio-demographic and behavioural attributes analysed (with the exception of current smokers), with the highest likelihood of support amongst those respondents from TAS, those aged 50 years and over, females, those from high-SES areas [SEIFA], those living in major cities, never smokers and never drinkers. The patterns of support across these attributes reflected broader trends in the social determinants of health, with levels of support increasing with increasing urbanicity and SES advantage. Only about one-third of current smokers indicated support for a retailer licensing system, but this group only made up less than 15% of the population. These patterns are important to consider as Australian research suggests there is greater tobacco retailer density and higher smoking rates in lower-SES areas and regional and remote areas.[5-7, 104, 163]

Our findings also indicate that around two-thirds of those aged 14-17 years were supportive of a tobacco retailer licensing system. The minimum purchasing age for tobacco products in Australia is 18 years, however recent research found that 9% of 12-15 year-old smokers purchased cigarettes themselves, and this figure increased to 24% amongst 16-17 year-old weekly smokers,[164] suggesting that many retailers are not adhering to the relevant legislation. Chapman and Freeman [141] argue that tobacco retailer licensing should be implemented and heavily restricted, with a potential loss of licence for breaches of conditions. Retailer compliance with tobacco control laws such as preventing sales to minors, the sale of illicit tobacco, and the promotion of tobacco products could be improved through the implementation of a positive licensing system that generates a sustainable revenue cycle, as recommended by Quit Victoria.[29] An Australian study found a reduction in attempted tobacco purchases amongst minors when there was sustained and vigorous enforcement of underage sales legislation.[48]

Without a comprehensive tobacco retailer licensing system in NSW, VIC and QLD, it is difficult to accurately determine both the number of retailers in these jurisdictions and how

many are complying with the relevant legislation at any point in time. Quit Victoria has estimated that there were approximately 8,000 retailers in VIC alone in 2014.[29] Local governments throughout VIC are provided with funding to undertake regular compliance checks, education visits and test purchasing amongst tobacco retailers. However, these activities only target retailers known to local government, whereas research suggests that it is the others that are less likely to comply with relevant tobacco retailing laws.[166] Recent research in NSW, for example, identified one unlisted tobacco retailer for every 12.6 registered retailers, and those unlisted retailers were significantly more likely to breach in-store legislation.[43] Retailers in more disadvantaged areas were also more likely to breach in-store regulations than those operating in less disadvantaged areas. This suggests that a negative licensing system does not improve compliance with existing retail legislation, nor does it necessarily lead to the accurate identification of all tobacco retailers.[43]

A number of best-practice solutions to reduce the density of tobacco retailers would be facilitated by the adoption of more consistent tobacco retailer licensing policies in Australia, including limiting the number of retailers within specified geographical areas, imposing minimum-distance requirements for retailers near schools, creating a maximum number of retailers proportional to population size, and limiting the types of businesses that can sell tobacco. Such initiatives could be adopted and enforced at the local level, in an approach that is similar to the one adopted to address alcohol availability in VIC.[40, 167, 168] It would seem, therefore, that the introduction of a comprehensive, positive tobacco retailer licensing system is the logical next step towards further strengthening tobacco control measures in NSW, VIC and QLD. Policy-makers in these jurisdictions should find encouragement in the high levels of public support for such policies and also by research in SA, which demonstrates that the number of tobacco retailer licences purchased or renewed can be reduced simply by increasing tobacco retailer licensing fees to as little as $A200.00 per annum.[39]

A report commissioned by the Federal Government in 2002 identified difficulties in nominating a constitutional head of power to oversee responsibility for the implementation of a tobacco retailer licensing system at the national level.[169] Despite this, the report urged the Federal Government to legislate for a tobacco retailer licensing system that overrides all existing state and territory approaches, whilst emphasising the importance of setting a licensing fee at an acceptable rate to ensure that it is not simply a revenue-raising exercise.[169] Such an initiative by the Federal Government would be consistent with the

World Health Organization's (WHO) Framework Convention on Tobacco Control (FCTC), which promotes the implementation of *"…licensing, where appropriate, to control or regulate the production and distribution of tobacco products in order to prevent illicit trade."*[12]

This study has used data from the NDSHS, which is a nationally representative survey of the attitudes and behaviours of Australians in relation to drug use with a reasonable response rate. However, the NDSHS data collection methodologies have changed over time, which may explain some of the trends presented. In 2004 and 2007, for example, the personal interview methodology was removed, with only 'Drop and Collect' and 'Computer-Assisted Telephone Interview' (CATI) methods employed. For 2010 and 2013, data were collected using only the Drop and Collect methodology. For 2016, a multi-mode collection approach was used, with respondents completing the survey online, via telephone or by paper.[146] It is not clear how these different methodologies might influence responses to the question about the implementation of a tobacco retailer licensing system.

The findings are also limited by the way in which the NDSHS determines support for the implementation of a tobacco retailer licensing system: only one question was asked in relation to this hypothetical policy and no additional contextual information was provided. For example, respondents were not told whether a positive or negative licensing system was being proposed, whether retailers would be required to pay and annual registration fee, the cost of the fee, what that fee might be used for, or whether wholesalers would also be licensed. Many respondents from jurisdictions that already have a retailer licensing system in place may not be aware of this and their responses might change if this information had been provided.

Finally, there were also minor differences in the way the question was worded in the survey over time, with an emphasis on a 'national' licensing system from 2013 onwards. Again, it is not clear how these differences might influence responses before and after the change.

Conclusions

The slowing decline in Australian smoking rates in recent years suggests the need for renewed investment in tobacco control activities.[32, 170] To further reduce smoking rates, Australian policy makers should consider reducing the availability of tobacco products through policies that have been shown to influence the density of tobacco retailers in communities.[170] This study has demonstrated consistent and widespread public support for

the licensing of tobacco retailers while other studies have demonstrated the impact of such policies on tobacco product availability, particularly amongst minors. The uniform adoption of a comprehensive, positive licensing system for tobacco retailers across jurisdictions would seem to be a useful next step towards further strengthening tobacco control measures in Australia.

Ethics approval and consent to participate

Written or verbal informed consent was required from an adult (18 years and over, usually parent or legal guardian) responsible for participants aged 12 to15 years at the time of the NDSHS survey. The La Trobe University Human Ethics Sub-Committee approved this project (Ref S17–215).

Consent for publication

Not applicable.

Availability of data and materials

The data that support the findings of this study are available from the Australian Data Archive but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Australian Data Archive. Please contact the Australian Data Archive to request permission (ada@anu.edu.au).

Competing interests

Mohd Masood is an Associate Editor of BMC Public Health.

Funding

This research was undertaken as part of PhD candidature at La Trobe University, Bendigo. La Trobe University provided the primary researcher with a scholarship, professional supervision, assistance with the design of the study, data analysis and interpretation, access to resources such as a computer and printing equipment, library resources, and other expertise. This research was supported by an Australian Government Research Training Program (RTP) Scholarship.

Authors' contributions

JB and SB analysed and interpreted the NDSHS data, and were major contributors in writing the manuscript. MM and MAR provided guidance and expertise when reviewing several

drafts of the manuscript. All authors contributed to the conception and design of the work, and read and approved the final manuscript.

Acknowledgements

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Abbreviations

ACT: Australian Capital Territory; CIs: Confidence Intervals; E-cigarette: Electronic cigarettes; FCTC: Framework Convention on Tobacco Control; NDSHS: National Drug Strategy Household Survey; NSW: New South Wales; NT: Northern Territory; QLD: Queensland; SEIFA: Socio-Economic Indices for Areas; SES: Socioeconomic Status; SA: South Australia; TAS: Tasmania; VIC: Victoria; WA: Western Australia; WHO: World Health Organization

Supplementary Table 7. 1 National and state/territory estimates of support for a tobacco retailer licensing system between 2004 and 2016

	Year of survey				
	2004	**2007**	**2010**	**2013**	**2016**
	N, % (95% CIs)	N, % (95% CIs)	N, % (95% CIs)	N, % (95% CIs)	N, % (95% CIs)
NSW	6240, 65.6 (64.5 – 66.8)	5159, 66.6 (65.4 – 67.9)	7224, 67.1 (66.0 – 68.2)	6110, 63.3 (62.1 – 64.5)	5795, 60.5 (59.2 – 61.8)
VIC	4804, 64.6 (63.2 – 65.9)	3833, 68.2 (66.7 – 69.7)	5257, 64.7 (63.4 – 66.0)	4856, 62.3 (60.9 – 63.6)	5279, 60.9 (59.6 – 62.2)
QLD	4626, 64.5 (63.2 – 65.9)	3395, 66.5 (65.0 – 68.1)	5203, 62.1 (60.8 – 63.4)	4020, 58.9 (57.3 – 60.4)	3573, 56.4 (54.8 – 58.0)
WA	2275, 63.0 (61.0 – 64.9)	1863, 69.7 (67.7 – 71.8)	2320, 63.7 (61.7 – 65.6)	2378, 60.0 (58.1 – 62.0)	2511, 59.9 (58.0 – 61.8)
SA	1845, 66.5 (64.3 – 68.6)	1498, 64.9 (62.5 – 67.3)	1929, 64.0 (61.8 – 66.1)	1805, 58.8 (56.6 – 61.1)	2105, 58.3 (56.2 – 60.4)
TAS	940, 70.2 (67.3 – 73.1)	889, 68.6 (65.6 – 71.7)	1002, 68.7 (65.8 – 71.5)	1070, 62.8 (59.9 – 65.7)	1037, 60.6 (57.6 – 63.6)
ACT	939, 66.2 (63.2 – 69.3)	936, 66.7 (63.7 – 69.7)	996, 69.4 (66.5 – 72.2)	1018, 63.2 (60.2 – 66.1)	982, 60.6 (57.6 – 63.7)
NT	839, 62.4 (59.1 – 65.7)	776, 60.3 (56.8 – 63.7)	980, 63.3 (60.2 – 66.3)	977, 56.1 (53.0 – 59.2)	1030, 56.8 (53.8 – 59.8)
Total	22508, 65.0 (64.4 – 65.7)	18349, 67.2 (66.5 – 67.9)	24911, 64.9 (64.3 – 65.5)	22234, 61.4 (60.7 – 62.0)	22312, 59.5 (58.9 – 60.2)

Proportion indicating support (95% CI). [a] Weighted by absolute person weight (Weight 7).

Chapter 8 Discussion

The overarching purpose of this thesis was to explore what happens when there is limited regulatory oversight of tobacco retailers in an already disadvantaged community. Four related studies using a variety of designs were completed. In this chapter I provide an overview of my findings and discuss the key implications. I then present the strengths and limitations of my research and recommendations for further work in this area. I conclude with a discussion on some of the impact my research has already had on tobacco control policy development in Australia.

Overview of findings

The key finding of Study 1 (Chapter 4) was that a large proportion (43.2%) of tobacco retailers that were operating in Local Government X were likely doing so without appropriate government oversight. Statistically significant differences were found between retailers that receive such oversight and those that do not by business and sales type, but not by other characteristics. Significant time and resources were required to complete this study because of the absence of a tobacco retailer licensing system in Victoria.

Study 2 (Chapter 5) was undertaken in preparation for Study 3 and sought to describe the methodological approaches used to measure both tobacco retailer density and smoking behaviour in the existing literature on the association between these variables. Significant heterogeneity was found in the operationalisation of both measures. Most studies assessed tobacco retailer density directly from geocoded locations using circular buffers at various distances, whilst past-month smoking behaviour was the most common smoking behaviour captured.

Study 3 (Chapter 6) drew on results from Studies 1 and 2 to analyse associations between tobacco retailer density and smoking behaviour in Local Government X. The key findings of this study were that, after adjusting for possible confounders including individual and suburb-level SES, living in suburbs with greater tobacco retailer density increased the odds of being an occasional smoker. Time and resource constraints meant that the smoking variable could not be analysed with the desired level of precision in this study.

The final study (Chapter 7) found overwhelming support for a national tobacco retailer licensing system in a representative sample of the Australian population. In 2016,

respondents from the lowest SES areas (63.2%), those living in regional (66.2%) and remote areas (61.2%), and 60.9% of Victorians indicated support for such a system.

Taken together, these findings support calls for the introduction for a tobacco retailer licensing system in Victoria. Several policy and methodological implications arise from these findings, as discussed below.

Policy implications

Compliance with retail tobacco sales legislation

Local Government X receives funding to visit only 36 tobacco retailers each financial year. If the figure from the original database provided by Local Government X is used (n=93), each listed tobacco retailer in Local Government X can expect to be visited approximately once every 2.5 years. This means that the vast majority of listed tobacco retailers are not checked on a regular basis (e.g. repeated visits during each financial year) and that unlisted retailers are unlikely to be formally inspected by Environmental Health Officers.

The absence of regular education visits and compliance checks is likely to create an environment where adherence to retail tobacco sales laws is not seen as important, particularly if the perceived likelihood of being fined or prosecuted for non-adherence is low.[49] Although not reported in Chapter 4, apparent breaches of tobacco sales legislation were observed at a number of retailers nonetheless. This included retailers not displaying the mandated signage[9] or retailers not appearing to adhere to the legislation on vending machine distance or location from a PoS. This is consistent with patterns found in New South Wales where more than one-quarter (26.6%) of tobacco retailers audited were non-compliant with at least one retail tobacco sales policy, and unlisted tobacco retailers were significantly more likely to be non-compliant than listed retailers.[43]

Funding implications

The introduction of a tobacco retailer licensing system might overcome some of the limitations with the current approach to funding the tobacco control activities of local governments in Victoria. For example, if a licensing fee was introduced, the income generated could be distributed back to local governments for the purposes of regular education visits, compliance checks and underage test purchasing. Currently tobacco control activities are a cost to the state budget. The introduction of a licensing fee would create additional revenue sourced from those retailers who are selling tobacco products. If the same

licensing fee as is used in the Northern Territory, which currently has the lowest annual retailer fee in Australia ($242.00 in 2019/20), was in place in Victoria, then Local Government X could receive up to $30,000 in licensing fees alone, which is approximately twice the amount it currently receives. If these funds were distributed on the basis of the actual number of tobacco retailers registered in each municipality, this would provide further incentive for local governments to ensure that all tobacco retailers are registered.

Retail tobacco availability

The introduction of a tobacco licensing fee as part of a positive tobacco retailer licensing system would likely see a reduction in the overall number of tobacco retailers operating within Local Government X. Research in South Australia[39] found that a large increase in the licensing fee resulted in a large decrease in the number of mostly low-volume retailers renewing their tobacco retailer licence, therefore reducing overall tobacco availability in the community. A licensing fee would need to be appropriately set to ensure that expenses to enforcement related activities such as education visits, compliance checks and underage test purchasing are covered. As supermarkets and tobacconists have the largest market share of tobacco in Australia,[50] it is unlikely that a flat rate licensing fee would discourage these high-volume, high-turnover retailers from continuing to sell tobacco, therefore other approaches to encourage these businesses to abandon tobacco sales may need to be explored in future research.[171] The next section will discuss best-practice tobacco retailer licensing systems adopted in other jurisdictions to encourage retailers to stop selling tobacco, and to reduce overall tobacco retailer density and tobacco retailer proximity broadly within the community, in low-SES areas and near schools.

Best-practice tobacco retailer licensing

Although contemporary tobacco retailer licensing systems have been in place across a number of Australian states and territories since 1998, jurisdictions in other countries have been more progressive in this area.

The US State of California requires all tobacco retailers to hold a licence, and in 2014, the City of San Francisco also introduced legislation to limit the overall number of local tobacco retailer licences available.[138] The tobacco retailer licensing system is designed to reduce tobacco retailer density and tobacco retailer proximity and create an enforcement system that has a quantifiable impact on the number of tobacco retailers operating. San Francisco's licensing system does not revoke licences from existing tobacco retailers, however it relies on

the attrition of retailers that currently hold licences, and very limited exceptions exist for the issuing of new licences. The legislation also restricts any retailers from selling tobacco within 150m of schools and other tobacco retailers. Small retailers that surrender their licence are supported to transition to sell healthy and fresh food options, with resources provided by Healthy Retail San Francisco.[138] As part of the tobacco retailer density policy development in San Francisco, the district with the fewest tobacco retailers was identified (n=37) and a maximum cap of 45 tobacco retailers per district was set. The total number of retailers will gradually reduce by nearly 50%, from approximately 972 retailers to 495 retailers over a period of 10 to 15 years, and within the first 10 months, the number of tobacco retailer licences in San Francisco had reduced by 8%.[138]

Similar to Australia, supermarkets in The Netherlands make up approximately 55% of all tobacco sales.[50, 172] The Netherlands recently introduced legislation to phase out the sale of tobacco products through vending machines by 2022 and across approximately 6,400 supermarkets operating in the country by 2024.[172, 173] It is anticipated that a phase-out of the sale of tobacco products in petrol stations will also occur after the ban on supermarket sales has come into effect, with the aim to eventually limit tobacco sales to specialist retailers only.[173]

In Australia, states and territories with tobacco retailer licensing systems already in place do not currently limit the number of tobacco retailer licences issued, nor is legislation in place to mandate minimum-distance requirements to other tobacco retailers or to schools for example. As a licensing system is not in place in Victoria, authorities are unable to introduce policies to regulate or cap the number of retailers selling tobacco, implement minimum-distance regulations, or phase out the sale of tobacco products from certain business types to reduce overall tobacco availability in the community. Therefore, a number of policy and methodological recommendations focusing on addressing retail tobacco availability and smoking behaviour in Victoria will be discussed in the next section.

Policy recommendations

Enforcement responsibilities

Despite the significant harms caused by tobacco use in the community, it could be argued that a lenient approach towards monitoring its sale and supply is taken when compared to liquor sales, as Environmental Health Officers are tasked with ensuring compliance for many aspects of public health. In contrast to tobacco sales legislation, liquor licensing regulations

are enforced by dedicated compliance inspectors. These inspectors are mandated through the VCGLR to visit liquor-licensed premises throughout Victoria to ensure compliance with the Liquor Control Reform Act 1998.[174] Police also undertake compliance checks to ensure liquor licensed premises are adhering to the legislation. It is recommended that roles dedicated to tobacco retailer compliance are created, similar to Tobacco Enforcement Officers which operate in Canada for example.[175] The creation of dedicated Tobacco Licence Inspectors could assist Environmental Health Officers to visit tobacco retailers operating in each Local Government Area within Victoria.

Similar to liquor licensing in Victoria, the issuing of tobacco retailer licences should include conditions that align with existing retail tobacco policies. This would create greater accountability for retailers, and breaches could be appropriately aligned with warnings, penalties or the cancellation of a licence if tobacco retailers are found to be consistently in breach of applicable sales laws. The introduction of a licensing system would also ensure that tobacco retailers are regularly checked, therefore increasing the likelihood of identifying non-compliant retailers and working with retailers to identify and address breaches in a timely manner.

Tobacco retailer licensing

As there is a strong SES gradient to tobacco use,[134] with lower-SES areas and non-metropolitan areas typically having higher smoking rates, Victoria could set a tobacco retailer licensing fee according to suburb-level SES. Combined with tobacco retailer density (and tobacco retailer proximity) restrictions, this would likely result in an overall decrease in tobacco availability in low-SES areas, although this has not been tried elsewhere. The city of San Francisco found that the introduction of a cap on the number of tobacco retailer licences will likely have the largest impact on tobacco availability in low-SES neighbourhoods. The two poorest districts currently have the largest number of tobacco retailers operating, however as this policy gradually comes into effect, these districts will progressively witness the greatest decline in retailers, from 180 tobacco retailers to 45 retailers respectively.[138] Within the first 10 months of this policy being implemented, one of those districts saw a 13% reduction in tobacco retailer licences.

Methodological recommendations

Tobacco availability data

As discussed in Chapter 3, the survey instrument piloted for Chapter 4 and subsequently abandoned was designed to collect data on the operating hours of each tobacco retailer in Local Government X. The collection of this data would have provided information on tobacco availability across different suburbs at different times of the day by different retailer types. Previous research[34] suggests that the extended opening hours of certain business types (e.g. supermarkets, petrol stations and convenience stores) may contribute to the ease of purchasing tobacco products at any time of the day. It is recommended that future research captures this data to determine whether retail tobacco availability changes at different times of the day across areas.

Usual place of purchase

Collecting data on the types of businesses that different types of smokers usually purchase tobacco products from may play an important role in understanding retail tobacco availability and purchasing behaviours, particularly as young people and those from lower-SES groups are typically more price-sensitive.[176, 177] Research in New South Wales[178] assessed pricing differences across neighbourhoods and found evidence of significantly lower cigarette prices in some retailer types, in lower SES areas, and in areas with a greater proportion of people under 18 years of age. Although not significant, the study found cigarette prices were lower in non-metropolitan areas, which is broadly in contrast to prices of other consumer goods which are typically more expensive in non-metropolitan areas. Similarly, research in Queensland[18] found evidence of price discounting for tobacco products in the lowest SES suburbs, however this difference did not remain significant when the average price was compared according to retailer type. This has important implications in terms of understanding how retail access to tobacco amongst minors, those from non-metropolitan areas and those living in lower-SES groups may influence smoking behaviour.

Although different tobacco retailer types may be located near smokers' homes, research suggests that supermarkets are preferred by adult smokers. A study conducted in New South Wales[34] found that more than half (55.3%) of current smokers usually or always purchased tobacco from supermarkets, while approximately 20% usually or always purchased from petrol stations, convenience stores or milk bars, and 15% usually or always purchased tobacco from a tobacconist. As discussed in Chapter 4, supermarkets made up 55% of the

total market share of tobacco sales in Australia in 2017.[50] In the same study, more than half of smokers reported never impulse-buying tobacco, however those who reported purchasing on impulse were more likely to be younger, single, smoke less than 10 cigarettes a day, had made a quit attempt in last 2 years, and intended to quit in the next month rather than never quit.

These findings have important implications for future research on the retail availability of tobacco and how this may influence smoking behaviour, as certain business types might be preferred by different types of smokers and amongst those living in non-metropolitan areas. It is recommended that research investigates whether this might be the case, particularly in non-metropolitan and lower-SES areas where tobacco availability appears to be greater[5, 34] and cigarette prices may be discounted.[178, 179] It is recommended that future research collects data on smokers' usual place of purchase for tobacco, and different business types could be weighted according to the likelihood of tobacco sales within defined geographical areas. This would identify business types that are likely to have the greatest market share of tobacco sales, and provide clearer evidence on associations between tobacco retailer density and/or tobacco retailer proximity and smoking behaviour.

Strengths and limitations

Strengths and limitations of each study have previously been covered in the relevant chapters of this thesis. This section will focus on the strengths and limitations of the overall thesis.

Many studies focusing on tobacco retailer density and smoking behaviour have been undertaken in metropolitan settings. In Australia, non-metropolitan areas are typically more disadvantaged and have higher smoking rates than metropolitan areas. Despite the overwhelming public health evidence of inequity and inequality between metropolitan and non-metropolitan areas in Australia, one of the major research gaps highlighted in this thesis was the paucity of research on tobacco retailer density and its association with smoking behaviour in non-metropolitan areas of Australia. A strength of this thesis is that it attempted to fill this gap. Future research on retail tobacco availability and smoking behaviour amongst low-SES groups in Australia will be able to build on this evidence.

A further strength of this thesis is that it demonstrated is possible to audit the completeness of an existing database of tobacco retailers using a combination of online sources and extensive fieldwork. Although this was time consuming and involved driving large distances, it produced a highly accurate database of tobacco retailers operating in a jurisdiction that does

not have any form of licensing or registration system. These methods could be replicated in either metropolitan or non-metropolitan settings in future studies.

Several unexpected ethical constraints arose during the planning phase of this thesis. First, the La Trobe University Human Ethics Committee imposed an informed consent model of data collection when an observational model was more appropriate. Second, the Committee severely restricted the scope of data that could be collected to remove the possibility of recording illegal activity. Collecting the proposed range of variables would have allowed a deeper analysis of the associations between retail tobacco availability and smoking behaviour and comparisons between known and unlisted tobacco retailers in Local Government X. The La Trobe University Human Ethics Committee's decision to prevent sharing of the updated tobacco retailer database with Local Government X was similarly unhelpful. This decision is likely to have created unnecessary duplication of work for EHOs who are already operating with limited capacity and resources; it appeared to put commercial interests first and did not take into consideration the benefits to public health, and it did not recognise the strong partnership the supervision team and I had formed with Local Government X.

A further limitation arose from the reliance on the Active Living Census for capturing smoking behaviour in Local Government X. In early 2019 I was asked to provide suggestions for the forthcoming iteration of this survey. I suggested that the survey instrument include questions about smoking frequency (how often), intensity (how many cigarettes), and recency (when participants last smoked), whether participants had made recent quit attempts, and the usual place of purchase that smokers purchase tobacco from. This information would have provided further context in relation to the potential associations between tobacco retailer density and smoking behaviour amongst respondents. Also discussed at the time was the possibility of asking for street address in addition to suburb of residence. Unfortunately, these suggestions were not incorporated due to the limited length of the survey.

Outcomes from this research

Throughout my time as a PhD candidate and after attending at the Oceania Tobacco Control Conference (OTCC) in Sydney in 2019, it became clear that there was an appetite amongst tobacco control advocates in Victoria and Queensland for research focusing on the implications arising from failing to regulate the retail availability of tobacco.

Whilst at the OTCC I was offered the role of Assistant News Analysis Editor for the Tobacco Control Journal. This has provided an opportunity to collaborate with colleagues working in

tobacco control globally to write news articles on tobacco industry interference, tobacco advertising and sponsorship, the introduction of tobacco control policies, and breaches of existing tobacco control policies by the tobacco industry for example. I have included some of this work as appendices, further showcasing my passion for tobacco control advocacy more broadly (Appendix E and Appendix F). I have gained insight into retail tobacco policies that are being implemented internationally, such as the planned phase-out of tobacco products from supermarkets in The Netherlands.

I presented on two draft studies (Chapters 5 and 7) at the OTCC and have kept in contact with a number of colleagues who work in the areas of research, advocacy and policy development in the retail tobacco availability field both within Australia and internationally. After the study in Chapter 7 was published, a copy was sent to these colleagues. This resulted in my primary supervisor and I meeting virtually with representatives from Cancer Council Queensland's advocacy team to provide further context around the national and Victorian retail tobacco availability landscape. I was also informed by a colleague from Quit Victoria that the Director of Quit Victoria had sent a copy of the study to the Victorian Health Minister's office for consideration.

Further correspondence with a representative from Quit Victoria led to the decision to provide a draft version of the study in Chapter 4 for internal use prior to the study being published. Quit Victoria provided positive feedback on the draft study and felt that it would be very useful for their advocacy efforts. I also provided the Department of Health with a draft version of the study for internal use prior to the study being published. Once the study in Chapter 4 was published, a media release was circulated by Quit Victoria and La Trobe University (Appendix G). I was interviewed by the Bendigo Advertiser and a newspaper article was published on this research (Appendix G). I participated in a radio interview with ABC Goulburn-Murray about the study which was subsequently broadcast throughout non-metropolitan Victoria. Healthy Greater Bendigo also included brief news items about the studies in Chapters 4 and 6 in the April and June editions of their online newsletters (Appendix G).

A copy of the study was sent to representatives from Local Government X as they had indicated a strong interest in holding discussions with Quit Victoria to determine how they could support advocacy for the introduction of a tobacco retailer licensing system in Victoria. I arranged a virtual meeting between Quit Victoria and Local Government X to discuss this

further. I was asked to present at a virtual meeting organised by Local Government X on retail tobacco availability and discussed findings from the study in Chapter 4 with Environmental Health Officers and health promotion workers from the hospital. I also provided Local Government X with a one-page policy brief providing recommendations for the introduction of a tobacco retailer licensing system (Appendix H).

I later presented at a virtual forum attended by representatives from Local Government X, the hospital, community health and Quit Victoria to discuss advocacy roles to support the introduction of a tobacco retailer licensing system in Victoria. Attendees were interested in developing an advocacy plan, which Quit Victoria and Local Government X are now leading.

In April 2021 I received correspondence from a representative within Local Government X to determine whether I was able to provide them with a GIS file of all tobacco retailers operating within the Local Government Area as part of a larger public health project that they were planning. As the Ethics committee did not allow us to provide Local Government X with an updated tobacco retailer database, I had to decline the request. This further highlights the issues discussed in Chapter 3 and Chapter 8, whereby decisions by the Ethics committee have impacted Local Government X in relation to research and public health responsibilities. However, the examples above illustrate the impact that this research has already had on Local Government X and there is clearly an appetite for further research in this area.

In June 2021 I emailed a colleague at the Cancer Council Queensland with links to the studies included in Chapters 4 and 6. He subsequently forwarded these studies to the manager of prevention strategy at Queensland Health and representatives from The Heart Foundation Queensland.

I was also invited by ABC Radio Melbourne to participate in an interview on ‘The Conversation Hour’ program focusing on how Victoria could reduce smoking rates further. Unfortunately due to a Coronavirus outbreak within the state of Victoria and the imminent announcement of lockdown restrictions, the interview was postponed. After it was rescheduled, I was informed by the producer that the direction of the program had shifted, however I would be kept in mind for future interviews.

In May 2021 I was invited to present at the Healthy Systems Network meeting in June organised by the City of Greater Bendigo, with a particular focus on how my research can address systems change and collective impact. Approximately 55 people attended the 45

minute virtual presentation, including a representative from the Department of Health. I subsequently received an invitation to present to the Tobacco Control Unit of the Department of Health at the end of July 2021, which is a fantastic opportunity to further the impact of my research. I accepted this invitation and am currently preparing a presentation.

Conclusion

Although significant tobacco control progress has been made in Victoria and smoking rates are at record lows, the adoption of comprehensive policies to address the mostly unregulated retail availability of tobacco products in the community could make it both a national and global leader in tobacco control. The findings in this thesis support calls for the introduction of a comprehensive tobacco retailer licensing system in Victoria to facilitate compliance with existing tobacco sales legislation and to move towards better regulation of the availability of tobacco products in Victorian communities, particularly in non-metropolitan and disadvantaged areas of the state. Whilst it is too soon to know where the meeting with the Department of Health might lead in this regard, it is a very promising first step.

Chapter 9 Appendices.

Appendix A. Ethical approval for Chapters 4 and 6: Tobacco retailer density and smoking behaviour in a rural Australian jurisdiction without a tobacco retailer licensing system and Identifying tobacco retailers in the absence of a licensing system: lessons from Australia.

John Baker

From:	humanethics@latrobe.edu.au
Sent:	Friday, June 15, 2018 9:57 AM
To:	Steve Begg
Cc:	John Baker; Mohd Masood; Aziz Rahman
Subject:	HEC18115 - New Application - Approved

** This is an automatically generated email, please do not reply. Contact details are listed below.**

Dear Stephen Begg,

The following project has been assessed as complying with the National Statement on Ethical Conduct in Human Research. I am pleased to advise that your project has been granted ethics approval and you may commence the study.

Application ID: HEC18115
Application Status/Committee: University Human Ethics Committee

Project Title: Addressing Access and Availability of Tobacco in Rural Victoria: Primary Data Collection and Analysis

Chief Investigator: Stephen Begg

Other Investigators: John Baker, Mohd Masood, Dr Muhammad Aziz Rahman

Date of Approval: 15/06/2018
Date of Ethics Approval Expiry: 15/06/2023

The following standard conditions apply to your project:

- Limit of Approval. Approval is limited strictly to the research proposal as submitted in your application.

- Variation to Project. Any subsequent variations or modifications you wish to make to your project must be formally notified for approval in advance of these modifications being introduced into the project.

- Adverse Events. If any unforeseen or adverse events occur the Chief Investigator must notify the UHEC immediately. Any complaints about the project received by the researchers must also be referred immediately to the UHEC.

- Withdrawal of Project. If you decide to discontinue your research before its planned completion, you must inform the relevant committee and complete a Final Report form.

- Monitoring. All projects are subject to monitoring at any time by the University Human Ethics Committee.

- Annual Progress Reports. If your project continues for more than 12 months, you are required to submit a Progress Report annually, on or just prior to 12 February. The form is available on the Research Office website. Failure to submit a Progress Report will mean approval for this project will lapse.

- Auditing. An audit of the project may be conducted by members of the UHEC.

- Final Report. A Final Report (see above address) is required within six months of the completion of the project.

You may log in to ResearchMaster (https://rmenet.latrobe.edu.au) to view your application.

Should you require any further information, please contact the Human Research Ethics Team on:
T: +61 3 9479 1443| E: humanethics@latrobe.edu.au.

Warm regards,

Human Research Ethics Team
Ethics, Integrity & Biosafety, Research Office

LA TROBE UNIVERSITY

Research Office

To	Stephen Begg
From	University Human Ethics Committee
HEC Number	HEC18115
Project title	Addressing Access and Availability of Tobacco in Rural Victoria
Subject	Modification request dated 11.03.2019 received from John Baker re: 1) Change to data collection method from detailed informed consent model to purely observational study design 2) Waiver of consent 3) We will no longer be providing [redacted] with an updated list of names and addresses of tobacco retailers in the municipality
Date	11 April 2019

The modification to this project submitted above was **approved** by the **University Human Ethics Committee**.

If this project is a multicentre project you must forward a copy of this letter to all Investigators at other sites for their records.

Please note that all requirements and conditions of the original ethical approval for this project still apply.

Should you require any further information, please contact the Human Research Ethics Team on:
T: +61 3 9479 1443 | E: humanethics@latrobe.edu.au.

La Trobe University wishes you every continued success in your research.

Warm regards,

David Finlay
Chair, University Human Ethics Committee

LA TROBE UNIVERSITY

Research Office

To	Steve Begg
From	SHE College Human Ethics Sub-Committee
HEC Number	S17-215
Project title	Addressing Access and Availability of Tobacco in Rural Victoria: Secondary Data Analysis
Subject	Modification request received from Steve Begg dated 02.07.2018 re: (1) Addition datase[redacted]Vellbeing Survey 11 ,14, 15)
Date	16 July 2018

The modification to this project submitted above was **approved** by the **SHE College Human Ethics Sub-Committee**.

If this project is a multicentre project you must forward a copy of this letter to all Investigators at other sites for their records.

Please note that all requirements and conditions of the original ethical approval for this project still apply.

Should you require any further information, please contact the Human Research Ethics Team on:
T: +61 3 9479 1443| E: humanethics@latrobe.edu.au.

La Trobe University wishes you every continued success in your research.

Warm regards.

Tanya Serry
Chair, SHE College Human Ethics Sub-Committee

Appendix B. Ethical approval for Chapter 7: Levels of support for the licensing of tobacco retailers in Australia: Findings from the 2004-2016 National Drug Strategy Household Survey.

LA TROBE UNIVERSITY

Research Office

To	Steve Begg
From	SHE College Human Ethics Sub-Committee
HEC Number	S17-215
Project title	Addressing Access and Availability of Tobacco in Rural Victoria: Secondary Data Analysis
Subject	Modification request received from Steve Begg dated 02.07.2018 re: (1) Addition dataset [redacted] Vellbeing Survey 11 ,14, 15)
Date	16 July 2018

The modification to this project submitted above was approved by the SHE College Human Ethics Sub-Committee.

If this project is a multicentre project you must forward a copy of this letter to all Investigators at other sites for their records.

Please note that all requirements and conditions of the original ethical approval for this project still apply.

Should you require any further information, please contact the Human Research Ethics Team on:
T: +61 3 9479 1443| E: humanethics@latrobe.edu.au.

La Trobe University wishes you every continued success in your research.

Warm regards,

Tanya Serry
Chair, SHE College Human Ethics Sub-Committee

Appendix C. Search strategy and results table for Chapter 5: Tobacco retailer density and smoking behaviour: how are exposure and outcome measures classified in the existing literature? A Systematic Review.

#	Search strategy and results: CINAHL (EBSCO)	Results	Search Type
1	Outlet density AND smoking	24	Standard
2	Retail density AND smoking	9	Standard
3	Smoking AND convenience store	36	Standard
4	Smoking OR tobacco AND density	0	Standard
5	Tobacco outlet density AND smoking	22	Standard
6	Tobacco retailer density AND smoking	10	Standard
#	**Search strategy and results: Cochrane**	**Results**	**Search Type**
1	Outlet density AND smoking	3	Standard
2	Retail density AND smoking	3	Standard
3	Smoking AND convenience store	5	Standard
4	Smoking OR tobacco AND density	274	Standard
5	Tobacco outlet density AND smoking	3	Standard
6	Tobacco retailer density AND smoking	1	Standard
#	**Search strategy and results: Medline (Ovid)**	**Results**	**Search Type**
1	Tobacco retailer density AND smoking	10	Standard
2	Outlet density AND smoking	35	Standard
3	Retail density AND smoking	4	Standard
4	Smoking AND convenience store	16	Standard
5	Smoking OR tobacco AND density	0	Standard
6	Tobacco outlet density AND smoking	26	Standard
#	**Search strategy and results: ProQuest**	**Results**	**Search Type**
1	Outlet density AND smoking	10	Standard
2	Retail density AND smoking	16	Standard
3	Smoking AND convenience store	37	Standard
4	Tobacco outlet density AND smoking	10	Standard

5	Tobacco retailer density AND smoking	8	Standard
6	Smoking OR tobacco AND density	0	Standard
#	**Search strategy and results: PsycArticles (Ovid)**	**Results**	**Search Type**
1	Outlet density AND smoking	2	Standard
2	Retail density AND smoking	0	Standard
3	Smoking AND convenience store	7	Standard
4	Tobacco outlet density AND smoking	0	Standard
5	Tobacco retailer density AND smoking	0	Standard
6	Smoking OR tobacco AND density	0	Standard
#	**Search strategy and results: PsychINFO (Ovid)**	**Results**	**Search Type**
1	Outlet density AND smoking	28	Standard
2	Retail density AND smoking	4	Standard
3	Smoking AND convenience store	15	Standard
4	Tobacco outlet density AND smoking	0	Standard
5	Tobacco retailer density AND smoking	9	Standard
6	Smoking OR tobacco AND density	0	Standard
#	**Search strategy and results: PubMed**	**Results**	**Search Type**
1	Outlet density AND smoking	44	Standard
2	Retail density AND smoking	44	Standard
3	Smoking AND convenience store	39	Standard
4	Tobacco outlet density AND smoking	43	Standard
5	Tobacco retailer density AND smoking	20	Standard
6	Smoking OR tobacco AND density	0	Standard
#	**Search strategy and results: Scopus**	**Results**	**Search Type**
1	Outlet density AND smoking	67	Standard
2	Retail density AND smoking	54	Standard
3	Smoking AND convenience store	97	Standard
4	Tobacco outlet density AND smoking	60	Standard
5	Tobacco retailer density AND smoking	37	Standard
6	Smoking OR tobacco AND density	0	Standard

#	Search strategy and results: Web of Science	Results	Search Type
1	Outlet density AND smoking	268	Standard
2	Retail density AND smoking	126	Standard
3	Smoking AND convenience store	146	Standard
4	Tobacco outlet density AND smoking	162	Standard
5	Tobacco retailer density AND smoking	85	Standard
6	Smoking OR tobacco AND density	0	Standard
#	**Search strategy and results: SocINDEX**	**Results**	**Search Type**
1	Outlet density AND smoking	14	Standard
2	Retail density AND smoking	7	Standard
3	Smoking AND convenience store	11	Standard
4	Tobacco outlet density AND smoking	13	Standard
5	Tobacco retailer density AND smoking	5	Standard
6	Smoking OR tobacco AND density	0	Standard

Appendix D. Summary of studies for Chapter 5: Tobacco retailer density and smoking behaviour: how are exposure and outcome measures classified in the existing literature? A Systematic Review.

Title	Author	Year	Data collection year	Country	Study design	Sample size	Sample age	Quality assessment rating
A comparison of individual versus community influences on youth smoking behaviours: a cross-sectional observational study	Adachi-Mejia, A. M.; Carlos, H. A.; Berke, E. M.; Tanski, S. E.; Sargent, J. D.	2012	2007	USA	Cross-sectional	3,646	13-18 years	Fair
A tale of two urbanicities: Adolescent alcohol and cigarette consumption in high and low-poverty urban neighborhoods	Davis, B; Grier, S.	2015	2003-2005	USA	Cross-sectional	10,000	12-17 years	Fair
Association Between Electronic Cigarette Marketing Near Schools and E-cigarette Use Among Youth	Giovenco, D.; Casseus, M; Duncan, D.; Coups, E.; Lewis, M.J; Delnevo, C.	2016	2014	USA	Cross-sectional	3,909	9-12 grade	Good
Banning tobacco sales and advertisements near educational institutions may reduce students' tobacco use risk: evidence from Mumbai, India	Mistry, R; Pednekar, M; Pimple, S; Gupta, P; McCarthy, W; Raute, L; Patel, M; Shastri, S.	2015	2010	India	Cross-sectional	1,533	8-10 grade	Good
Characteristics of tobacco retailers in New Zealand	Marsh, L; Doscher, C; Robertson, L.	2013	2011-2012	New Zealand	Cross-sectional	NR	15 years and over	Fair
Density and Proximity of Tobacco Outlets to Homes and Schools: Relations with Youth Cigarette Smoking	Lipperman-Kreda, S; Mair, C; Grube, J.; Friend, K.; Jackson, P; Watson, D	2014	2009-2010	USA	Cross-sectional	1,543 (2009) and 1,312 (2010)	13-18 years	Good
Density of tobacco retail outlets near schools and smoking behaviour among secondary school students	Scully, M; McCarthy, M; Zacher, M; Warne, C; Wakefield, M; White, V.	2013	2008	Australia	Cross-sectional	2,044	12-17 years	Good
Density of Tobacco Retailers Near Schools: Effects on Tobacco Use Among Students	McCarthy, W; Mistry, R; Lu, Y; Patel, M; Zheng, H; Dietsch, B.	2009	2003-2004	USA	Cross-sectional	19,306	Middle school and High school	Good
Does exposure to cigarette brands increase the likelihood of adolescent e-cigarette use? A cross-sectional study	Best, C; van der Sluijs, W.; Haseen, F.; Eadie, D.; Stead, M.; MacKintosh, A. M.; Pearce, J.; Tisch, C.; MacGregor, A.; Amos, A.; Miller, M.; Frank, J.; Haw, S.	2016	2014	United Kingdom	Cross-sectional	1,404	Secondary 2 (mean age 14.0 years) and Secondary 4 (mean age 15.9 years)	Good
E-cigarette specialty retailers: Data to assess the association between retail environment and student e-cigarette use	Bostean, G; Crespi, C.; Vorapharuek, P; McCarthy, W.	2017	2013-2014	USA	Cross-sectional	67,701	Grades 7, 9 and 11	Good
E-cigarette use among students and e-cigarette specialty retailer presence near schools	Bostean, G; Crespi, C.; Vorapharuek, Patsornkarn; McCarthy, William J.	2016	2013-2014	USA	Cross-sectional	67,701	Grades 7, 9 and 11	Good
Effects of neighbourhood socioeconomic status and convenience store concentration on individual level smoking	Chuang, Y.; Cubbin, C.; Ahn, D.; Winkleby, M. A.	2005	1979-1990	USA	Cross-sectional (multiple)	8,121	25–74 years	Fair
Exploration of the Link Between Tobacco Retailers in School Neighborhoods and Student Smoking	Adams, M; Jason, L.; Pokorny, S; Hunt, Y.	2013	2002	USA	Cross-sectional	10,662	Grades 7-10	Good

Is adolescent smoking related to the density and proximity of tobacco outlets and retail cigarette advertising near schools?	Henriksen, L; Feighery, E; Schleicher, N.; Cowling, David W.; Kline, Randolph S.; Fortmann, Stephen P.	2008	2005-2006	USA	Cross-sectional	24,875	High school	Good
Is neighbourhood access to tobacco outlets related to smoking behaviour and tobacco-related health outcomes and hospital admissions?	Barnes, R; Foster, S; Pereira, G; Villanueva, K; Wood, L.	2016	2003–2009	Australia	Cross-sectional	12,270	18 years and over	Good
Local Tobacco Policy and Tobacco Outlet Density: Associations With Youth Smoking	Lipperman-Kreda, S; Grube, J; Friend, K.	2012	2000* and 2009*	USA	Cross-sectional	1,491	13-16 years	Good
Retail food availability, obesity, and cigarette smoking in rural communities	Hosler, A.	2009	2003 and 2000-2005	USA	Cross-sectional	274	NR	Fair
Retail tobacco outlet density and youth cigarette smoking: a propensity-modeling approach	Novak, S; Reardon, S; Raudenbush, S; Buka, S.	2006	1995-1999	USA	Cross-sectional*	2,116	11-23 years	Good
Small-area estimation and prioritizing communities for tobacco control efforts in Massachusetts	Li, W; Land, T; Zhang, Z; Keithly, L; Kelsey, J.	2009	1999-2005	USA	Cross-sectional*	55,467	18 years and over	Good
Smoking and binge-drinking among adolescents, Ontario, Canada: Does the school neighbourhood matter?	Larsen, K; To, T; Irving, H; Boak, A; Hamilton, H; Mann, R; Schwartz, R; Faulkner, G.	2017	2013	Canada	Cross-sectional	6,142	Grades 9-12	Good
The added value of accounting for activity space when examining the association between tobacco retailer availability and smoking among young adults	Shareck, M; Kestens, Y; Vallee, J; Datta, G; Frohlich, K.	2016	2011-2012	Canada	Cross-sectional	1,994	18-25 years	Good
The association between the density of retail tobacco outlets, individual smoking status, neighbourhood socioeconomic status and school locations in New South Wales, Australia	Marashi-Pour, S; Cretikos, M; Lyons, C; Rose, N; Jalaludin, B; Smith, J.	2015	2008-2011	Australia	Cross-sectional	29,375	16 years and over	Good
The density of tobacco retailers and its association with attitudes toward smoking, exposure to point-of-sale tobacco advertising, cigarette purchasing, and smoking among New York youth	Loomis, B; Kim, A; Busey, A; Farrelly, M; Willett, J; Juster, H.	2012	2000-2008	USA	Cross-sectional	70,427	9-17 years	Fair
The density of tobacco retailers in home and school environments and relationship with adolescent smoking behaviours in Scotland	Shortt, N. K.; Tisch, C.; Pearce, J.; Richardson, E. A.; Mitchell, R.	2016	2010-2011	United Kingdom	Cross-sectional	20,446	Secondary 2 and Secondary 4	Fair
The Moderating Role of Gender in the Relationship Between Tobacco Outlet Exposure and Tobacco Use Among African American Young Adults	Brown, Q; Milam, A.; Bowie, J; Ialongo, N; Gaskin, D; Furr-Holden, D.	2016	2009	USA	Cross-sectional	283	21-24 years	Good

Tobacco outlet density and converted versus native non-daily cigarette use in a national US sample	Kirchner, T; Anesetti-Rothermel, A; Bennett, M; Gao, H; Carlos, H; Scheuermann, T; Reitzel, L; Ahluwalia, J.	2017	2012	USA	Cross-sectional	2,376	25 years and over	Fair
Tobacco outlet density and smoking prevalence: Does racial concentration matter?	Reid, R; Peterson, N; Lowe, John; Hughey, J.	2005	2000-2002	USA	Cross-sectional	NR	Adults*	Fair
Tobacco outlet density, cigarette smoking prevalence, and demographics at the county level of analysis	Peterson, N; Lowe, J; Reid, R.	2005	2000-2002	USA	Cross-sectional	3,662	18 years and over	Good
Tobacco outlet density near home and school: Associations with smoking and norms among US teens	Schleicher, N; Johnson, T; Fortmann, S; Henriksen, L.	2016	2011-2012	USA	Cross-sectional	2,771	13-16 years	Good
Tobacco Point-of-Purchase Marketing in School Neighbourhoods and School Smoking Prevalence: A Descriptive Study	Lovato, C; Hsu, H; Sabiston, C; Hadd, V; Nykiforuk, C.	2007	NR	Canada	Cross-sectional	22,318	Grades 10-11	Fair
Tobacco Retail Environments and Social Inequalities in Individual-Level Smoking and Cessation Among Scottish Adults	Pearce, J; Rind, E; Shortt, N; Tisch, C; Mitchell, R.	2016	2008-2012	United Kingdom	Cross-sectional	28,751	16 years and over	Good
Tobacco retail outlet density and risk of youth smoking in New Zealand	Marsh, L; Ajmal, A; McGee, R; Robertson, L; Cameron, C; Doscher, C.	2016	2012	New Zealand	Cross-sectional	27,238	14-15 years	Good
Tobacco Retail Outlet Density and Young Adult Tobacco Initiation	Cantrell, J., Pearson, J. L., Anesetti-Rothermel, A., Xiao, H., Kirchner, T. R., & Vallone, D.	2016	2012-2013	USA	Cross-sectional	4,288	18-34 years	Good
Tobacco retailer density surrounding schools and cigarette access behaviors among underage smoking students	Leatherdale, S; Strath, J.	2007	2000-2001	Canada	Cross-sectional	20,297	Grades 9-12	Good
Tobacco retailer density surrounding schools and youth smoking behaviour: a multi-level analysis	Chan, W.; Leatherdale, S.	2011	2005-2006	Canada	Cross-sectional	26,924	Grades 9-12	Good
Using student and school factors to differentiate adolescent current smokers from experimental smokers in Canada: A multilevel analysis	Kaai, S; Leatherdale, S; Manske, S; Brown, S.	2013	2008-2009	Canada	Cross-sectional	5,440	Grades 9-12	Good

NR =Not Reported. *Not specified.

Appendix E. Tobacco Control Journal Worldwide News and Comment editions.

https://tobaccocontrol.bmj.com/content/28/1/3

https://tobaccocontrol.bmj.com/content/29/1/3

https://tobaccocontrol.bmj.com/content/29/2/127

https://tobaccocontrol.bmj.com/content/28/3/241

https://tobaccocontrol.bmj.com/content/29/3/247

https://tobaccocontrol.bmj.com/content/29/4/363

https://tobaccocontrol.bmj.com/content/29/5/483

https://tobaccocontrol.bmj.com/content/29/6/601

https://tobaccocontrol.bmj.com/content/30/1/4

https://tobaccocontrol.bmj.com/content/30/2/121

https://tobaccocontrol.bmj.com/content/28/3/241

https://tobaccocontrol.bmj.com/content/30/3/241

Appendix F. Tobacco Control Blog articles.

https://blogs.bmj.com/tc/2019/12/01/world-pmi-in-global-motorsport-smoke-free-pr-spin/

https://blogs.bmj.com/tc/2019/02/16/chevrons-barcodes-and-arrows-pmis-continued-subliminal-promotion-of-combustible-products/

https://blogs.bmj.com/tc/2020/07/03/tobacco-industry-lobbies-bangladesh-government-agency-to-champion-its-business-during-covid-19-pandemic/

https://blogs.bmj.com/tc/2020/07/04/waterpipe-tobacco-waste-as-a-source-of-toxic-contaminants-in-the-environment/

https://blogs.bmj.com/tc/2020/09/05/spain-covid-19-prompts-smoking-regulation-in-streets-and-terraces/

https://blogs.bmj.com/tc/2020/11/18/global-tobacco-industry-interference-index-highlights-csr-and-lack-of-transparency/

https://blogs.bmj.com/tc/2020/11/21/philip-morris-and-the-government-of-canada-collaborate-on-covid-19-vaccine-development/

https://blogs.bmj.com/tc/2021/01/20/monitoring-and-exposing-tobacco-industry-interference-in-u-s-public-policy/

Appendix G. Media coverage for 'Identifying tobacco retailers in the absence of a licensing system: lessons from Australia' study and 'Tobacco retailer density and smoking behaviour in a rural Australian jurisdiction without a tobacco retailer licensing system' study.

Identifying tobacco retailers in the absence of a licensing system: lessons from Australia study:

https://mailchi.mp/dc645053df6b/healthy-greater-bendigo-newsletter-april-2021?e=ff670759a7

https://www.bendigoadvertiser.com.au/story/7114220/study-reveals-alarming-hole-in-tobacco-retail-oversight/

https://www.latrobe.edu.au/news/articles/2021/release/study-reveals-lack-of-tobacco-oversight

https://www.quit.org.au/news/study-reveals-alarming-lack-government-regulation-tobacco-products-victoria/

Tobacco retailer density and smoking behaviour in a rural Australian jurisdiction without a tobacco retailer licensing system study:

https://mailchi.mp/f7cd087bb136/healthy-greater-bendigo-june-2021?e=ff670759a7

Appendix H. One-Page Policy Brief for Local Government X.

Possible Policy Recommendations for the Introduction of a Tobacco Retailer Licensing System in Victoria: [redacted]

John Baker (PhD Candidate), La Trobe Rural Health School: College of Science, Health and Engineering.
J.Baker@latrobe.edu.au

Background

- Tobacco is sold by an estimated 29,907 to 40,000 retailers in Australia (2014); however only some jurisdictions have tobacco retailer licensing systems (RLS) in place.[1]
- Victoria and Queensland are the only States or Territories without a RLS or registration system in place, despite approximately 8,000 tobacco retailers operating in each state respectively.[1] All other states (except New South Wales [NSW]) have adopted a "positive" retailer licensing system: retailers are required to register and pay an annual fee (ranging from $242.00 in the Northern Territory to $1161.54 in Tasmania).[1] NSW requires retailers to register once-off, and no fee is paid.
- RLSs have been used in other jurisdictions to facilitate compliance with tobacco-related legislation, to regulate the number of retailers, and to reduce tobacco availability in lower socioeconomic (SES) neighbourhoods and near schools.[2,3]
- Zoning and planning regulations do not currently take into account the retail sale of tobacco products.[4] For example, new businesses can sell tobacco without any pre-approval from Local Government authorities. This is in contrast to other potentially harmful products or services e.g. fast food retailers, liquor retailers etc.

Policy Recommendations

- The introduction of a positive RLS by the Victorian Department of Health and Human Services (DHHS) could be implemented.
- The income generated through licensing fees can be used to create a system for regular compliance checks for tobacco retailers. These fees could be collected by the DHHS and distributed based on the number of retailers identified as operating in each LGA, providing incentive to accurately identify tobacco retailers.
- A policy option could include capping the number of licences available within defined areas. For example, limits per suburb, per-population or similar and introducing minimum-distance rules (to other retailers or schools).[4,5]
- [redacted] could play a formal role in working with other Local Governments, MAV and other stakeholders as listed below to advocate for the introduction of a positive RLS in Victoria.

Practice-based Recommendations for [redacted]

- Liquor-licensed premises that sell tobacco should be formally recorded in Local Government databases: research suggests this may not be occurring consistently.
- Changes to underage test purchasing of tobacco product purchase approaches: employing adults aged 18 years who are deemed to appear under 18 years by a panel of professionals so test-purchasing can occur in liquor-licensed premises without a responsible adult (e.g. an Environmental Health Officer) being present.[6]

Possible Stakeholders

Cancer Council Victoria, Quit Victoria, the Heart Foundation, VicHealth, the Municipal Association of Victoria, other Health and Community Services organisations, the Department of Health and Human Services, the Victorian Commission for Gaming and Liquor Reform (VCGLR), interstate Health Departments, Youth leadership groups (e.g. [redacted] Youth Council), and businesses that do not sell tobacco but could if they chose to (e.g. Aldi, some liquor-licensed premises etc.) and businesses that no longer sell tobacco.

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