MONASH University

What drives South Asians in Australia to drive?
Unpacking the determinants of immigrants' and international students' mobility choices

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Abstract

Australia's population has seen enormous growth in recent years, which is accelerated by high rates of immigration. However, despite the changing demographics of the Australian population, we have very little research to understand the effects of immigration on travel behaviour in Australia. Most of the existing research on the travel behaviour of immigrants comes from the United States, often focusing on Hispanic/Latino populations. The findings from these studies are not necessarily relevant in other countries with different immigration schemes and immigrant subpopulations. This thesis deepens our understanding of immigrant travel behaviour and perceptions in Australia by utilising qualitative and quantitative methods. By focusing on South Asian immigrants in Victoria, this thesis explores the fastest growing immigrant group and the fastest growing state (by population) of Australia. This also included insights on international students – an immigrant subpopulation often overlooked in travel behaviour research globally.

First, the travel behaviour of South Asian and Australian-born populations was compared using census and existing travel survey data. Among South Asians there was a higher level of carpooling, lower travel by driving (especially among females) and generally higher public transport use on average. However, assimilation occurs where reliance on cars becomes higher the longer a person resides in Australia. To better understand the reasons behind these differences, and why travel behaviour evolves over time, two more studies were undertaken – a survey and focus groups with South Asian and Australian university students. It was found that past travel behaviour and attitudes play an important role, and that both attitudes and travel behaviour change depending on how long South Asian students have been in Australia. Furthermore, the location of community members and cultural places of interest plays were found to play a significant role in the travel behaviour of South Asian students. Lastly, we conducted interviews with South Asian families (generally skilled immigrants) to explore in-depth their evolution of perceptions and travel behaviour from the time they arrived in Australia until today. Once again, strong patterns of evolving travel behaviour and perceptions of modes were found depending on how long families had lived in Australia, including a 'honeymoon period' of very positive initial perceptions towards all travel modes in Australia that eventually 'wear off' over time.

Overall, recently arrived South Asian immigrants travel more sustainably, i.e. more public transport and active travel; however, this quickly transforms to high levels of car-dependency. Our research suggests that unless policymakers or transport planners intervene, South Asians, and potentially other immigrant groups, will quickly assimilate to car dependency, further adding strains to the road infrastructure.

Declaration

This thesis is an original work of my research and contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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Date: May 11, 2021

Publications during enrolment

Listed below are the publication(s) and conference proceedings that arose during the candidature of this PhD.

Journal paper(s)

Shafi, R., Delbosc, A. and Rose, G. (2020) Travel attitudes and mode use among Asian international students at an Australian university. Transportation Research Part D: Transport and Environment. Volume 80, March 2020, 102259

Conference proceeding(s)

Shafi, R., Delbosc, A. and Rose, G. (2020) Residential and Daily Travel Preferences of South Asian International Students in Australia. Transportation Research Board Annual Meeting. Washington, United States.

Shafi, R., Delbosc, A. and Rose, G. (2019) The Travel Attitudes and Behaviours of South Asian International Students: A Study from Monash University. Australasian Transport Research Forum. Canberra, Australia.

Shafi, R., Delbosc, A. and Rose, G. (2017). Do South Asian migrants in Australia travel differently to native-born Australians? Australasian Transport Research Forum. Auckland, New Zealand.

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A man is only ever as strong as the people around him.

I was not on this journey alone. Many helped me along the way. I have only named a few.

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PART 1
Background and Approach

1 Introduction

1.1 Overview

This thesis explores the travel behaviour of South Asian immigrants in Australia against that of native-born Australians. It aims to determine whether there are differences in the travel behaviour of those two groups and to identify the factors which explain any differences which are identified.

We know very little about the travel habits of immigrants in Australia but based on research from other countries (Blumenberg and Smart 2010, Tal and Handy 2010, Tsang and Rohr 2011, Liu and Painter 2012), they are likely travel differently to native-born Australians. Exploration of immigrants' travel habits and perceptions, and how they evolve over time, has the potential to provide valuable insight into how immigrant's travel behaviour may shape the development of the transport system of Australia.

The next section will briefly highlight the research context of this thesis. This is followed by the research objectives and an outline of the thesis structure. The chapter concludes with a brief overview of all the chapters in this thesis.

1.2 Research context

Recent years have seen the Australian population grow at a rapid pace. Much of this growth is attributed to the high influx of immigrants to the country. To put this into perspective, Australian's total population (including immigrants) grew by 12.2% between 2011 and 2016; during the same time period, the overseas-born population grew by 16.5% (Australian Bureau of Statistics (ABS) 2016). As of June 2020, approximately 30% of Australia's population was born overseas (Australian Bureau of Statistics (ABS) 2020). This population growth has led to increased travel demand and as a result, governments across Australia have developed substantial investment programs designed to increase the capacity of Australia's urban transport systems (Infrastructure Australia 2020). While these plans seek to respond to the increase in the magnitude of the demand, little consideration is given to the implications of the changing cultural composition of the country.

In the context of Australia, South Asians make up one of the fastest growing and largest immigrant groups. South Asia refers to seven countries: India, Bangladesh, Pakistan, Sri Lanka, Maldives, Nepal and Bhutan. They are, at present, the largest immigrant group in Australia (ABS 2016b) at approximately 750,000 people (growing from about 250,000 in 2011) and were the fastest growing subpopulation between 2006 and 2016 with a growth of around 200%. For this reason, South Asians have been chosen as the cultural population to study for this thesis. South Asians come from a very different cultural and transport context to what they experience when they arrive in Australia. Their attitudes, social norms and travel habits developed in their home country have the potential to influence their perceptions and travel behaviour in Australia.

Research conducted elsewhere (mainly in the United States) has highlighted that immigrants can face a different set of challenges compared to native-born populations. These can include language barriers, cultural stigmas and safety beliefs (Blumenberg and Smart 2011, Chatman 2014, Smart and Klein 2017).

Although understanding immigrant travel behaviour in Australia could enhance transport planning, little research has been conducted on this topic. This thesis aims to bridge some of these research gaps to establish if and how South Asian immigrants travel differently, and to identify potential factors contributing to any differences. The thesis also seeks to advance the understanding of how travel behaviour changes over South Asian immigrants' duration of residence in Australia.

1.3 Research objectives and thesis structure

Specific to this thesis, there are three key research objectives as listed below:

- Research Objective 1: Identify key travel behavioural differences between South Asians in Australia and native-born Australians
- Research Objective 2: Understand the factors which affect travel behaviour of South Asians and Australians
- Research Objective 3: Understand how South Asian immigrants' travel behaviour evolves during their time in Australia

Each research objective has a set of underlying research questions. The research questions were guided by an extensive literature review (in Chapter 2) and are presented in Chapter 3.

1.4 Thesis structure

The thesis is composed of three parts containing a total of 8 chapters, as illustrated in Figure 1-1.

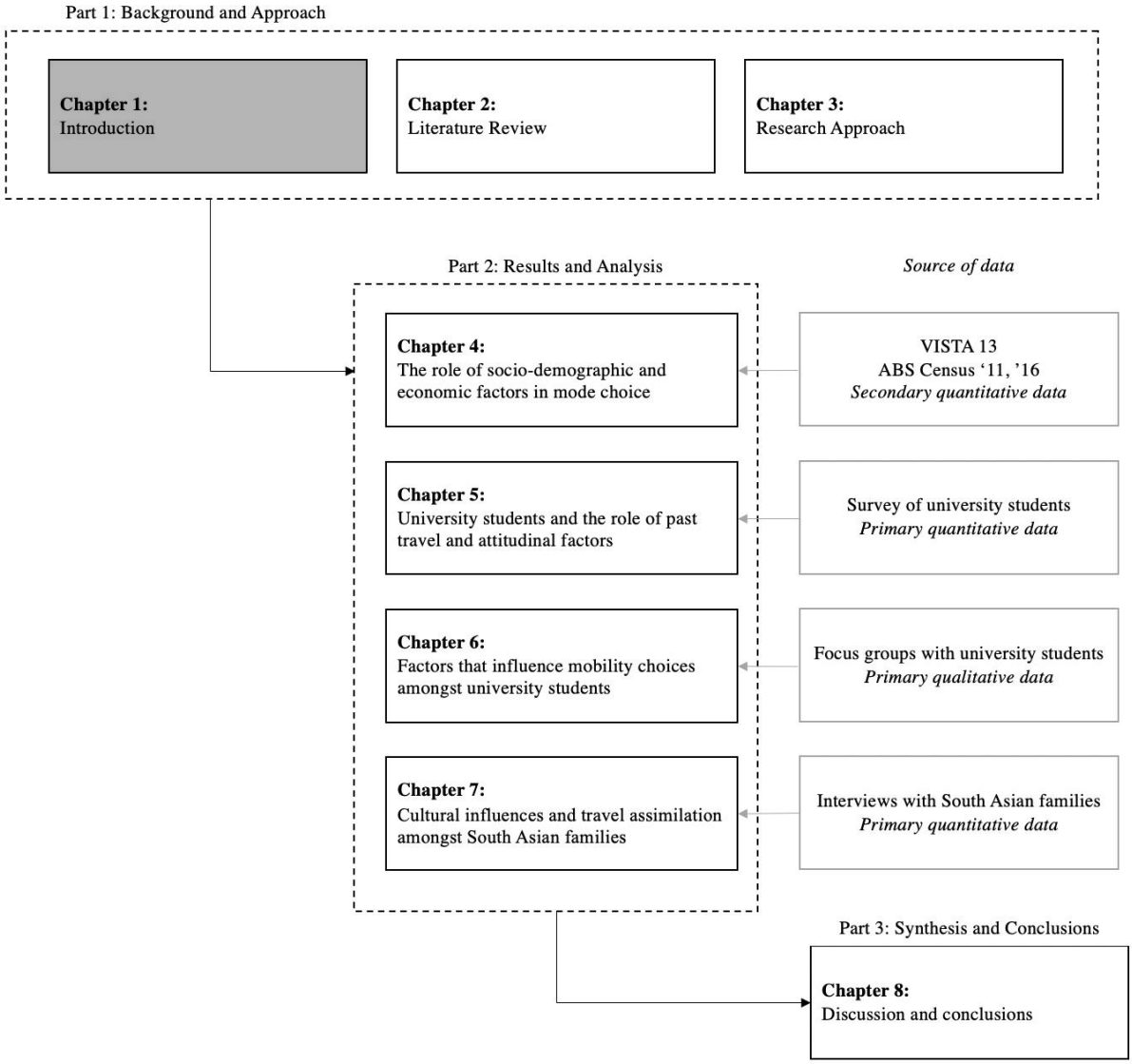


Figure 1-1 Thesis structure (this chapter is shaded)

1.4.1 Part 1: Background and Approach

This part of the thesis describes the background, context and research approach. It consists of three chapters, as outlined below.

- Chapter 1: Introduction
    - This chapter introduces the thesis.
- Chapter 2: Literature Review
    - This presents a review of the literature on immigrants' travel habits. It also highlights the research gaps and key findings that helped design the tasks in

this thesis and introduces the research questions that underpin the thesis' research objectives.

- Chapter 3: Research Approach
    - This section describes the methodology used in this thesis, including descriptions of the secondary data sources, the approach to quantitative and qualitative data collection and analysis methods.

1.4.2 Part 2: Results and analysis

The second part of the thesis presents the analyses undertaken that helped to address the knowledge gaps. Part 2 consists of four chapters as outlined below:

- Chapter 4: The role of socio-demographic and economic factors in mode choice
    - This chapter compares the travel behaviour of immigrants compared to native-born Australians. The 2012/13 Victorian Integrated Survey of Travel and Activity (VISTA) dataset, in conjunction with the Australian Bureau of Statistics (ABS) Census, were analysed to identify differences in travel habits while accounting for socio-demographic differences.
- Chapter 5: University students and the role of past travel and attitudinal factors
    - The chapter compares the travel attitudes and past travel habits of international and native-born Australian university students. It explores the role that these attitudes play in their present-day mode use frequency. It also explores how having used a particular travel mode in the past influences the frequency of using that mode in the present, and how the travel behaviour of international university students changes over their time in Australia.
- Chapter 6: Factors that influence mobility choices amongst university students
    - The chapter presents the analysis of focus groups undertaken with university students (both native-born and international students from South Asia) to distinguish similarities and differences in their decision-making processes, and how different upbringings lead to different travel behaviour.
- Chapter 7: Cultural influences and travel assimilation amongst South Asian families
    - This chapter draws on qualitative methods to address how assimilation towards car dependency occurs amongst South Asian households. The analysis also helps further our understanding of the influence of culture, past experiences and gender on mobility choices.

1.4.3 Part 3: Synthesis and conclusion

The final part (and chapter) of this thesis is a synthesis of findings.

- Chapter 8: Discussion and Conclusions
    - This chapter summarises the findings of the thesis and critically reflects on the limitations of the research undertaken as part of this thesis. It identifies potential future research directions and considers the implications of this research for policy and planning in transportation.

1.5 Research contributions

This research has provided new and nuanced insights into immigrants' travel behaviour.

While there has been research on immigrants' travel behaviour in Australia (Klocker, Toole et al. 2015, Yoo, Diamond et al. 2015, Kerr, Klocker et al. 2016), it is quite limited and often focussed on high-level travel patterns. In contrast, this thesis provides the first in-depth understanding of the travel behaviour of South Asians in Australia, thereby advancing understanding in relation to one of the largest immigrant groups. We have found that immigrants rely on carpooling and public transport more than their native-born counterparts in Australia. Attitudes and past habits were identified as playing a key role as decision-making factors. While these conclusions have also been made in immigrant research elsewhere (primarily in the United States), such findings are the first of their kind in Australia.

A lot of the research that exists on immigrant travel behaviour originates from the United States. However, the research on skilled immigrants and international students is rare. While this perhaps reflects the profile of immigrants in the United States, skilled immigrants and international students are two of the most dominant immigrant subpopulations in Australia. As result, this thesis was designed to focus on them. International students are often underrepresented in travel surveys and overlooked in day-to-day travel behaviour research. This thesis addresses that knowledge gap.

Throughout this thesis, we dive deeply into the past travel experiences of the immigrant respondents to develop understanding of the cultural practices they used to prior to their arrival in Australia. The research also helped to further our understanding of assimilation of travel behaviour and the role played by attitudes amongst immigrants. Bringing in research from various disciplines and regions of the world greatly enriched the narrative surrounding immigrants travel habits as we know it.

The research will help to raise awareness of this under-researched topic in Australia. Ideally, future research in this field will receive support from governments and statutory agencies, as is commonly the case for many comparable studies originating from the United States and other countries. Immigrants have rarely been studied in Australia and *country of birth* variables are not asked on travel surveys in fear of intrusiveness (Department of Transport and Main Roads Queensland, personal communication, May 2017) or political correctness (Monash University Campus Access and Transport, personal communication, June 2018). However, differences in cultures, past habits and social norms mean immigrants deserve greater attention from transport planners and policymakers in Australia as a *one size fits all* approach risks being ineffective in our efforts to shift towards a sustainable transport future. Beyond the realm of immigrants, the research has also uncovered the importance of *soft* factors such as past travel habits and perceptions on current travel behaviour, something overlooked in most travel surveys. Integrating a few relevant questions into on-going travel surveys conducted in Australia has the potential to provide the insight needed to better inform policymakers and assist them to make better decisions that are more likely to be accepted and adopted by all sectors of the community including immigrant sub-populations.

2 Literature Review

The thesis structure highlighting Chapter 2 is presented below in Figure 2-1.

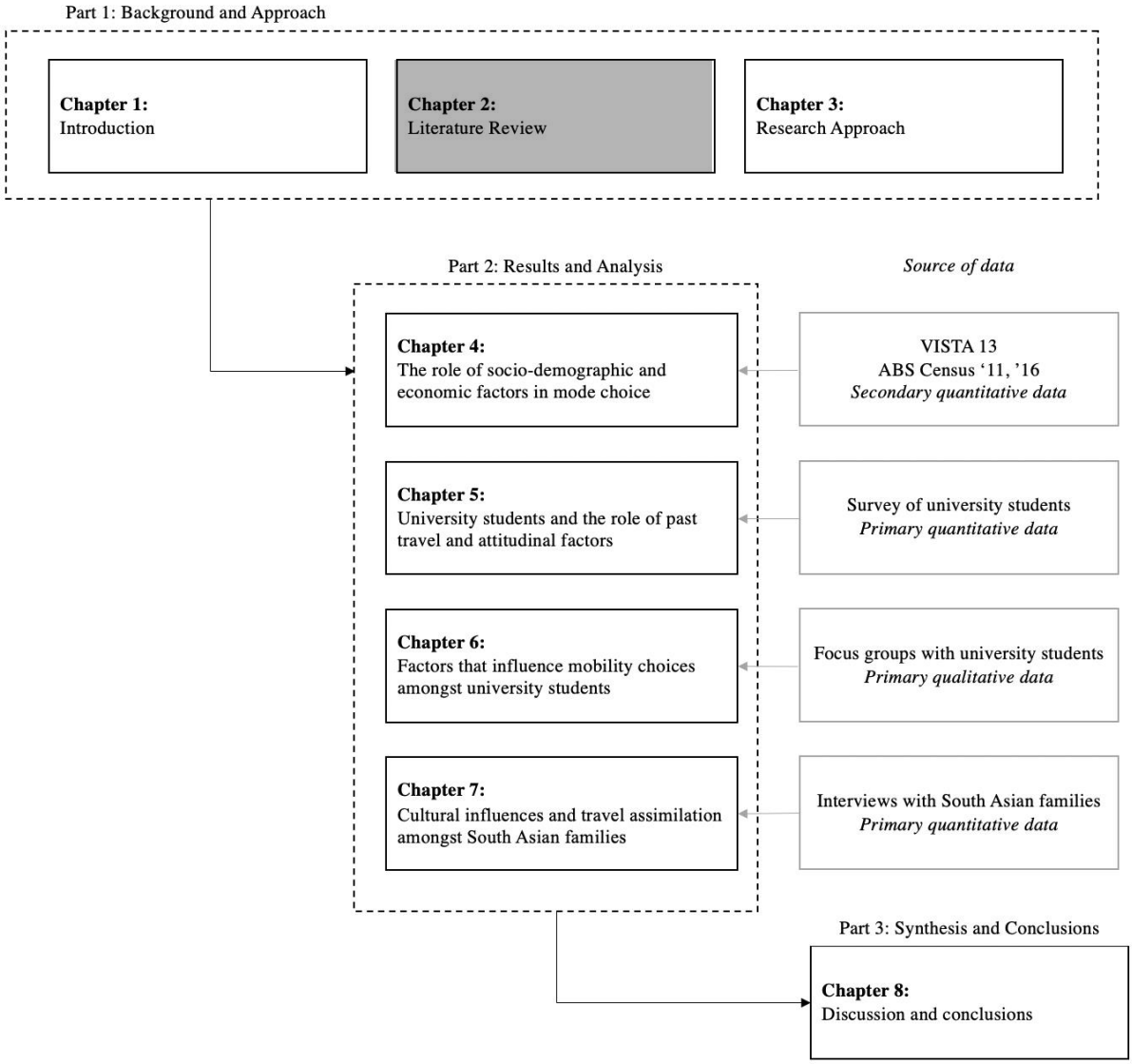


Figure 2-1 Position of Chapter 2 in thesis structure

2.1 Introduction

This chapter presents a critical analysis of the literature reviewed for this thesis. It uses both a systematic literature search and an additional informal search (of both published and grey literature) along with a thematic analysis to identify research gaps. The workflow illustrated in Figure 2-2 highlights the methodology employed in this literature review.

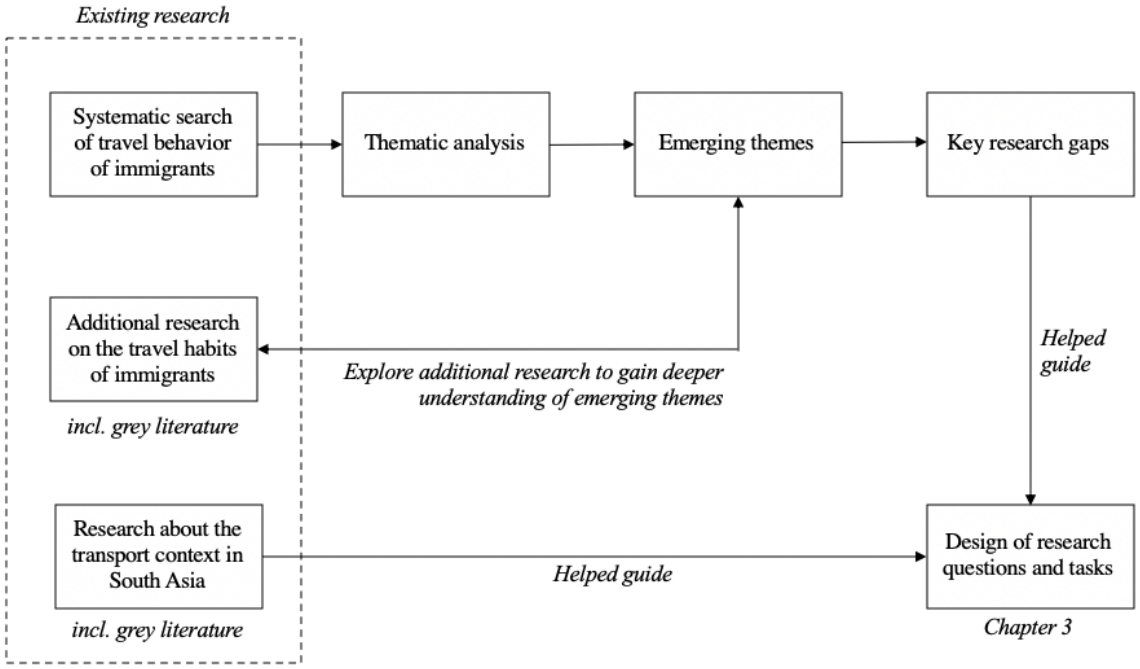


Figure 2-2 Literature review workflow and link to thesis design

This chapter has multiple components as illustrated in Figure 2-2. First, a systematic search about the travel behaviour of immigrants was performed; this was done across multiple databases to identify relevant research on the topic. Next, a thematic analysis was performed on the returned pieces of literature to distinguish the key themes addressed in that research, and establish what is already known about the topic more broadly. This also paved way to identify key research limitations of the existing research, including those specific to the Australian context.

The limitations were further elaborated with an expanded search of published and grey literature, through keyword searches on Google Scholar and Scopus, and by screening through the reference lists of appropriate research papers. This expanded search broadened understanding of the research gaps and helped to identify potential avenues of research for Australia (to be discussed in Section 2.4).

Furthermore, an overview of travel habits in South Asian and other developing countries was undertaken to further our understanding of culture and past travel habits. This is in addition to, and somewhat different from, the research on immigrants, and examines research conducted in South Asia to better understand South Asian travel culture and infrastructure. This helped design research questions and tasks more effectively (as highlighted in Figure 2-2).

2.2 A systematic search for relevant literature

The primary objective of this search was to identify research that identified travel habits of immigrants, how this behaviour compared to their native-born counterparts and what factors were attributed to causing any differences in travel habits. The following search terms were applied:

(immigrant OR settler OR expatriate OR (migrant AND communit*))

AND

(walk* OR cycli* OR car OR transit OR public trans* OR active trav* OR travel OR mobility)

NOT

(touris* OR hospital* OR medic* OR refuge* OR humanit* OR smuggl* OR export OR import OR *legal OR legal* OR retire*)

The first set of terms highlights immigrants in general and narrows down travel research where immigrants are the main focus of this study. The next group of terms refer to the various travel modes and/or mobility. The last and final group are a set of exclusion terms that helped narrow down the number of search results by eliminating literature not relevant to the focus of this research. For example, the term "travel" resulted in many research papers on refugees, medical patients and tourists, and explored more broadly the process of coming *to* Australia (temporary or permanent migration), rather than travelling *within* Australia. Short-term trips, for example tourism or business trips, were also deemed not relevant to this research. To exclude these, further screening was performed by filtering each specific database by subject areas, research areas and/or terms, as highlighted in Table 2-1 under the column "Field restrictions". The databases used were Scopus, Compendex, Inspec, GeoBase and Web of Science (Core Collection). Each individual database was then screened for articles in English and relevant fields of study, as presented in Table 2-1. There was no publication year restriction applied in the searches. The searches across all the databases were made on February 21, 2020.

Table 2-1 Methodological database search for relevant studies

	Initial search terms	In English only	Field restrictions	Results (as imported to Covidence)
Scopus	270	243	Exclude subject areas: Medicine, Immunology and Microbiology, Computer Science, Business, Management, Accounting	169
Compendex	97	94	-	94
Inspec	57	-	-	57
GeoBase	1,073	-	Exclude terms: Labour Mobility, Health, Entrepreneur, Religion, Social Identity, Human Capital, Class, Emigration	675
Web of Science (Core Collection)	5,022	4,575	Limited to research areas: Demography, Sociology, Geography, Management, Ethnic Studies, Social Sciences Other Topics, Social Sciences Interdisciplinary, Social Issues, Urban Studies, Transportation, Public Administration, Government Law, Psychology, Engineering, Development Studies	1,276
Total studies				2,271

After these initial 2,271 studies were imported to Covidence (online systematic review management software), duplicates (280 studies) were identified and removed, bringing down the number of studies to 1,991. However, despite the extensive list of exclusion terms, there were still many irrelevant papers. The papers excluded generally discussed issues surrounding immigrants travelling to a new country, economics, youth and culture, etc. There were many other papers on assimilation, but not necessarily in the realm of day-to-day travel habits, but rather cultural. The title and abstracts of studies were then screened to identify research concerned with short-term mobility choices of immigrants compared to native-born residents. Upon conclusion, 35 studies[1] were deemed relevant for this purpose. It is important to emphasize that this search only includes studies considering immigrants' day-to-day travel after using the aforementioned search terms and judging for subject relevance.

Table 2-2 below presents a summary of the final studies explored in-depth for this search. Each study is classified based on the region of research, the type of data used (qualitative or quantitative), the key immigrant group(s) in focus (Latinos, Asian etc.), and the key themes that were addressed in the research (socioeconomics, gender etc.).

[1] This return is solely based on the parameters described above. The likelihood of similar research existing beyond these 35 papers is very high, many of which were found using other means and presented throughout the thesis.

Table 2-2 Systematic search results

(Author/s Year)	Region of research				Method		Immigrant group/s				Theme which relates to key finding(s)					
	United States	Australia/ New Zealand	Europe	Other	Quantitative	Qualitative	Overall	Latino/ Hispanic	Asian	Other	Socioeconomics	Attitudes/ Culture	Gender	Ethnic Enclaves	Travel Assimilation	Other
(Barajas 2019)	X				X	X		X				X		X		
(Bartzokas-Tsiompras and Photis 2019)			X		X		X				X	X				
(Chakrabarti and Painter 2019)	X				X		X				X					
(Haustein, Kroesen et al. 2019)			X		X		X					X	X			
(Matsuo 2019)	X				X			X			X		X			
(Yum 2019)	X				X			X	X		X	X				
(Barajas, Chatman et al. 2018)	X				X			X			X					
(Barajas 2018)	X					X		X			X	X				
(Kaplan, Wrzesinska et al. 2018)			X		X					X	X	X	X			
(Asgari, Zaman et al. 2017)	X				X			X			X	X			X	
(Newbold, Scott et al. 2017)				X	X		X				X					
(Hu 2017)	X				X				X						X	
(Shin 2017)	X				X		X				X		X	X		
(Klocker, Toole et al. 2015)		X			X		X				X	X				
(Smart 2015)	X				X		X					X		X	X	
(Butler and Hannam 2014)				X	X		X				X	X				

(Chung, Choi et al. 2014)				X	X				X				X									
(Blumenberg and Smart 2014)	X				X		X						X				X					
(Chatman 2014)	X				X		X										X		X			
(Bhat, Paleti et al. 2013)	X				X		X						X						X			
(Chatman and Klein 2013)	X					X	X						X	X					X			
(Liu and Painter 2012)	X				X			X					X	X			X					
(Syam, Khan et al. 2012)		X			X		X						X									
(Lovejoy and Handy 2011)	X					X		X						X								
(Blumenberg and Smart 2010)	X				X		X						X								X	
(Ma and Srinivasan 2010)	X				X		X						X						X			
(Smart 2010)	X				X		X						X			X						
(Tal and Handy 2010)	X				X		X						X						X			
(Blumenberg 2009)	X				X		X						X			X			X			
(Cline, Sparks et al. 2009)	X				X			X					X	X								
(Kim 2009)	X				X		X						X	X	X							
(Beckman and Goulias 2008)	X				X			X					X						X		X	
(Bohon, Stamps et al. 2008)	X					X		X					X	X								
(Pisarski 2007)	X				X		X						X						X			
(Heisz and Schellenberg 2004)				X	X		X						X	X	X				X			
Total (35)	*26*	*2*	*3*	*4*	*31*	*4*	*21*	*24*	*3*	*1*			*29*	*17*	*8*	*6*			*12*		*2*	

There is remarkable consistency across the majority of the research papers. Firstly, 26 out of 35 of such studies were undertaken in the United States. Secondly, most of the research is based on implementing quantitative methods; only five of the research papers utilised any qualitative methods. Research also seemed to emphasize Latino or Hispanic groups, with 11 studies specifically focusing on them, while a further 21 studies focused on the broader overview of immigrants' travel or compared between multiple immigrant groups. There were only three studies focusing on Asian immigrants or ethnicities, but none particularly emphasized South Asian immigrants; a few papers do however acknowledge Indian immigrants.

Although most papers covered many of the themes in Table 2 in their introduction or literature review, papers were classified based on the main emphasis of their research questions or analysis. For example, although Hu (2017) explored almost all themes listed in Table 2-2, the conclusions mostly related to travel assimilation. Similarly, Lovejoy and Handy (2011) mention income and car ownership and the role they play, but the main conclusions revolved around social factors and the role community plays in making certain travel choices, particularly carpooling.

Furthermore, it should be noted all of the aforementioned research papers in Table 2-2 were undertaken in the 21st century (despite no year limitations in the search conditions); the research emphasizing Asians was undertaken in the last decade. This suggests that the topic of immigrants' travel habits is fairly new. The thematic results of this systematic search will be described in-depth in the next section.

2.3 Results of thematic analysis – key findings

The following sections consider the key themes which emerged from the analysis of the literature. In turn, these include travel differences, factors that influence those differences and travel assimilation within immigrants.

2.3.1 Different travel behaviour

Most research found various degrees of travel behaviour differences that exist between native-borns and immigrant populations or ethnic minorities. The general conclusion is that immigrants drive less for their daily travel needs and are more reliant on non-driving modes of transport such as public transport, walking and cycling. For example, immigrants have been found to carpool more across multiple pieces of research in the United States (Pisarski 2007, Blumenberg and Smart 2010, Blumenberg and Smart 2014). Immigrants were also less likely to drive, or as described in US research, utilise single-occupancy vehicles less (Smart 2015). Indian immigrants on average used auto less according to another research on immigrants (Chatman 2014); this is especially the case for recently arrived immigrants who have lower auto use than American native-borns. Settled Indian immigrants in the United States, on the other hand, had similar auto-use to their native-born counterparts according to that research.

There is also seemingly higher transit use amongst many immigrant groups. Research in Canada has shown that immigrants from regions such as Southeast Asia, South America or Africa are more likely to use public transit, while immigrants from Europe and Oceania were least likely (Heisz and Schellenberg 2004). Active travel (walking and cycling) amongst immigrants was also higher in American research (Pisarski 2007, Smart 2015), especially amongst older immigrants (Beckman and Goulias 2008). However, the opposite was found to be true in more cycling-dominated cultures. This was evident in research undertaken in Denmark and the Netherlands where immigrants have been found to cycle less than their native-born counterparts (Haustein, Kroesen et al. 2019).

2.3.2 Factors that affect travel behaviour

In the studies explored, the researchers find an "immigrant effect" on travel behaviour. Yet in many of the quantitative papers, that is the scope of the study – whether a difference in travel behaviour exists. This is especially true in the studies from Australia (Klocker, Toole et al. 2015, Kerr, Klocker et al. 2016). However, the underlying factors (motivations, constraints, attitudes etc.) are not explored in all research. This section summarises some of the factors that were discussed when exploring literature around immigrant travel behaviour.

A range of socio-economic factors have been identified which help to explain why differences exist in travel behaviour between immigrant groups and native-borns. Researchers commonly explored income in some form and most concluded that income and other economic factors are the most important determinants of mode choice and longer-term travel choices. For example, immigrants were found to have lower income and car ownership rates, and consequently higher carpooling in America (Blumenberg and Smart 2010). There is also evidence of lower income levels restricting immigrants from cycling or using public transit (Barajas, Chatman et al. 2018). In the United States, higher income groups were found to cycle less and drive more (Smart 2010). This agreed with another study from New Zealand comparing different ethnicities, which found that Asian and European ethnicities have both the highest incomes and a higher percentage of car use (Syam, Khan et al. 2012).

However, there has been some research which has found that income is not always be a significant reason behind differences in travel behaviour. For example, differences in carpooling levels between Hispanic immigrants and native-borns were still insignificant when immigrant status, socioeconomics, occupation and location are all accounted for (Cline, Sparks et al. 2009). It is also possible that household income may have no influence on mode choice (Hu 2017). Lower literacy, and sometimes language barriers, are also mentioned concurrently with lower incomes, and are possible causes of travel habit differences between native-borns and immigrant groups.

Gender was a common factor explored in a quarter of the studies found in the systematic review (see Table 2-2). Most studies that analysed non-economic factors concluded that gender plays an important role in the travel behaviour of immigrants, although *why* gender was an important factor was seldom explored. For example, auto-use was lower amongst Hispanic females in the United States, even if they were working, educated or were American citizens (Matsuo 2019). In another study, female, working immigrants were less likely to use public transit (Kim 2009). Interactions between gender and culture may also play a role; however, this was not explored any further in most research. Cultural or attitudinal factors can also play a role (Tal and Handy 2010). For example, immigrants held certain social and personal perceptions against cycling which meant they were less likely to switch to cycling (Barajas 2019). Immigrants were also found to have more positive views on transit than native-borns due to a lack of personal transportation options, or the perceived superiority of transit services in the country of immigration compared to their home countries (Kim 2009). There were challenges that arose amongst immigrants due to lack of personal transportation (Bohon, Stamps et al. 2008), including lack of travel flexibility due a reliance on carpooling and struggles in adapting to the local culture. The role of past habits may also play a prominent role, as one study found immigrants were found to be more likely to cycle even after controlling for socio-demographic factors (Blumenberg and Smart 2010).

Despite all this, socio-demographics and economics remain the key predictors for travel behaviour of immigrants. Another factor often highlighted is residential location, and the related concept of ethnic enclaves amongst immigrants. That dimension is discussed more specifically in Section 2.3.3.

2.3.3 Ethnic enclaves

The location of households is an important determinant of travel behaviour. For example, those living in transit-rich neighbourhoods also tend to have higher dependency on public transport (Smart and Klein 2017). Many immigrants choose to reside in ethnic enclaves – they are regions where immigrant populations, usually from the same ethnic background, tend to live together (Nguyen 2004). The presence of ethnic enclaves has been clearly identified in research conducted in the United States and they play a crucial role in immigrants' travel behaviour.

U.S. research has highlighted that the highest reliance on carpooling often arises from living in ethnic enclaves (Smart 2015, Shin 2017). Research has also shown that residential location choice could be a key determinant in auto use (Chatman and Klein 2013) even after controlling for socioeconomics. Those living in ethnic enclaves have the highest nonwork carpooling trips (Shin 2017). However such findings may not hold true in all contexts, as some research has also shown that ethnic enclaves play no role in auto use by immigrants (Chatman 2014).

There are several possible cultural elements which can explain why ethnic enclaves are formed apart from the cultural reassurance of living in an area with others of the same ethnic origin (Nguyen 2004). U.S. research has shown ethnic enclaves often form near local shops that cater

to particular tastes/needs of immigrant groups (Chatman 2014). The carsharing culture is also facilitated by fellow immigrants residing in close proximity as it allows for the easier exchange of resources (Lovejoy and Handy 2011). Immigrants may self-select into neighbourhoods to overcome language barriers when trying to enter the job market (Shin 2017) which can be achieved quite simply by living near job opportunities in their native language (Nguyen 2004).

Different ethnic enclaves have also shown different characteristics. Asian enclaves in particular are known to have higher levels of employment and lower population density than Hispanic enclaves (Shin 2017). This could be a result of how ethnic enclaves were initially formed – inner-city locations, jobs, good transit access and so on (Nguyen 2004).

2.3.4 Travel assimilation of immigrants

The length of stay in a foreign country is often seen as an important factor influencing the travel behaviour of immigrants. Recently arrived immigrants are often more transit-dependent that their longer-residing immigrant counterparts. Many reasons could attribute to this, including driving ability and struggling to adapt to a new driving culture (Chatman and Klein 2013).

Over time however, immigrants tend to become more car-dependant while moving away from transit (Pisarski 2007). This was further established in research studying immigrants' household auto ownership and residential location choice (Bhat, Paleti et al. 2013). For example, recent immigrants were found to have the biggest differences in travel behaviour when compared to native-born Americans (Tal and Handy 2010). Even when compared to fellow immigrants residing for a longer time, recently-arrived immigrants tend to spend more time making trips (Beckman and Goulias 2008). The most gender-segregated travel differences were also found to be amongst the recently arrived immigrant groups (Heisz and Schellenberg 2004). Assimilation can also be accelerated by higher incomes or residential relocations in the same manner, as discussed earlier. Recently arrived immigrants also contributed the most to transit ridership (Chakrabarti and Painter 2019); however, the same research has shown that immigrants who relocate after arriving become less likely to use transit. Another study showed that longer-residing immigrants in Canada have been found to move away from transit (Heisz and Schellenberg 2004). Despite questions around the degree of assimilation, it is generally accepted that there is some form of assimilation, and it mostly is towards higher car use and lower public transport use.

However, looking across the research literature it is clear that not all immigrant communities assimilate in the same way. Research has shown that single-person households and more recent immigrants assimilate faster than other immigrant cohorts (Ma and Srinivasan 2010). Asian immigrant groups have been found to assimilate to the automobile culture more than any other immigrant groups (Hu 2017). One study concluded that travel behaviour largely assimilates in as little as 5-10 years (Myers 1997, Tal and Handy 2010). On the other hand, another study found that immigrants never fully assimilate to the travel behaviour of native-borns; even after 20 years immigrants are less likely to buy a car or hold beliefs such as 'walking is important to save money' (Blumenberg and Smart 2011). Of course, many factors may explain those differences such as the ethnicity in the study, the area in which the study was undertaken, and the socioeconomics of participants involved. Furthermore, the concept of assimilation generally revolves around socioeconomic and demographic factors. For example, in the US, it is relatively common for recently arrived immigrants to reside in lower-income neighbourhoods, often in city centrals, before relocating to high-income suburban neighbourhoods over time – this also correlates with higher automobile use (Handy, Blumenberg et al. 2009, Blumenberg and Smart 2010). When exploring Asian immigrants in

the United States (Hu 2017), factors such as income and literacy were mainly discussed when referring to travel habit differences between recently-arrived and longer-residing Asian immigrants. For Australian immigrants however, it is more likely that factors beyond socioeconomic constraints play an influential role in determining level and rate of travel and spatial assimilation.

2.3.5 Key research limitations and gaps from the thematic analysis

There were a few key research gaps in current research identified, especially when considering the Australian context. The four major limitations are listed below.

- The focus is on Hispanic and Latino groups while Asian immigrants are rarely explored in comparison.
    - South Asian immigrants are quite poorly explored. There were some research papers that explore Indian immigrants (Chatman and Klein 2013), but often alongside with other immigrant groups mostly for comparison purposes.
    - Immigrants and ethnicities are often explored in conjunction, especially in the United States. This is more common for particular immigrants/ ethnicities, such as Hispanics and Latinos, or even Asians (race or immigrant from geographical namesake).
- When exploring the reasons for travel behaviour differences, the emphasis is mainly on socio-demographics, with very limited consideration of attitudes or past travel behaviour.
    - The emphasis is stronger on the role of sociodemographic factors, with 29 papers explored the role of sociodemographic and economic differences. Seventeen papers looked at cultural or attitudinal factors that might influence travel behaviour (refer to Table 2-2).
    - Several papers found that socio-demographics could not fully explain differences in travel behaviour, suggesting that this is an important area for further study. This included research conducted in Australia (Klocker, Toole et al. 2015) and in the United States for Asian immigrants (Hu 2017).
    - The pre-arrival travel habits of immigrants (i.e. how immigrants used to travel prior to their arrival in their present country of residence) was not explored in any existing research. This may be in important factor, especially amongst the more recently arrived immigrants and international students.
- Studies tended to group all members of an immigrant group together, even though age and life stage plays an important role in travel behaviour.
    - Most research studied adults, and in some cases, specifically working adults. Particular sub-groups, such as international students, have been rarely studied.
    - Interactions at a household level has only been addressed through the element of carpooling; other intra-household interactions such as family decision making or the role of gender in an immigrant household have not been explored in-depth.
- There is very little research from Australia.
    - The literature is dominated by research in the United States (26 out of 35 returned studies in Table 2-2).
    - There was only one research piece originating from Australia that could be identified through the systematic search (Klocker, Toole et al. 2015).

2.4 Avenues for new research

At this point, the thematic analysis of the systematic literature review had helped to identify a set of key research gaps and current limitations in existing research. Due to the limited number of returned research items using the steps, an additional exploratory search was conducted using Google Scholar and Scopus to identify more themes or add to recurring themes. In addition, the reference lists presented at the end of each research article that appeared on the systematic search were also a source of new research material to study. This included more peer-reviewed journal articles, as well as conference proceedings, published reports and news articles. This exploratory search uncovered numerous other papers that did not appear in the systematic search results. While many papers explore travel habits of immigrants more broadly, there were numerous papers that were not as relevant to our research but contributed to our understanding to the underlying factors that influence immigrants' travel habits.

In this section, those aforementioned limitations will be further expanded into new research directions while emphasizing the importance of exploring these gaps in the Australian context. This section draws both from the studies found using the systematic search (35 studies) and numerous other studies found using the additional means descripted in Section 2.2. The discussion in this section is categorized based on the gaps from the thematic analysis identified previously in Section 2.3.5.

2.4.1 South Asians are an under-researched immigrant group

As the systematic review identified, research on this topic is dominated by American studies and primarily focuses on Hispanics and/or Latino immigrants. Conclusions drawn from this research are not necessarily relevant to other countries or to other immigrant groups. For example, American research has identified that Asian immigrants stand out from other immigrant groups. In one instance, research has shown that Asians were more likely than Hispanics to commute by single occupancy vehicles amongst recently arrived immigrants (who lived in United States for less than six years) (Blumenberg 2009). The same study also stated that Asians are the only population group with higher median incomes than non-Hispanic whites. In another example, in an analysis of the US National Household Transportation Survey data, Indian immigrants were found to be younger, more recently-arrived and had the highest average household income amongst immigrant groups and native-borns (Tal and Handy 2010). This is particularly important for South Asian immigrants in Australia, who are generally younger and often in their prime studying or working years.

However, those differences often get overlooked, perhaps because Latino or Hispanic immigrant groups make up the largest immigrant population in the United States. For example, a recent research article on 2017 has stated the absence of empirical research examining Asian immigrants' travel patterns in the United States (Hu 2017). This is despite the fact that more immigrants today are arriving from Asia than ever before, especially in countries such as New Zealand (Jones and Schultz 2014), Canada (Asia Pacific Foundation of Canada 2018) and the United States (Smith 2018), and this is rarely acknowledged. Furthermore, American research may be less relevant to the Australian context because Australia's immigration system emphasises bringing in students and skilled, educated immigrants (as presented in Figure 2-3). And with immigrations laws being tighter and immigration streams being more competitive today than it ever was, the competence of immigrants with respect to education, skills and/ or wealth is ever-increasing.

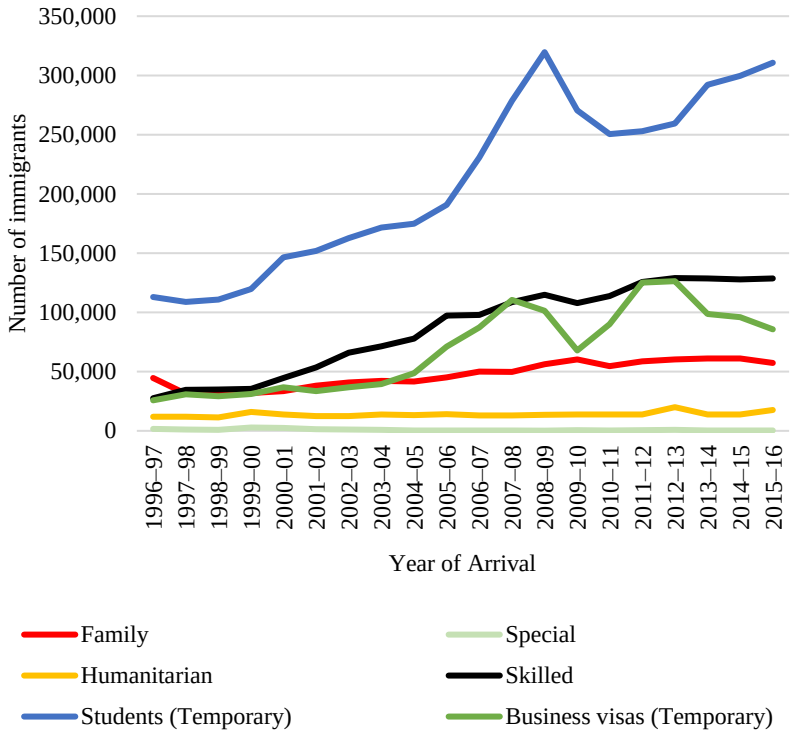


Figure 2-3 Immigrants inflow into Australia (Source: based on Phillips and Simon-Davies 2017)

As a result, some of the ethnic groups emphasized upon in American research are not representative of the case in Australia. In the United States, about half the foreign-born population come from Mexico (Radford 2019). On the other hand, in Australia, immigrants generally come from South Asian countries (India, Sri Lanka, Bangladesh), China or other developing Asian countries (Australian Government Department of Immigration and Border Protection (DIBP) 2015), as presented in Figure 2-4 below. This adds the possibility of a unique culture and set of social perceptions which may or may not influence travel behaviour. Ethnicity and race aside, the Australian immigration system also ensures that immigrants are less likely to face the socioeconomic disadvantages that are generally associated with immigrants and ethnic minorities in the United States.

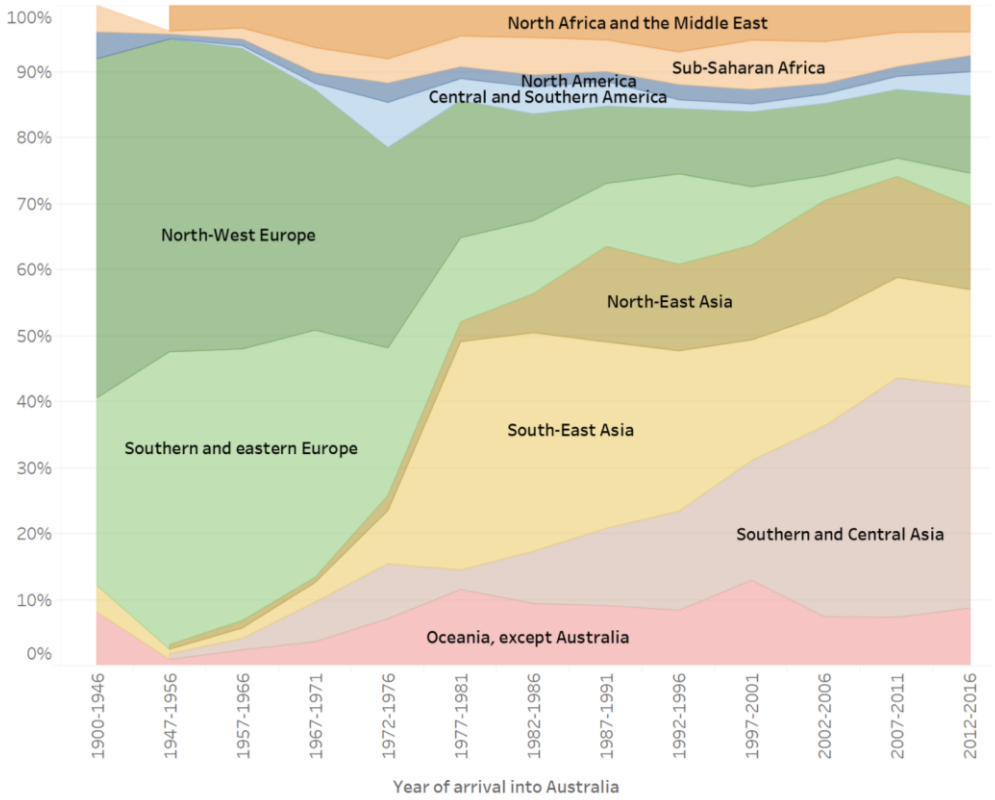


Figure 2-4 World region of birth by year of arrival into Australia, Greater Melbourne workers, 2016 (Source: Loader 2020).

Research on Asian immigrants is rare, on South Asian immigrants is even more limited, and in Australia, such research is virtually non-existent. This is despite the fact that the overseas-born Asian population in Australia is growing rapidly. Traditional sources of immigrants include those arriving from New Zealand, England and Italy, but recent years has seen their cohorts largely keep up with natural population growth or see a decrease in numbers (negative growth) (Australian Bureau of Statistics (ABS) 2019). In contrast, the Australian population born in South Asia has seen tremendous growth over the past 10 years: ~89% growth between 2006-2011 (Australian Bureau of Statistics (ABS) 2011), when they were the fastest-growing immigrant group, and ~56% between 2011 and 2016 (Australian Bureau of Statistics (ABS) 2016). As of the 2016 census, close to 750,000 people living in Australia were born in South Asia. That is why this thesis is crucial to further our understanding of ethnically diverse groups in Australia and understand the travel patterns of recently arrived immigrants.

2.4.2 International students are underrepresented

A further limitation highlighted by this literature review is the absence of research on specific sub-populations of migrants, such as skilled migrants or international students. International students are fast becoming an important source of permanent immigrants in developed countries. Their numbers are rising every year in a number of developed countries (Verbik and Lasanowski 2007) and they are a large source of skilled immigrants. There are over one million international students in the United States (Institute of International Education (IIE) 2019), and another one million in UK (Stern 2019) and Canada (ICEF Monitor 2019) combined. Their

daily travel habits are likely to shape public transport patronage and overall travel behaviour of societies on a more macroscopic level.

There are very few cross-cultural studies on international students' travel, and most of this research is tourism oriented. Multiple tourism studies confirm that students from different countries of birth have different preferences for travel mode and tourism activities (Kim and Jogaratnam 2003, Varasteh, Marzuki et al. 2015). However, tourism studies are unlikely to be directly relevant to policy makers and transport planners when developing a transit system or strategizing the shift away from cars for urban travel.

Another study across multiple countries has shown that undergraduate students in Indonesia and China have a stronger desire to purchase a car compared to those from developed countries such as the Netherlands or the United States (Belgiawan, Schmöcker et al. 2014). However, international students' day-to-day travel behaviour and choices are not examined in the literature summarized in Table 2 or in subsequent ad-hoc searches.

Examination of national / state level travel surveys reveals one possible reason for this lack of research: international students are severely underrepresented in travel surveys. A clear example is the 2013 VISTA survey (Transport for Victoria 2013); amongst the South Asians who completed the survey, only 4.3% were students, but according the 2016 Census (Australian Bureau of Statistics (ABS) 2016), 25% of South Asians in Australia were students. The underrepresentation of students and young adults has been raised as an issue for travel survey datasets in general not just in Australia (Stangeby 2000, Wang, Khattak et al. 2012).

International students are of greater importance to the Australian economy than many other countries. The education sector is Australia's largest service-based export (Department of Foreign Affairs and Trade (DFAT) 2016) and fourth largest export overall (Department of Foreign Affairs and Trade (DFAT) 2017). About half (45%) of all immigrants who arrived in Australia in 2016 were university students, and for some countries of origin such as China, that proportion can be even higher at 71% (ABS 2016). The state of Victoria in particular is referred to as 'The Education State' and it is home to one-third of all international students in Australia (Minister for Training and Skills 2016). The highest intake of international students in Australia are of Chinese origin but a quarter of South Asians living in Australia are students (ABS 2011). International students are a vital component to the Australian economy with close to a million registered international students, 400,000 of whom are in universities (Australian Government Department of Education 2018). As of June 2018, half a million immigrants from developing Asian countries were enrolled in Australian academic institutes and were residing on student visas, a quarter million of whom were university students (DET 2018). Recent years have seen the number of international students increase considerably and there is evidence that many international students in Australia want to settle and work in Australia upon the completion of their studies (DIBP 2015) – in fact, survey results from the past from Monash University has found that 71% of international students intended to work in Australia after their studies.

Despite there being no sound data on international students obtaining permanent residencies collected by the government, estimates have put this figure around 20,000 permanent residents from international students every year (Birrell 2019). The same study stated that in 2017-18 alone, almost 200,000 international students shifted from student visas to other temporary visas, prolonging their stay in Australia even further. Due to these limitations, and the importance of international of students to the Australian economy as a whole, it is only fitting that more research on this topic should be conducted, as intended in this thesis.

2.4.3 The importance of psychosocial and other non-economic factors

Another limitation with most immigrant-focused research is that the differences found between immigrants and native-born groups are mostly attributed to socio-demographic and economic factors. While these factors still play key roles in determining travel behaviour, there are a host of other potential factors at play, particularly psychosocial factors such as attitudes, habits, family dynamics and social support networks.

Some studies of immigrant travel behaviour have identified psychosocial influences. For example, for immigrants in particular, the behaviour of the head of family plays a key role in the individual's travelling choices (Smart and Klein 2017). There is also research on social exclusion amongst certain migrant workers within communities, which extends to use of transportation services as well (Chung, Choi et al. 2014).

It should also be noted that there is no research on the role pre-arrival past travel habits play in present-day travel behaviour in the context of immigrants. There is more generalized research on how important past habits are when studying travel behaviour. Studies analysing habit suggest that people are likely to do what they have done in the past (Haustein, Klöckner et al. 2009). Previous travel choices have been found to influence present-day and future transport decisions (Ouellette and Wood 1998, Ajzen 2002, Muromachi 2017). For example, Smart and Klein (2017) argued that commuters are more likely to continue their travel practices even after moving to low-transit regions. Research in the field of social psychology has also addressed the process in which attitudes are shaped with the help of past habits (Albarracin and Wyer Jr 2000), which in turn may influence travel choices. For immigrants who arrive from different transport networks and cultures, past habits are quite likely to play an important role in present-day travel behaviour. To date, however, this has not been directly studied, especially in the context of immigrants in a foreign country.

In the context of Australian research, several studies focussed on the role that socio-demographic and economic factors play in the travel behaviour of immigrants (Klocker, Toole et al. 2015, Yoo, Diamond et al. 2015, Kerr, Klocker et al. 2016). One paper found that travel behaviour differences could not be attributed to socio-demographics alone (Klocker, Toole et al. 2015). The other two papers indirectly implied that 'other factors' (possibly psychosocial in nature) are likely to explain differences in travel behaviour.

That's not to say that sociodemographic and economics factors will not play any factor – it is such that Australian immigrants are unlikely to face socio-economic difficulties or barriers. This is because Australian immigrants on average, compared to American immigrants, have been found to have higher levels of English fluency, education, and income (Antecol, Cobb-Clark et al. 2003). In fact, South Asian immigrants on average are more skilled and educated than Australian natives. There is a substantial body of research that studied immigrants integrating into the Australian culture and their roles in the community (Koleth 2010, Liu 2011), however, very little research has been undertaken to examine the extent of this integration to roads and assimilating travel patterns.

In summary, the gaps in the literature suggest that a more in-depth look at immigrants' adaptation to a new transport network or travel practices is needed. But to better understand the process, one must understand the travel practices and infrastructure of South Asian cities, which shaped the travel habits of South Asian immigrants before their arrival in Australia. The following section outlines the final component of this chapter – the travel behaviour context of South Asia.

2.5 The travel behaviour context of South Asia

In Section 2.4.3, the importance of psychosocial factors such as attitudes and past travel behaviour for Australian immigrants making travel choices was highlighted. This section of the thesis explores travel behaviour research from South Asia to further our understanding of the immigrants we will be studying in this thesis. While primarily research related to the South Asian transport context is discussed, the findings are occasionally supported by information from other developing countries in Asia.

In immigrant travel research, not many researchers actually study the transport networks of the countries where immigrants come from or the travel behaviour exhibited by them before they migrate. It can be of importance in the Australian context, as most South Asians in Australia are first-generation immigrants (Australian Bureau of Statistics (ABS) 2016). In such a case, where they are known to come from cities and transport systems that differ significantly from the Australian context, perhaps an analysis of their past may help explain their present choices.

For this reason, this section of the thesis provides an introduction and further context of travel behaviour in South Asia. This review was conducted through an informal thematic search of the academic and grey literature. This work helped design better data collection tools for this thesis.

2.5.1 Social status surrounding cars

In some respects, there are similarities in factors behind car ownership in developed and developing countries. Studies show that cars are associated with self-presentation, status and self-esteem (Sheller 2004, Getersleben 2007). Cars are also known to provide greater privacy, safety and security than public transport (Ellaway, Macintyre et al. 2003). Private vehicles allow many to go to places which public transport simply cannot take them, such as natural attractions (Sheller 2004). In both developed and developing countries, a car provides more freedom, job opportunities and a better quality of life (Handy, Blumenberg et al. 2008, Delbosc and Currie 2014). These are the broader luxuries of owning and using a car.

However, there are also differences in car use and perceptions of car ownership between Australia and South Asia. Most apparent is the varying levels of economic barriers to car ownership in Australia and South Asia. Australia has one of the highest motor vehicle ownership rates in the world, standing at 731 motor vehicles per 1000 as of 2016 (World Heritage Encyclopedia 2016). In the same year, car ownership in South Asian countries ranged from 3 per 1000 (Bangladesh) to 76 per 1000 (Sri Lanka). However, car ownership levels are climbing quickly in many South Asians cities (Bandyopadhyay 2008). It is estimated that passenger car ownership in India would grow by 775% by 2040 (Abbas 2018). In countries like Bangladesh, China, India Sri Lanka and Pakistan, car ownership rate growth outpaced GDP growth (Senbil, Zhang et al. 2007). This coincides with the rapid urbanization that is taking place in the region. For example, Malaysia has seen rapid growth in the number of vehicles and car use (vehicle population outpaced resident population over 3x), and this was primarily because cars were considered more cost- and time- effective when compared to public transport (Onn Chiu Chuen 2014).

Car ownership is considered very aspirational in developing countries and is often associated with a particular social class or occupation more so than in Australia. This is consistent with evidence that states that countries with a higher power distance, i.e. countries where it is accepted that there is uneven distribution of power (e.g. India, China), a car has a distinct

positive symbolic value (Haustein, Kroesen et al. 2019). There are also a growing number of first-time vehicle owners who greatly value their vehicles (Raza 2016). In India for example, it has been found that people with higher education or in a respectable occupation want to purchase a car (Verma, Manoj et al. 2016) while in China, entrepreneurs and employees in foreign firms cite their occupations as reasons for wanting to buy a car (He and Thøgersen 2017). This is unsurprising given the lower literacy rates and income levels in developing countries (UNDP 2016). In contrast, recent work in Australia found that very few young people thought having a car was an indication that someone was 'doing well in life' (Delbosc and Currie 2014). Such cultural and symbolic differences usually remain unexplored in immigrant travel research but provide valuable insights to understanding immigrants' travel behaviour.

2.5.2 Carpooling, carsharing and chauffeurs

In developed economies, it is normal for the owner of a car to also be the primary driver. However, cars are used very differently in developing countries (Enam and Choudhury 2011). Ownership of a car is reserved for the affluent in many developing countries, so it is not uncommon for one to hire a chauffeur. In fact, a pilot study in Dhaka, Bangladesh showed that driver salary accounts for over two-thirds the operating cost of a car (Mahmud and Rabbani 2012). The same study also suggested that women were far less likely to drive than men. Amongst the 1000+ people surveyed (300 of whom had access to a car), only half (50.6%) could drive. The gender distribution of participants able to drive were approximately 80:20 (male: female). It should also be noted that the survey sample was specific to the highly educated and people employed full-time, and only 20% of the participants were females.

Similar studies in South Asia argue that the inability to drive a vehicle actually has little correlation with actually using a car (Enam and Choudhury 2011) because it is quite common to carpool and carshare. Heavy congestion, high costs and difficulties of parking at end destinations (Rathi 2017) mean that it is easier to let someone else take care of the driving. It also helps that typical chauffeur salaries are very low (when compared to developed economies). Having a driver also means that one car can be used to transport more people and serve several purposes. In Australia on the other hand, it is more common for large households to simply buy a second car (Australian Bureau of Statistics (ABS) 2011).

In summary, carpooling and carsharing, especially within families, is common in South Asia. While commercial carsharing services (e.g. GoGet) have been studied in Australia (Nawangpalupi and Demirbilek 2008), how and why carsharing works within families and friendship networks is not well-studied. Studies have also shown that this carpooling and carsharing culture also extends to South Asians in Australia (Yoo, Diamond et al. 2015) and immigrants in the United States (Kim 2009).

2.5.3 Perceptions of using public transport

Public transport infrastructure varies substantially between Asia and Australia, and so do attitudes toward public transport.

Public transport is almost exclusively bus-oriented and heavily supplemented by paratransit services (further discussed in Section 2.5.5) in South Asia, and across most of the developing Asian countries. Only a few large cities in South Asia have operating metro systems (Singh 2015). There are some plans which may suggest that the situation is improving, and many metro projects are currently under construction in Bangladesh, India and Pakistan, but the fact remains that public transport takes second priority in transport planning in those regions

(Bandyopadhyay 2008, Hameed and Anjum 2016). Instead, government policies in India and other South Asian countries, in attempts to decongest city centres, tend to build road networks outwards that facilitate private modes of transport and longer commute times. This leads to lower bus use and increased paratransit services and private transport. In India, the share of total registered buses amongst the total motor vehicle population decreased from 11.1 % in 1951 to 1.1% in 2004 (Bandyopadhyay 2008). In Pakistan, lack of policy means that bus services are of poor quality and low in number. For example, buses are overcrowded (up to 120 people travelling on buses designed to carry 70-80 people) and most use old technology from the 1980s that don't meet modern day emission standards (Hameed and Anjum 2016)

Research has shown that South Asians are concerned with factors that attract comparatively little attraction in Australia, such as poor ticketing systems and poor bus staff courtesy (Rathi 2017). Most South Asian cities have very poor transit services that tend to be slow, overcrowded, uncomfortable, undependable and even dangerous (Pucher, Korattyswaropam et al. 2005). There is an absence of the basics such as published timetables and efficient ticketing systems (Enam and Choudhury 2011). This pales in comparison to developed countries, where factors hindering use of public transport are mostly due to service frequency, journey time and the cost of a trip (Beirão and Cabral 2007, Currie and Delbosc 2015).

In addition, cultural norms and frequent harassment mean South Asian women perceive public transport negatively when compared to their male counterparts (Enam and Choudhury 2011), and have a higher tendency towards private vehicles (Verma, Manoj et al. 2016). While gender related issues surrounding public transport use has been previously highlighted in western research (Thomas 2009), South Asian public transport system combated this issue by introducing gender-segregated train cars and buses (Peters 2001). The safety and security concerns also extend beyond South Asia to developing Asian countries. In Indonesia, research has shown that safety and security issues directly discourage potential riders from using transit services (Susilo, Joewono et al. 2010).

Above all, in South Asia people generally use transit simply because they cannot afford privatised modes of transport (Iyer and Badami 2007, Enam and Choudhury 2011, Raza 2016). This can also happen in developed countries where bus riders have been found to have poorer socioeconomic backgrounds, as evidenced in (Taylor and Morris 2015) the United States or even the United Kingdom (Fearnley 2006). However, this doesn't necessarily have to be the case in all developed countries, where transit use may come as a result of habits or have associated advantages such as environmental benefits or productivity (Campbell 2012). The latter is likely to be more relevant in Australia.

As a result of this situation, people in South Asia buy a car at the very first opportunity they are able to so do (Srinivasan and Rogers 2005, Raza 2016), and use it if they have access to one (Enam and Choudhury 2011, Mahmud and Rabbani 2012). The rising car ownership rates have also coincided with the rapid economic growth that South Asian countries, along with other developing countries on the continent have been experiencing (Senbil, Zhang et al. 2007). The increasing number of first-time car owners may suggest that if economic conditions were not a barrier, car ownership would be been higher in those countries. Base on this evidence, it is very likely that immigrants from South Asia and other developing countries have much higher car ownership rates than their counterparts in their home regions.

2.5.4 Motorcycles

Motorcycles account for a much higher mode share in South Asian cities' road space, compared to cities in developed economies such as Australia. That is because motorcycles have very

specific advantages in developing cities: high manoeuvrability and smaller parking requirements (Iyer and Badami 2007). Road congestion leads to motorcyclists simply using footpaths. In addition, motorcycles are the cheapest motorized form of private transport in those countries to purchase and maintain (Raza 2016). Consequently, there are far more motorcycles than cars in India (Iyer and Badami 2007). Furthermore, lack of proper law enforcement in countries such as India and Pakistan mean that motorcycles can be used in manners unimaginable in western countries (Srinivasan and Rogers 2005). It is common to see a whole family on one motorcycle, and that includes two adults and one or two children.

However, as these Asian countries experience higher economic growth, more people are starting to replace motorcycles with cars. Car ownership rates and motorcycles ownership rates have been found to be inversely correlated in Kuala Lumpur, Malaysia (Senbil, Zhang et al. 2007). This has also been found this is also the case in other South Asian cities (Raza 2016).

2.5.5 Paratransit services

In developed economies, paratransit services usually refer to modes reserved for those with special needs or disabilities. In South Asian countries on the other hand, they refer to informal forms of public transport. Such transport modes include rickshaws (pedal tricycle), auto-rickshaws (motorised versions of tricycles) and minibuses (in various forms with different local names) (Shimazaki and Rahman 1995). They are some of the most common forms of public transport in those regions.

Paratransit services exist in order to offer the benefits of door-to-door services akin to cycling and walking, as well as the benefits of longer-distance transport modes such as private cars and public transport. In heavily congested city centres, they offer high flexibility in terms of timetables and locations and are very affordable (Pucher, Korattyswaropam et al. 2005). While it can be considered an improvement over public transport (given it better deals with poor road conditions and limited public transport infrastructure), paratransit directly contributes to the congestion problems that persist in South Asia (Kumar, Singh et al. 2016).

2.5.6 Household structures and ethnic enclaves

While the vastly different transport context in South Asia has is likely to be important for understanding the travel behaviour of South Asians in Australia, there are also important cultural differences between households that may impact travel behaviour. Australians tend to live with family until financial independence, especially up until the completion of their education and the beginning of stable work (Cobb-Clark 2008). Afterwards however, independent living is generally seen as a part of adult life, and residential location greatly depends on a combination of lifestyle, work and family commitments (ABS 2013). This is quite different to South Asian culture and practices.

In South Asia, family bonds are prioritised in living arrangements (Jambunathan and Counselman 2002). It is also quite common for young adults to live with their families even after financial independence. In a study in Pakistan, 85 % of all households are nuclear families (parents and children), while 15% live in a combined arrangement of two or more families in one dwelling (MPGO and CDGK 2007). This is significantly different in Australia, where the 2011 census showed 22% of people lived in single-person households and a further 31% of people lived in two-person households (Australian Bureau of Statistics (ABS) 2011). In contrast, there is evidence of South Asians living in larger households in Australia across various datasets (Transport and Main Roads Queensland Government (TMR) 2009, Australian

Bureau of Statistics (ABS) 2011, Transport for Victoria 2013, Australian Bureau of Statistics (ABS) 2016).

Since most South Asians are first generation immigrants, they may prefer to live closer to family or fellow community members in ethnic enclaves. There is research documenting the value of ethnic social networks as a form of emotional support (Andersen 2010), or even to meet transport needs (Blumenberg and Smart 2014).

There is some evidence of this in Australia. The states of Victoria and New South Wales (NSW) combined account for about three-fourths of the first-generation South Asian immigrants living in Australia (Victoria 38%, NSW 36%). Inside those states, large South Asian communities have developed. For example, in the suburb of Truganina in Victoria, over 25% of the population were first-generation South Asian immigrants; it should also be noted that over 35% of residents living in those areas were born to South Asian fathers (culturally considered the head of the household). The reason behind South Asian immigrants choosing to live in such suburbs is one of interest as there is no evident differences in socioeconomics (income, education etc.) between South Asian immigrants and the native-born population.

South Asians ethnic enclaves in Australia are also somewhat unique compared to enclaves dominated by other ethnicities and in other countries. For example, South Asian ethnic enclaves do not appear to be as concentrated as, say, Chinese ethnic enclaves; in the suburb of Box Hill in Victoria for example, over 35% of residents were of Chinese ancestry (Australian Bureau of Statistics (ABS) 2016). South Asian ethnic enclaves are also not particularly known for higher employment rates, as are Asian enclaves in the United States (Shin 2017). Furthermore, South Asian, and are far away from the city centre (with Lynbrook and Noble Park, two suburbs with large South Asian populations, both approximately 30 km from the CBD), resulting in poor transit connectivity and no trams. These neighbourhood characteristics are likely to have an important impact on the travel behaviour of South Asian immigrants.

Given the importance of cultural connections of immigrants, the concept of ethnic enclaves, particularly for South Asians in Australia, will be further explored in this thesis.

2.6 Chapter summary

This literature review took place in three parts. The systematic search (Section 2.2) in the first part provided a limited number (35) of peer-reviewed research papers, which were then analysed thematically in the second part (Section 2.3) to understand the current scope of research and identify key limitations. There were four major limitations identified and those helped guide the third part of this literature review. Those gaps were further explored using a wider range of research and grey literature to better understand new avenues of research, especially for the Australian context (Section 2.4). Lastly, a brief overview into the travel context of South Asian countries amongst other developing Asian countries was presented in Section 2.5). This helped strengthen our understanding of the cultural element of immigrants' past that may possibly help guide their travel decisions while in Australia.

The knowledge gaps were identified fairly early on in the chapter (Section 2.3.5). To recap, there were four major gaps:

- The focus of past research was on Hispanic and Latino groups; Asian (and particularly South Asian) immigrants were rarely explored in comparison
- The emphasis was mainly on socio-demographics, with very limited consideration of attitudes or past travel behaviour.
- There was very little focus on specific sub-groups of immigrants such as students or families.
- There was very little research from Australia.

The rest of the chapter incorporated additional insight that could further narrow those gaps and provide the foundations for the design of this thesis' tasks. This helped formulate the research objectives and questions of this thesis (presented in Chapter 3). The information presented in this chapter also helped guide the formulation of data collection tools that were utilised in this research.

The findings reported in this chapter which address research on immigrant travel behaviour *and* the travel context in South Asia helped to design the tasks involved this research. The next chapter, Chapter 3: Research Approach, explores the various data collection and analysis tasks that have been undertaken to study the travel behaviour of immigrants in the context of South Asians in Australia.

3 Research Approach

The thesis structure highlighting Chapter 3 is presented below in Figure 3-1.

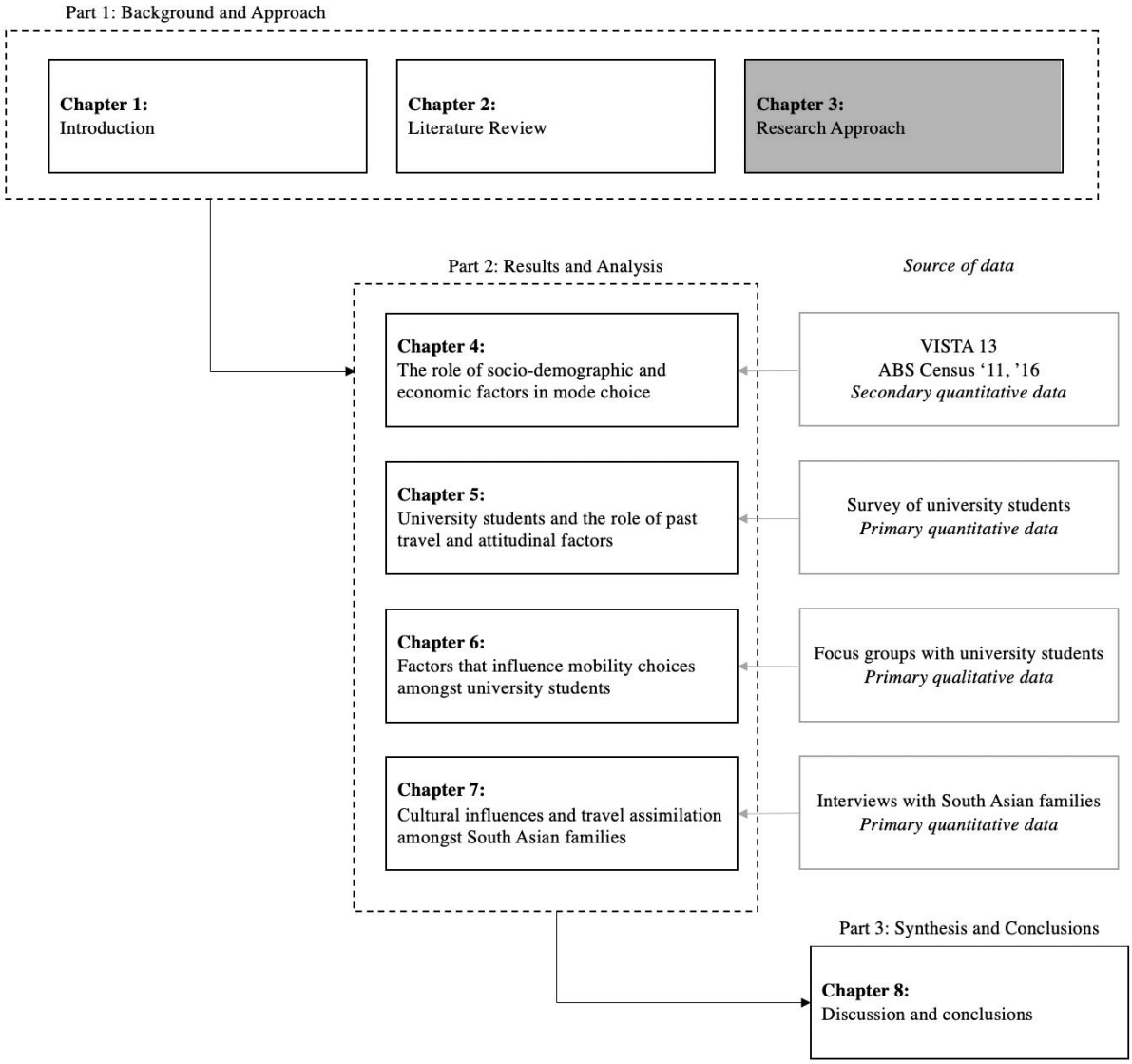


Figure 3-1 Position of Chapter 3 in thesis structure

3.1 Introduction

This chapter builds on the three research objectives introduced in Chapter 1, and the four key research gaps identified in Chapter 2, to introduce the research questions framed to help fill those gaps. These research questions were guided by theoretical frameworks with proven relevance in travel behaviour research.

Following the discussion of the research questions, the chapter then presents the data we used to support the analysis presented in this thesis, including the size of the dataset(s), their design and collection methods (for primary datasets, including transcripts for qualitative analysis). We end the chapter by outlining the qualitative and quantitative tools we utilised throughout this thesis.

3.2 Research objectives, theoretical underpinnings and research tasks

This thesis began by introducing three research objectives in Chapter 1. The three objectives are re-stated below:

- Research Objective 1: Identify key travel behavioural differences between South Asians in Australia and native-born Australians
- Research Objective 2: Understand the factors which affect travel behaviour of South Asians and Australians
- Research Objective 3: Understand how South Asian immigrants' travel behaviour evolves during their time in Australia

The previous chapter highlighted the following four key research gaps identified from the extensive literature review:

- Past research focus is on Hispanic and Latino groups, Asian immigrants are rarely explored in comparison
- Emphasis is mainly on socio-demographics, with very limited consideration of attitudes or past travel habits.
- There is very little focus on specific sub-groups such as students or families.
- There is very little research from Australia.

To address those knowledge gaps, we propose the following research questions to underpin the three research objectives:

- Research Objective 1: Identify key travel behavioural differences between South Asians in Australia and native-born Australians
    - RQ 1.1: How does short-term travel behaviour differ?
    - RQ 1.2: How do long-term mobility choices differ?
- Research Objective 2: Understand the factors which affect travel behaviour of South Asians and Australians
    - RQ 2.1: What role do attitudes play in shaping travel behaviour?
    - RQ 2.2: How important are past travel habits in present day mode use?
    - RQ 2.3: How does gender influence travel behaviour?
- Research Objective 3: Understand how South Asian immigrants' travel behaviour evolves during their time in Australia
    - RQ 3.1: How does mode use change over time?
    - RQ 3.2: How do attitudes towards travel modes change over time?

3.2.1 Theoretical frameworks

Insights from two foundational theoretical frameworks, namely the Theory of Planned Behaviour (Ajzen 1985) and the Hierarchical Choice Structure of travel demand (Salomon and Ben-Akiva 1983) are relevant to answering many of the research questions identified above.

A key intention of the data collected was to examine the influence of 'soft' factors on day-to-day and long-term travel intentions. Soft factors refer to the non-economic factors that influence travel choices amongst immigrants – these include factors such as cultural practices, past habits and beliefs amongst other things. Most of the factors we are considering when trying to explain behaviour of immigrants do not necessarily fit into the traditional notion of "rational"

decision-making factors implied by economic theory (Handy, Blumenberg et al. 2008). As a result, the Theory of Planned Behaviour, which originated in psychology, was particularly useful in designing our studies.

3.2.1.1 Theory of Planned Behaviour

A growing body of research studying habits or the influence of particular perceptions on travel behaviour is drawing insight from the Theory of Planned Behaviour (TPB) (Ajzen 1991), a version of which is presented in Figure 3-2. This theory is an evolution of several other theories and frameworks such as the Theory of Reasoned Action (Ajzen 2012), and has evolved to, and been modified into, more complex models such as the Comprehensive Action Determination Model (Klöckner and Blöbaum 2010). Fundamentally at its core however, the concept is that behaviour is guided by intentions, which in turn is influenced by a set of personal and societal beliefs.

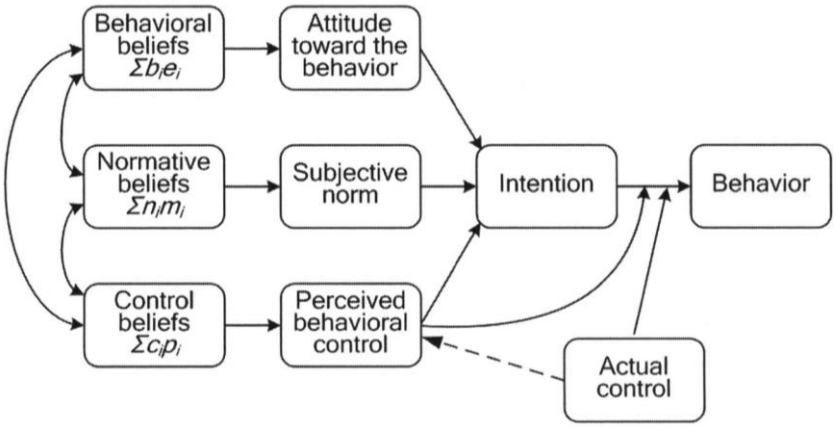


Figure 3-2 Basic structure of Theory of Planned Behaviour (Ajzen 2012)

The theory suggests that human behaviour is guided by three constructs of beliefs (Ajzen 2012), as listed below.

- Behavioural belief, which encompasses one's personal set of beliefs relevant to performing a particular action.
- Normative belief, which accounts for one's consideration of peers' and broader society's judgement towards performing a particular action.
- Control belief, which takes into consideration one's self-assessment of ability to performing a particular action.

The framework has been tested and used as a fundamental concept in a variety of travel behaviour research studies to better articulate the effects and importance of soft factors such as attitudes and subjective norms on present-day travel behaviour (Forward 2004, Donald, Cooper et al. 2014), including one related to immigrant travel behaviour (Handy, Blumenberg et al. 2008). The TPB helped guide us in formulating survey questions and designing interviews so that the otherwise exploratory nature of our research was founded on sound concepts derived from previous research.

3.2.1.2 Hierarchical Choice Structure of Mobility and travel

The Hierarchical Choice Structure of Mobility and Travel (Salomon and Ben-Akiva 1983) was selected as another useful framework to guide the development of the research questions. This framework further helps with our understanding of the possible causal direction of relationships, particularly between long-term decisions (such as where to live) and short-term decisions (such as whether to drive to work).

The structure of the Salomon and Ben-Akiva's conceptual model is illustrated in Figure 3-3. This structure highlights the relationship(s) between lifestyle choices, mobility choices and travel choices, and helps better understand the concept of travel demand and the underlying factors that influence travel demand. This model is an iteration of the hierarchical choice structure of mobility and travel hypothesized earlier (Ben-Akiva 1973). The key distinction in this iteration over the basic framework is the segregation of the population by lifestyle choices (Component I in Figure 3-3), which we are assuming at this stage is a major differentiating factor between immigrant and native-born groups in Australia. As with the Theory of Planned Behaviour, this framework also helped guide the design of research questions, questionaries and discussion guides.

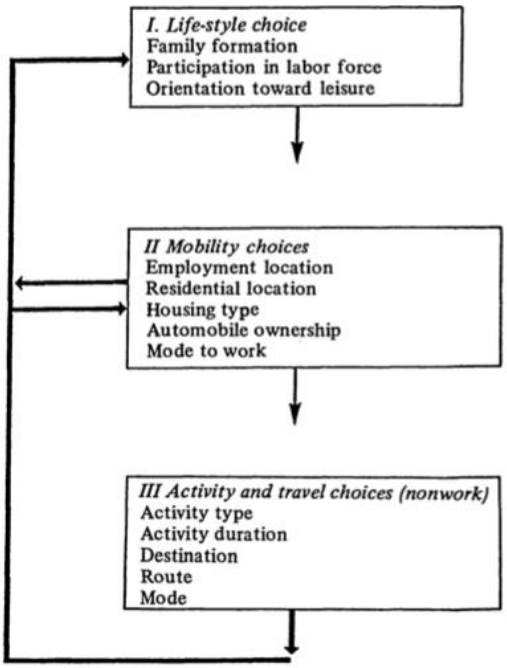


Figure 3-3 Extended choice hierarchy (Salomon and Ben-Akiva 1983)

3.2.2 Research Tasks

The tasks progression in the thesis is presented in Figure 3-4. The thesis begins by examining the literature (Task 1, presented in Chapter 2) and is followed by an analysis of secondary datasets, specifically the Victorian Integrated Survey of Travel and Household Activity (VISTA) and Census (Task 2). From there we narrow down our "South Asian immigrant" cohort to smaller subpopulations for our studies, which led to three tasks with primary data (Tasks 3-5). The last task of this thesis (detailed in Chapter 8) is a synthesis of all key findings. We will discuss these tasks in greater detail later in this chapter.

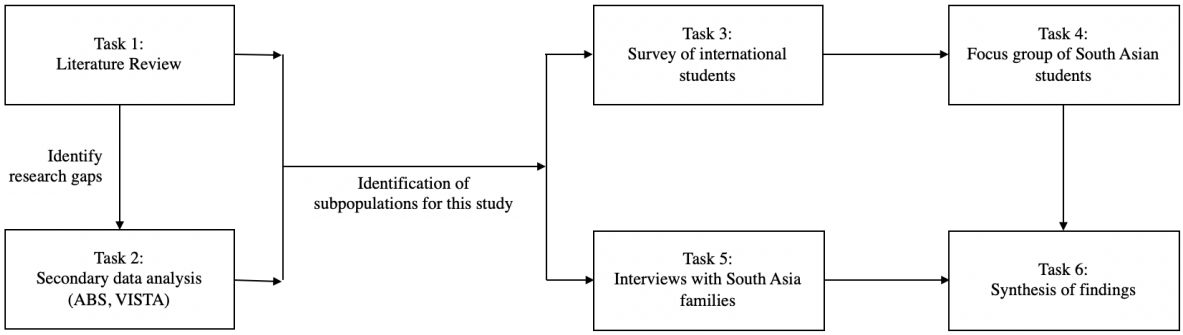


Figure 3-4 Outline and progression of tasks in thesis

The thesis tasks illustrated in Figure 3-4 are linked with the aforementioned research objectives and questions as shown in Table 3-1. From the table, it can be seen that the relationship between research objectives and research tasks is complex. Some research tasks were better suited to answer different research questions; others could only provide partial insights into a given question. Although this introduces some complexity, it is also a strength as it allows the data to triangulate and address the research questions from different angles and perspectives.

Table 3-1 Linking thesis objectives with thesis chapters

Research Objective	Research Question	Thesis tasks					
		Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
		Chapter 2: Literature Review	Chapter 4: The role of socio-demographic and economic factors in mode choice	Chapter 5: University students and the role of past travel and attitudinal factors	Chapter 6: Factors that influence mobility choices amongst university students	Chapter 7: Cultural influences and assimilation amongst South Asian families	Chapter 8: Synthesis of findings
1. Identify key travel behavioural differences between South Asians in Australia and native-born Australians	1.1: How does short-term travel behaviour differ?		X	X			X
	1.2: How do long-term mobility choices differ?		X	X	X		X
2. Understand the factors which affect travel behaviour of South Asians and Australians	2.1: What role do attitudinal factors play in shaping travel behaviour?	X		X	X	X	X
	2.2: How important are past travel habits in present day mode use?	X		X	X	X	X
	2.3: How does gender influence travel behaviour?	X	X			X	X
3. Understand how South Asian immigrants' travel behaviour evolves during their time in Australia	3.1: How does mode use change over time?		X	X		X	X
	3.2: How do attitudes towards travel modes change over time?			X	X	X	X

3.3 Research context

In the introduction of this thesis (Chapter 1), we made a case for why we are doing this research in Australia (and Melbourne in particular), and why we specifically focused on South Asian immigrants. We further elaborate on these choices and present our reasoning for why we further narrowed down our study groups to particular subpopulations.

3.3.1 Study location

We are undertaking this research in Victoria, Australia with a focus on Greater Melbourne (the State Capital). There are two main reasons for choosing Melbourne: representativeness for the most part but also its proximity to the researchers.

Victoria, the state, is located in southeast Australia. Melbourne is its capital and is currently (at the time this thesis is being written) the second largest city in Australia. Melbourne has seen the highest population growth of any Australian city as of 2019 (Capuano 2019). It is expected to overtake Sydney within the next 10 years as the most populous city, even in a post pandemic (COVID-19) economy (Bennett 2020). More South Asians live in Victoria than any other state in Australia, and they are largely concentrated in particular regions and suburbs within Victoria (Australian Bureau of Statistics (ABS) 2011, Australian Bureau of Statistics (ABS) 2016). Figure 3-5 illustrates the proportion of people living across Melbourne who are South Asian by birth. The maps were generated with QGIS using data from the 2016 Census (Australian Bureau of Statistics (ABS) 2016), and the boundaries represent postal area codes (POA). This is compared against the proportion of native-born Australian residents across Greater Melbourne. It can be seen that unlike native-born Australian population in Melbourne who are somewhat evenly dispersed across the city (Figure 3-5b), South Asian immigrants are much more concentrated in particular postal area codes (Figure 3-5a).

Monash University was chosen as the location to undertake our studies on international students (Chapters 5 and 6). It is the largest university in Australia by enrolment (>83,000), and has the largest number of international students on temporary visas (>26,000) as of 2018 (Australian Government Department of Education 2018). Its main and largest campus is located in the suburb of Clayton which is 17km from the city centre in Melbourne. Other large Victorian university such as RMIT or Melbourne University have their main campuses in the city centre – however not all South Asian immigrants (or Australians for that matter) live there. Monash University's Clayton campus is located in a low urban density suburban environment which is located away from the radial train lines which serve Metropolitan Melbourne. It is also not served by Melbourne's extensive tram network, and consequently, the only form of public transport access to the campus is by bus. However, it should be noted that only a small proportion of the Victorian population, less than 150,000 out 4.4 million (Australian Bureau of Statistics (ABS) 2016), live in the inner city. As such, the suburban setting of the Monash Clayton campus is more representative of the style of urban living which the majority of the population relate to.

While there is sound reasoning behind the aforementioned choices, there is also the element of proximity to the researchers who are all based in Melbourne. The physical presence greatly helped with data collection and marketing of survey and questionnaire material that meant it was a more efficient and economical option from the perspective of the research.

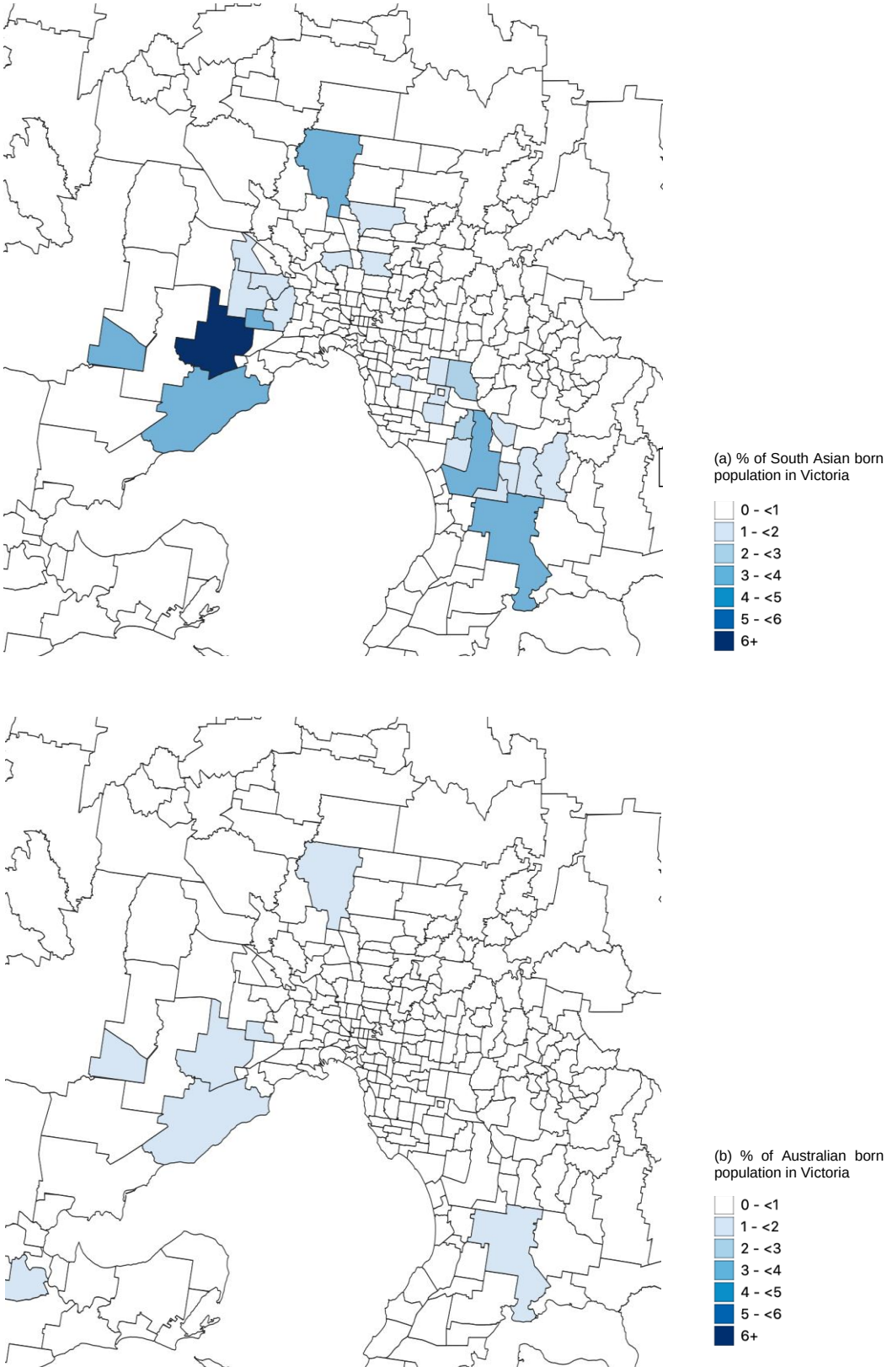


Figure 3-5 Comparison of proportion of (a) South Asian immigrants and (b) native-born Australian residents across Victoria (data retrieved from ABS Census 2016, and mapped using QGIS); maps showing postal area code (POA).

3.3.2 Defining target groups

In this thesis, country of birth is used to determine whether a person is considered a South Asian[2] immigrant. This means second generation South Asians were classified as Australians in this study or leaves the possibility that a potential "Australian" born to Australian parents in South Asia is classified as South Asian. It also be noted however that even the Australian census asks country of birth and bases statistics on immigration using this variable (Australian Bureau of Statistics (ABS) 2019), hence continuing this practice in this thesis is justifiable.

We established in Chapter 2 why we were focusing on South Asian immigrants. However, it is quite likely that South Asian immigrants are not one homogenous group but rather overlapping cohorts with different characteristics and travel needs. University students, families with children and working adults without families each have unique lifestyles and a particular set of travel needs. The same set of determinants for travel choices would not necessarily be applicable for all groups. So, given the resources available for the thesis, we focussed on two groups for the collection of primary data: international students and families with children.

In Chapter 2 we discussed how underrepresentation of international students is not unique to Australia but reflects a global problem. Research also generally tends to overlook this particular cohort. However, international students are important to the Australian economy. Furthermore, many international students have stated clearly their desire to settle in Australia; in our survey of international students (analysis to be presented in Chapter 5), about half the respondents stated they would wish to settle in Australia, or have already settled, with a further 40% stating they were undecided. In another survey at Monash University, 71% of university students expressed their desire in work in Australia after the completion of their studies (Delbosc 2018). These findings suggest that a significant proportion of South Asian international students will continue to use Australia's transport infrastructure after they complete their studies. This is even without accounting for the fact that every year, more new students are arriving in Australia. They are young and dynamic, can adapt easily to new experiences and infrastructure, and once they settle in Australia, are likely to be in their prime working years.

Another significant cohort of South Asians are families with children[3], most of whom came to Australia for long-term work. This cohort, many of whom are citizens or permanent residents of Australia, are more likely to have lived for longer in Australia compared to international students. This allowed us to study a wide spectrum of immigrant households, from those who arrived recently to those who has been residing in Australia for decades. This helped us to explore the concept of travel assimilation (introduced in Chapter 2) and the evolution of decision-making factors at a household level. Households are also more likely to be flexible with regards to their residential choices as opposed to international students, with the latter group likely having financial and proximity constraints. Furthermore, gender is expected to play a much larger role at a household level where there are more responsibilities around the house, and the presence of a family and children than is the case for students. This is something which our university student participants didn't have to consider given the life stage they were at. Lastly, the households in our study comprise at least two generations cohabitating – parents and their children. The differences between the two groups within each household, and the potential transfer of cultural values (if any), were also of interest.

[2] As outlined in Chapter 2, "South Asia" is defined as Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, unless otherwise defined due to data limitations.

[3] The term *children* here do not necessarily refer to those below the age of 18; rather we recruited households where immigrant parents and their children (born or not born in Australia) lived together.

3.4 Overview of data sources

Throughout this thesis we draw from several secondary and primary data sources. In this chapter, we introduce the various data sources, how we collected them (for primary datasets) and how they contributed to answering our research questions.

As shown in Table 3-2, the thesis chapters are structured around thesis tasks, which in turn are structured around the various datasets used. From the table, it can be seen that the analysis of secondary datasets makes up Task 2, which is reported in Chapter 4 of the thesis. The three primary datasets correspond to Tasks 3, 4 and 5, which in turn relate to Chapters 5, 6 and 7 in this thesis.

Both qualitative and quantitative data sources were used in a mixed-methods approach. This provided the opportunity to triangulate around the research questions using multiple methods. Triangulation is a common approach when qualitative methods are employed as it is seen to reduce bias and increase the reliability and validity of results (Jonsen and Jehn 2009).

Table 3-2 Linking datasets and thesis tasks

Dataset	Year(s)	Data Type			Thesis Tasks			
		Source	Quantitative	Qualitative	Task 2	Task 3	Task 4	Task 5
					Chapter 4: The role of socio-demographic and economic factors in mode choice	Chapter 5: University students and the role of past travel and attitudinal factors	Chapter 6: Factors that influence mobility choices amongst university students	Chapter 7: Cultural influences and travel assimilation amongst South Asian families
Census, Australian Bureau of Statistics	2011, 2016	Secondary datasets	X		X			
Victorian Integrated Survey of Travel and Activity	2013		X		X			
SE Queensland Household Travel Survey	2009		X		X			
Survey of university students	2018	Primary datasets		X		X		
Focus groups with university students	2019			X			X	
Interviews with South Asian families	2020			X				X

3.5 Secondary datasets used

Several secondary datasets were used for analysis and, where relevant, for comparative purposes. The three main datasets were the Census (two sets from 2011 and 2016), the Victorian Integrated Survey of Travel and Activity (VISTA) from 2013 and the Southeast Queensland Household Travel Survey from 2013 (the last one was used purely for comparison purposes, albeit being a much smaller dataset).

3.5.1 Australian Bureau of Statistics (ABS) Census 2011 and 2016

The ABS Census, or simply the Census as it is commonly referred to, is Australia's national population census. It collects information on a broad range of demographic, social and economic factors. In Chapter 4, the census was used to determine the socio-demographic and economic characteristics of immigrants in Australia.

At the time the analysis in Chapter 4 was undertaken, the 2011 Census was the latest census data available to us. Furthermore, it is closer in age compared to the VISTA dataset (from 2013) and the SEQ HTS (from 2009), the latter of which we used for comparison.

The 2011 Census contains information from approximately 465,000 South Asians and 15,000,000 native-born Australians, while the 2016 Census saw those numbers increase to approximately 730,000 and 18,000,000 respectively. Over 97% of South Asians in Australia had both parents born overseas, indicating that most South Asians are first-generation immigrants.

For our analysis, TableBuilder Pro was used as to present and illustrate aggregated data. ABS do not release any identifiable information and so person-level responses cannot be retrieved. Through a process called *perturbation*, ABS also adjusts aggregated results using small introduced errors for confidentiality purposes (Australian Bureau of Statistics (ABS) 2017). This meant we could only use the aggregated data to identify general patterns.

3.5.2 VISTA 2013

The Victorian Integrated Survey of Travel and Activity (VISTA) is an annual travel and activity survey that is collected by the state government of Victoria. The VISTA survey collects information about every trip undertaken by every member of a household on a given day. This includes the trip origin and destination and the mode used for the journey. It also collects individual and household characteristics, such as car ownership, household location and demographics. The 2013 version is the latest that was available to us for analysis.

The data included 7,422 respondents with a country of birth of Australia and 415 born in South Asia[4]. Furthermore, the dataset consisted of 14,447 trips by Australians and 827 trips by South Asians. The final table of demographics and finer details is presented in Chapter 4.

[4] This dataset did not have any participants from Bhutan or the Maldives. As a result, South Asia in this case is limited to Bangladesh, India, Nepal, Pakistan and Sri Lanka.

3.5.3 SEQ HTS 2009

We also analysed the Southeast Queensland Household Travel Survey from 2009 (Transport and Main Roads Queensland Government (TMR) 2009). This was used purely as a point of comparison to our results from VISTA and Census in Chapter 4 to see if certain trends were still valid based on data from another state. Queensland is a state in north-eastern Australia and has fewer South Asian immigrants than New South Wales or Victoria; however, this was the latest non-Victorian dataset we could access that included country of birth information. The dataset consisted of 20,735 respondents who were classified as Australians and 190 as South Asians. All respondents were residents of Queensland at the time of the survey. All South Asian countries bar the Maldives were represented in this dataset. We would have preferred a more recent version of SEQ HTS, but 2009 was the last survey where country of birth was asked before it was deemed 'intrusive' and removed from their survey (Department of Transport and Main Roads Queensland, personal communication, May 2017).

3.5.4 Other government publications and statistics

The Australian Bureau of Statistics also presents aggregated datasets and figures besides the Census that were used needed throughout our analysis. Other departments of the Australian government also produce datasets that were used for justification throughout this study. This includes the Department of Education, Skills and Employments (DESE)'s publication of student statistics in Australia, and Department of Immigration and Border Protection (DIBP)'s and Department of Home Affair (DHA)'s reports on immigration trends and systems. These have been referred frequently throughout this thesis.

This completes the description of the secondary datasets analysed in this research. The following section focusses on the primary data, along with the survey design and data collection procedures we employed to collect that data.

3.6 Primary data collection

While the secondary datasets analyses made it possible to answer some of the research questions, they were limited with regards to the questions asked. Consequently, additional (primary) data collection was necessary to answer other research questions.

3.6.1 Survey of university students

The first dataset we collected was a survey with university students (Task 3/ Chapter 5). We conducted the survey at Monash University with the comparing international university students from South Asia to their native-born counterparts. The survey and recruitment were approved by the Monash University Human Research Ethics Committee (Project ID # 11737).

3.6.1.1 Survey design and scales

The survey questions drew primarily upon the principles of the Theory of Planned Behaviour, which associates attitudes and beliefs with actions (discussed in Section 3.2.1). Given the limited insight available from other studies comparing travel habits of immigrants and native-born Australians, greater emphasis was placed on attitude and habit questions in this survey.

To maximize response rates in this study, careful consideration was given to managing respondent burden which had implications for both the number and type of questions included. Responses were mainly recorded using closed questions using either a scale or categorical (participants choosing one or multiple responses) response. The full questionnaire is attached at the end of this thesis (Appendix A). Respondents typically took ten minutes or less to complete the survey.

A total of 22 attitudinal questions were asked, and responses were recorded on a scale of -2 to 2, where -2 = Strongly Disagree and 2 = Strongly Agree. These questions covered attitudes to car ownership, car use, public transport use and active transport.

Given the consideration of respondent burden, asking respondents to complete a full travel diary was not regarded as appropriate and so mode use was measured in two ways. Respondents were asked their preferred choice of mode for particular trip purposes ("work", "study", "recreation" and "other"), choosing between one of four travel modes (drive or driven, public transport, walking and cycling). In addition, frequency of mode use for university and non-university-based trips were asked for each mode and responses were recorded on a one to five-point scale, where 1 = never and 5 = always. *Non-university trips* covered recreational, shopping and work-based trips because asking mode frequency for each non-university trip purpose would make the survey longer and potentially reduce the response rate.

Questions on past habits included how frequently they used a given mode for educational, recreational and other purposes during high school. Responses to those questions were recorded on a scale of 1 to 5, where 1 = Never and 5 = Always. For students on international visas, this referred to travel in their home countries prior to arriving in Australia; all our international student participants completed at least their high school prior to arriving in Australia, with some students even completing a Bachelor's degree. Furthermore, a question about growing up in a household with cars was also included. Other questions related to typical socio-economic and demographics parameters , such as age, gender, driving license status, household structure and car access[5]. The survey also included questions covering the

[5] Car access does not necessarily mean car ownership, as many (especially households) are likely to share cars.

participants' parents place of birth, what level of education they were enrolled in at the time of the survey, which Monash campus they were attending and the number of years they had been living in Australia (for students from Asia).

No questions about personal or household income were asked as international students and domestic students face different financial responsibilities. International tuition fees are substantially higher than domestic fees, while many domestic students opt to live with their parents. For this reason, international students are more likely to come from families of wealth. Consequently, questions were included about whether the student worked and how much financial support they were receiving from their parents with respect to educational expenses, housing, food and utilities.

3.6.1.2 Recruitment and dataset size

The survey was coded into the online survey software Qualtrics and a link was distributed through posters with tear-off tabs, postcards and personal contacts around the Monash University campuses. Social media, particularly Facebook student pages and student social clubs, were used extensively to promote the survey. Participants were offered the chance to enter a prize draw for a single AU$200 gift voucher.

At the time the survey closed, 496 responses were recorded. The analysis only includes participants who completed all the questions on the survey, were aged 18 or over and were born in a relevant country. This included 174 responses from Australian-born students and 72 responses from South Asian students. However, as this sample size was small for more in-depth statistical analysis, we expanded some analyses to include international students from developing Asian countries[6] more broadly as they are largely expected to face the same challenges and have similar decision-making processes. Within the final, cleaned dataset, there were 154 responses from students from developing Asian countries (which includes the 72 South Asian responses).

3.6.2 Focus groups with university students

In order to provide a more in-depth understanding of the travel behaviour of South Asians, for our second study involving primary data collection, we conducted focus groups with university students (Task 4/ Chapter 6). A qualitative approach has the advantage of providing new insights in under-researched areas (Clifton and Handy 2003), which is why focus groups were chosen for this research. Not only did such a set-up allow participants to share their experiences in their own words, but the group discussions also allowed them to reflect on their experience in light of the experience of others. The discussions helped generate many concepts and themes that were previously not picked up on in the university student survey or the literature review undertaken by the researchers. That is one advantage of qualitative research (Kitzinger 1995).

The focus groups were conducted at Monash University, with the aim to better understand the decision-making factors that influence travel and residential choices of South Asian international students, and how they compared to their native-born counterparts. The survey and recruitment were approved by the Monash University Human Research Ethics Committee (Project ID # 17351).

[6] Developing Asian countries consist of Bangladesh, China, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Vietnam. The DIBP has a longer list of developing Asian countries, however, there were no respondents from those countries.

3.6.2.1 Recruitment and dataset size

The participants were recruited from the survey of university students (Task 3), and only those who provided their contact details and consent to be contacted for future research were contacted. We conducted four focus groups with 29 Monash University students, 13 of whom identified themselves as domestic, Australian students. The rest, 16 participants, were on international student visas, having arrived from South Asia[7] for pursuing various qualifications. Each participant received a AU$40 gift voucher, and each focus group lasted for about an hour. All sessions were recorded, and later transcribed for analysis.

3.6.2.2 Interview script design

Semi-structured interview scripts were prepared that covered a range of topics beyond the areas usually covered in travel surveys. The script was modified between sessions as new themes emerged. Many of the questions asked were based on themes that were derived from the Theory of Planned Behaviour (Section 3.2.1). Some of the topics discussed included the following:

- Attitudes and mode perceptions
- Social (friends and family) perceptions on travel habits and its influence on participants
- Past travel habits, including early childhood and high school
- Present day travel habits, including mode choices
- Future plans, including work, residence location, preferred mode choice

An interview script is attached in Appendix B1. Due to the nature of how the study was conducted, there were further 'impromptu' questions included based off respondent responses during the focus group discussions.

3.6.3 Interviews with households

The two studies using university students provide the views of one important section of the South Asian community. However, students face very different travel behaviour circumstances compared to working families. For this reason, we extended our qualitative data collection and included an additional component which focussed on South Asian family households.

We recruited a wide range of families ranging from recently arrived immigrants to those who have been residing in Australia for decades. The focus of these interviews was to explore the potential evolution of decision-making factors of households depending on how long they lived in Australia. Consequently, unlike the studies with students, we did not compare these respondents with native-born families. The survey and recruitment were approved by the Monash University Human Research Ethics Committee (Project ID # 17351).

3.6.3.1 Recruitment and dataset size

Initial contact with cultural communities and potential recruits were facilitated by a representative of the Multicultural Advisory Committee at the City of Monash Council through distribution marketing material at libraries and personal contacts with community members. The first few interviews were also conducted within the council office premises in Glen Waverley, Victoria. Initially interviews were conducted with residents of the City of Monash (south-east of Melbourne, home to Monash University's Clayton campus).

[7] In this study (applicable for both Task 4 and Task 5), only Bangladesh, India, Pakistan and Sri Lanka were represented, and were classified as South Asians.

However, the COVID-19 outbreak in 2020 in Melbourne and consequent 'stay at home' orders resulted in the interviews moving online via Zoom or telephone calls. The lack of marketing (due to closure of many public places) and uncertainties surrounding mobility and employment led to a sharp drop in interest in the study, and many supposedly confirmed recruits did not end up participating. This led to recruiting beyond the City of Monash by snowballing through the existing participants and their contacts.

We recruited 13 South Asian[8] households for this study. Each household was represented by one or both adult heads of the family (the *father* and/or the *mother*), leading to 20 participants. The longest-settled household had lived in Australia for three decades, whereas the most recent arrived in 2018. Each participating household received an AU$60 gift voucher in recognition of their participation in the interview. Interviews typically lasted up to an hour. All sessions were recorded, and later transcribed for analysis.

3.6.3.2 Interview script design

The parameters we wished to explore in this study were considered more sensitive than the ones in the focus groups – factors like the role of gender, income, household responsibilities and education. Unlike the focus group participants who were all university students, the participants in this study came from a diverse range of backgrounds and life experiences. Instead of focus groups, which could have potentially led to discomfort amongst participants if asked to speak openly in front of strangers and the difficulty in finding suitable time slots, the data collection was undertaken using an interview format.

The interviews were structure broadly into three key segments, and explored a range of topics as detailed below:

- Past travel habits and mobility choices
    - Year of arrival, license acquisition
    - Travel habits in country of birth (or before arriving in Australia).
    - Travel habits after first landing in Australia
- Present day mobility choices
    - Residential location and decision-making factors involved
    - Car use and ownership
    - Public transport availability and use
    - Barriers from using particular modes
- Future travel habit intentions and evolution
    - Participant's perceptions of what changed over the years
    - Future intentions – residential relocation, car purchase.
    - Motivations for increased public transport or active travel use.

A sample interview script is attached in Appendix B2. As with the study in Task 4, there were also 'impromptu' questions asked in response to issues raised by respondents, but those questions have not been included on the sample script.

[8] In this study only Bangladesh, India, Pakistan and Sri Lanka were represented.

3.7 Analysis Methods

This section outlines some of the key analyses that were performed across the thesis. There were other smaller analyses that are presented and discussed throughout Chapters 4 through 7.

3.7.1 Defining mode of travel

To bring consistency amongst the analysis of the various datasets described earlier, several key variables were pre-defined, such as country-of birth. Travel mode is another. For a city like Melbourne where the population predominantly lives in the suburbs, it is common to utilise multi-model travel (e.g. driving to a station, then taking the train to the CBD, or utilising active travel and first and last mile trips). In such instances, where participants selected several modes of travel for a particular trip, the Priority Mode approach has been used on trips with multiple modes to assign a main mode of transport (TUTI 2008). Throughout this thesis, we mainly focused of five modes of travel: car as a driver, car as a passenger, public transport, walking or cycling. The priority mode approach is listed as below (in order, reclassified to suit our analysis):

- Public transport
    - Includes: Train, Tram, Public bus (in that order)
- Vehicle as driver
- Vehicle as passenger
- Bicycle
- Walking
- All other modes were classified as *other* and were generally excluded from our analysis irrespective of their position on the Priority Mode approach ladder. These include (in order) school bus, taxi, motorcycle, and other modes. When analysing the ABS Census data, the *other* category also included ferry and truck.

3.7.2 Quantitative analysis methods and methodology

The quantitative methods outlined here apply to the analysis conducted and presented for Tasks 2 and 3 (Chapters 4 and 5). The analyses were performed using IBM SPSS® statistical software.

3.7.2.1 Univariate and bivariate analysis

All quantitative analyses began with descriptive statistics that are presented in tabular or graphical form to highlight key trends and patterns that we explore further. This includes highlights of most socio-demographic and economic variables.

Throughout the thesis, we compare immigrants and native-borns to examine differences between them. We also compared recently arrived immigrants to long-term immigrant residents. We employed t-tests, one-way ANOVA and the Chi-Square Test of Association (also can be referred to as Chi-Square Test of Independence).

3.7.2.2 Multivariate analysis

We run several logistic regression models in this thesis. Depending on the variables available, we ran both multinomial logistic regression models (for Chapter 4/ Task 2) and binary logistic regression models (for Chapter 5/ Task 3).

In Chapter 4 / Task 2, we ran multivariate logistic regression models to predict the likelihood of driving a car vs. car as passenger, public transport and active travel. The main objective of this model was to determine if the factors that predict mode choice differed between South Asians and native-born Australians.

In Chapter 5 / Task 3 we ran separate binary logistic regression models predicting whether a student was a frequent vs. infrequent user of either the car, public transport, walking or cycling. In this analysis, a range of socio-economic factors, including country of birth, were used as independent variables.

3.7.2.3 Factor Analysis (used only in Chapter 5)

The international student survey (Chapter 5/ Task 3) recorded data on a number of potential factors (22 in total) and reducing that data through factor analysis aided interpretation. Principal components analysis provided a mechanism to reduce the number of attitude variables into factors. Varimax rotation was used, and factors were determined initially based on eigenvalues being greater than one. Subsequent consideration of the scree plot and the proportion of variance explained brought the number of factors down to four. Variables were omitted in an iterative fashion (parameters were removed manually between each iteration) based on low communalities or being evenly loaded on more than on latent variable (factor loading of variable > 0.7 for one factor was used as a rule-of-thumb). In this manner, we were able to reduce 22 factors to four variables that was used for the follow-up regression modelling.

3.7.3 Qualitative methods

Qualitative analysis is particularly helpful to explore new themes and ideas (Patton 1990), and has been quite common in the field of travel behaviour research (as our thematic analysis of the literature review has shown in Chapter 2, Table 2-2). Unlike quantitative data and analysis however, where it is quite straightforward to replicate results, qualitative analysis often draws on a combination of numerous and sometimes overlapping approaches to interpreting the data. And unlike assessing rigour of quantitative analyses which often have numbers and supporting statistical measure to help ensure quality and aid interpretation, in qualitative analysis, the best we have is *trustworthiness or soundness* (TalkadSukumar and Metoyer 2019).

The qualitative methods outlined here apply to the analysis conducted and presented for Tasks 4 and 5 (Chapters 6 and 7).

3.7.3.1 Qualitative approaches

A qualitative *approach* is, quite simply, a strategy for conducting qualitative research. It considers the very purpose of doing the study in the first place, the role of the researcher in the study, and assists in strategizing the actual analysis. There are five broad qualitative approaches (Creswell 2007, Elkatawneh 2016), as listed below:

- Ethnography: observing an *ethnos* (Greek for multitude or nation), i.e. a (single or group of) participant(s) by communicating with target participant in their *environment* to understand systems or practices.
- Narrative: constructing a *narrative,* i.e. a story, by interweaving a series of events to highlight importance of chronology.
- Phenomenological: to identify and discuss a *phenomenon,* i.e. an event or an activity, generally relying on participants' own perspectives.
- Grounded theory: building up a *theory* based on data to provide and explanation for a particular event or occurrence.
- Case study: building a *case* by using multiple data sources to understand one particular parameter (e.g. an event, an entity).

Our analyses in Tasks 4 and 5 relied heavily on the narrative and phenomenological approaches. While these two of the five approaches outlined above, there is often overlap between the approaches, as is the case between narrative and phenomenological approaches (Wertz 2011). In fact, modern research sees both approaches as being in harmony (Patterson 2018).

Both of these approaches have been used in various fields of immigrant research, albeit not necessarily for day-to-day travel habits. The narrative approach has been quite popular to better understand experiences of immigrant subjects through their stories, as shown in research on particular immigrants settling in a country (Woodgate and Busolo 2018) or immigrants experiencing language ideologies (De Fina and King 2011). We used this approach to understand the evolution of travel habits and residential choices of immigrants. The phenomenological approach has been quite helpful in identifying and assessing phenomena that helped develop our subjects' perceptions.

The approaches helped design our tasks, including what type of questions we would ask, what kind of participants we would recruit and the type of findings we are looking for.

3.7.3.2 Analytical tools and techniques

We used many analytical tools to answer the research questions set for each task. Some of the tools listed are usually not explicitly discussed in the realm of transport research but helped us negate some of the over-reliance on researcher's intuitions involved. As part of us building *trustworthiness* with the reader, here are four key techniques we utilised across our thesis.

3.7.3.2.1 Thematic analysis

Perhaps the most common technique used in travel behaviour research is thematic analysis (Braun and Clarke 2006): identifying recurring themes and patterns across the data (i.e. across interviews or focus groups). The advantage of using this analysis over others is that it can work seamlessly with any of the approaches mentioned above, whereas some of the other analytical tools may be restricted to particular qualitative approaches. While this can broadly explain what we did for the most part of our analysis, there was one other analysis method that we also utilised to better understand our data and therefore provides a more accurate description of how we analysed our data.

3.7.3.2.2 Observational analyses

Body language is often an important part of qualitative analysis and has proven effective in prior research (Welch and Piekkari 2006, Manookian, Cheraghi et al. 2014), analysis of which is very difficult to do (if not impossible) with only transcriptions and audio recordings. It is a common feature of structural narrative analysis (or structural qualitative analysis), where interviewer observations of body language and the tone in which stories were narrated are noted and analysed (Barthes and Duisit 1975, Ahmed 2013). For our interviews and focus groups, we recorded non-responses to particular questions, or redirecting the conversation by the participants. The consequent interpretation helped add a new layer of data with not only new insights, but in many instances, instant validation of the some of the comments made during the sessions. The observations also helped modify questionnaires in-between interviews to deepen our understanding of specific factors, which were probed in-depth in following sessions, or alternatively, to simply avoid particular questions that were seemingly causing discomfort to participants.

3.7.3.2.3 Triangulation

To add depth to any qualitative analysis to increase the validity of findings, an approach taken by researchers is commonly referred to as triangulation (Jonsen and Jehn 2009). We did so by triangulating existing literature and our own findings from the other studies in this thesis. Our literature review encompassed several inter-disciplinary studies that may, on first glance, not seem directly relevant in understanding travel behaviour of immigrants in Australia. Primarily, the literature review involved exploring research that provided a deeper understanding of the South Asian travel culture and practices (Section 2.5, Chapter 2). There was also research on immigrants more broadly, including literature on evolving mindsets on car ownership (Campbell 2012), living arrangements (Cobb-Clark 2008), immigrant neighbourhoods (Andersen 2010) and various data and evidence that supported some of our arguments and findings in this thesis.

3.7.3.2.4 Reasoning – inductive and deductive

During various phases of the analysis, we employed the two common reasoning techniques – inductive and deductive reasoning. Perhaps the more frequently one used was inductive reasoning, a more common feature of Grounded Theory approach (Heath and Cowley 2004). This is where our findings were strongly related to the data we collected (transcriptions of our interviews and focus groups) at the very rudimentary stages of our qualitative analysis. We opted for this at the beginning of our analysis without any pre-assumed theoretical framework knowledge to include as many new findings as possible.

The thematic analysis yielded many themes (or findings). Some of these concepts were logical and easily traceable to other themes or theory, while others were peripheral facts and findings that didn't do directly address our research questions. We started structuring those *logical* concepts/ themes around the existing frameworks that we discussed in Section 3.2.1 earlier, in a manner which is known as deductive reasoning (Elo and Kyngäs 2008).

3.8 Chapter summary

This chapter introduced the data underpinning the research presented in this thesis, and the various analysis techniques utilised. In summary, we use six major datasets, three of which were secondary datasets (VISTA, SEQ HTS and ABS Census), while three were primary datasets (interview with university students, focus groups with university students, and interviews with South Asian families). Two major theoretical frameworks influenced and informed the primary data collection efforts and analysis – the Theory of Planned Behaviour (Ajzen 2012) and the Hierarchical Choice Structure of Mobility and Travel (Salomon and Ben-Akiva 1983).

The research analysis techniques could be broadly classified into qualitative and quantitative approaches. Quantitative analysis included a range of univariate and bivariate analyses (included descriptive statistics and t-tests), and multivariate modelling (logistic regression modelling). Qualitative analysis included thematic analysis, observational analysis, triangulation and reasoning.

Each of these analyses were carefully considered to complete the narrative and to address the shortcomings of these methods. For example, the datasets for our quantitative analysis generally contained lost of respondents; however, the two secondary datasets were not tailored for our analysis, while the survey with university students was limited by how many questions we could ask for the sake of participation and survey completion. The qualitative analysis, on the other hand, may be useful in identifying important data that is missing from the survey analyses. Using a variety of statistical tools (both quantitative and qualitative) ensured that our evaluation was holistic and balances.

Using these tools, we were able to fulfil the three key research objectives of this thesis by answering eight research questions. Figure 3-6 shows the research objectives and associated research questions. In the following chapters that diagram is used to indicate which questions are being addressed in each Chapter. This is done to aid in navigating the next four chapters.

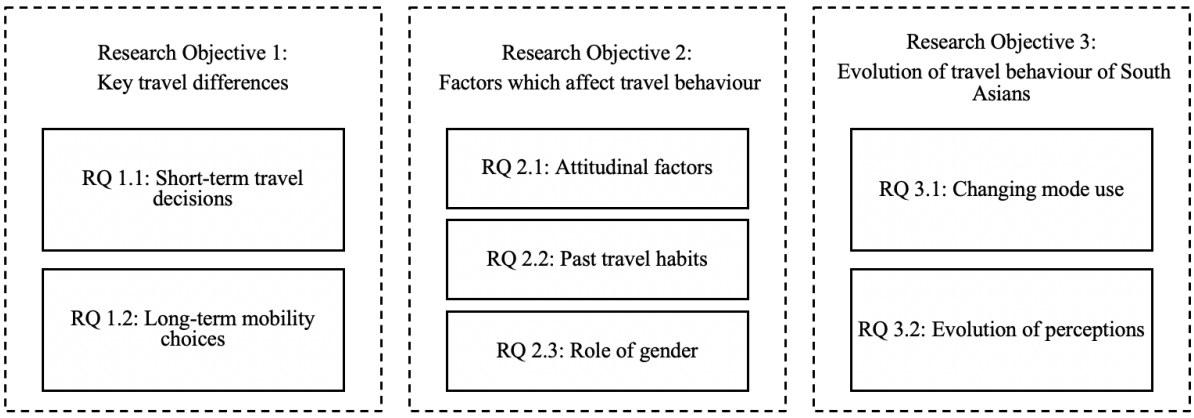


Figure 3-6 Thesis context diagram for Chapters 4 through 7

PART 2

Results and Analysis

4 The role of socio-demographic and economic factors in mode choice

The thesis structure highlighting Chapter 4 and the research questions answered in this chapter are presented in Figure 4-1 and Figure 4-2 respectively.

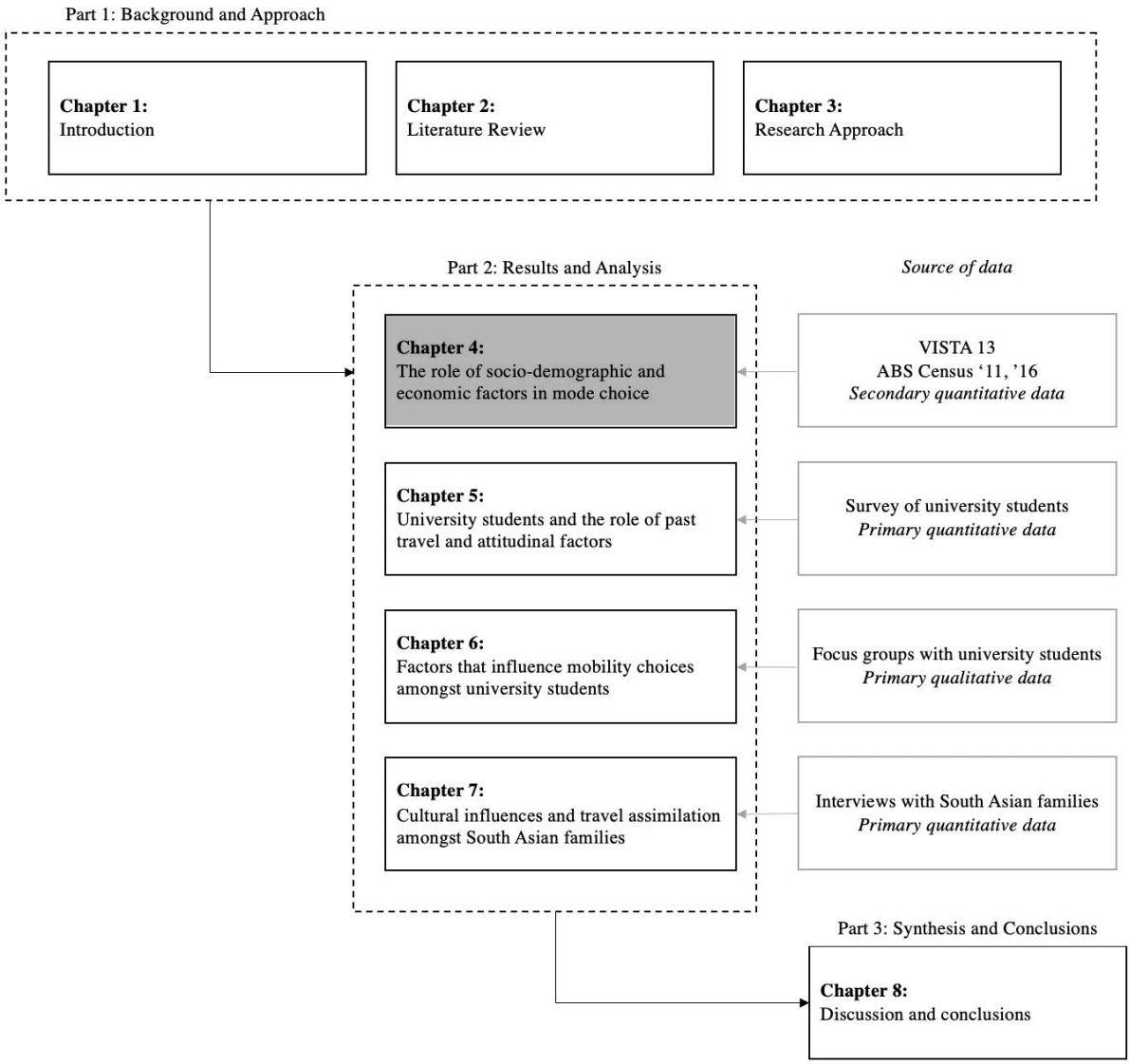


Figure 4-1 Position of Chapter 4 in thesis structure

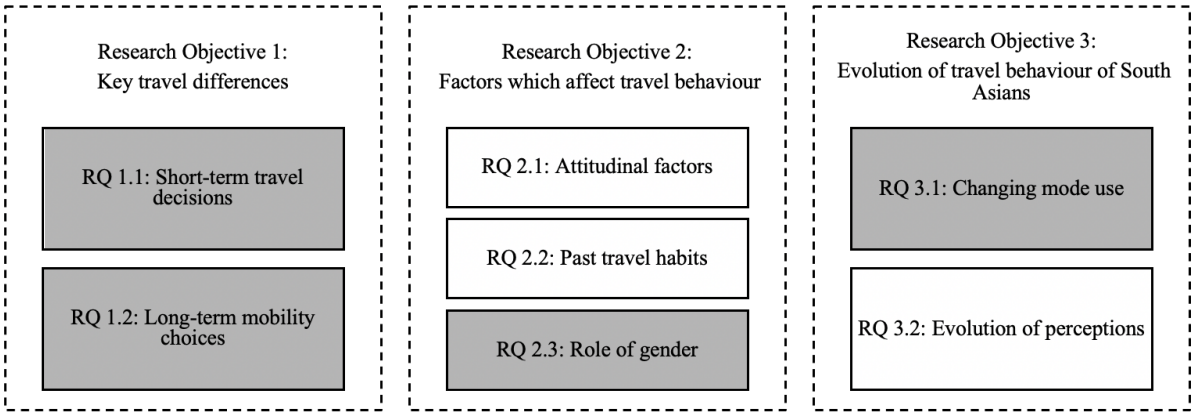


Figure 4-2 Thesis context: Chapter 4

4.1 Introduction

This chapter presents the findings of the second major task of this thesis, and the first analytical task. It presents the results of analyses of secondary datasets that highlight key travel differences between respondents born in South Asians and local-born Australians. The analysis reveals some gender differences and provides initial insight into how mode use changes over time (as highlighted in Figure 4-2). In Chapter 3: Research Approach, we discussed in-depth the motives behind doing this analysis and the analysis methods employed.

In this chapter, we drew upon the 2013 Victorian Integrated Survey of Travel and Activity (VISTA) (Transport for Victoria 2013), the 2011 and 2016 Australian Bureau of Statistics (ABS) Census (Australian Bureau of Statistics (ABS) 2011) and the 2009 Southeast Queensland Household Travel Survey (SEQ HTS) (Transport and Main Roads Queensland Government (TMR) 2009). For any analyses that involved comparisons across multiple datasets, we used the 2011 Census data because the data was closest in time to the two household travel surveys (2013 VISTA and 2009 SEQ HTS). We used the most recent census (2016) in section 1.4.3 as this analysis was only conducted on Census data.

Some of the results in this paper were presented at the 39th Australasian Transport Research Forum (ATRF) in Auckland, New Zealand, in 2017 (Shafi, Delbosc et al. 2017).

Note that for the remainder of this and subsequent chapters, ‘South Asian’ refers to an immigrant born in South Asia and living in Australia. ‘Australian’ refers to a native-born resident of Australia.

4.2 Task objectives

In Chapter 3: Research Approach, we highlighted the secondary datasets we used to further our understanding of the profile of South Asian immigrants in Australia by analysing various demographic and economic parameters. Specifically, by the end of this chapter, we will have covered the following research questions (see also Figure 4-2):

- Research Objective 1: Identify key travel behavioural differences between South Asians in Australia and native-born Australians
    - RQ 1.1: How does short-term travel behaviour differ?
    - RQ 1.2: How do long-term mobility choices differ?
- Research Objective 2: Understand the factors which affect travel behaviour of South Asians and Australians
    - RQ 2.3: How does gender influence travel behaviour?
- Research Objective 3: Understand how South Asian immigrants' travel behaviour evolves during their time in Australia
    - RQ 3.1: How does mode use change over time?

The chapter workflow is illustrated in Figure 4-3 below.

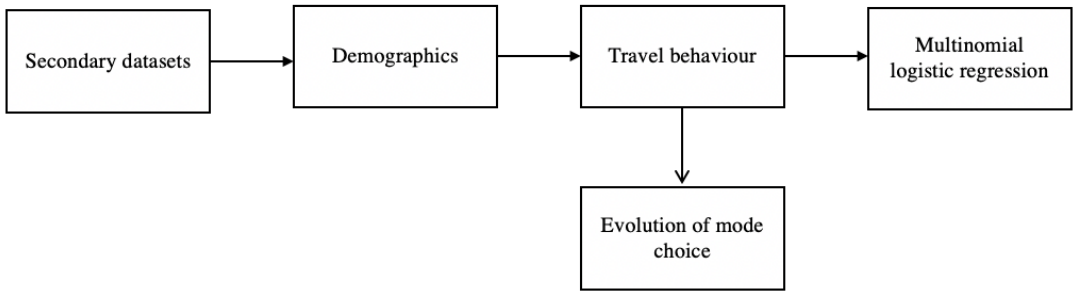


Figure 4-3 Chapter 4 workflow

The chapter has three major components. Firstly, there is a comparison of the demographics between Australians and South Asians in Australia. Secondly, we gain some high-level understanding of the travel behaviour of South Asians and Australians, how they compare and how South Asian travel behaviour changes over time.

The third component is a set of multinomial logistic regression models to better highlight the role of sociodemographic and economic factors in mode choice. In particular, we explored the role of gender as a possible indicator of cultural relevance.

4.3 Demographic profile of South Asian immigrants in Australia

This section provides an overview of the demographic profile of South Asians in Australia. Their demographics are compared to native-born Australians. This provides contextual background for the remainder of the chapter and thesis. It also begins to touch on some of the long-term mobility choice differences between South Asians and Australians (RQ 1.2) by comparing car ownership and licensing rates.

4.3.1 Age, ancestry and residence in Australia

The 2011 Census data was used to determine the age profile of people born in South Asia compared to native-born Australians, and the results are presented in Figure 4-4. That figure shows that the majority of South Asians are young adults, with 40% aged between 25 and 35, compared to 14% for Australians.

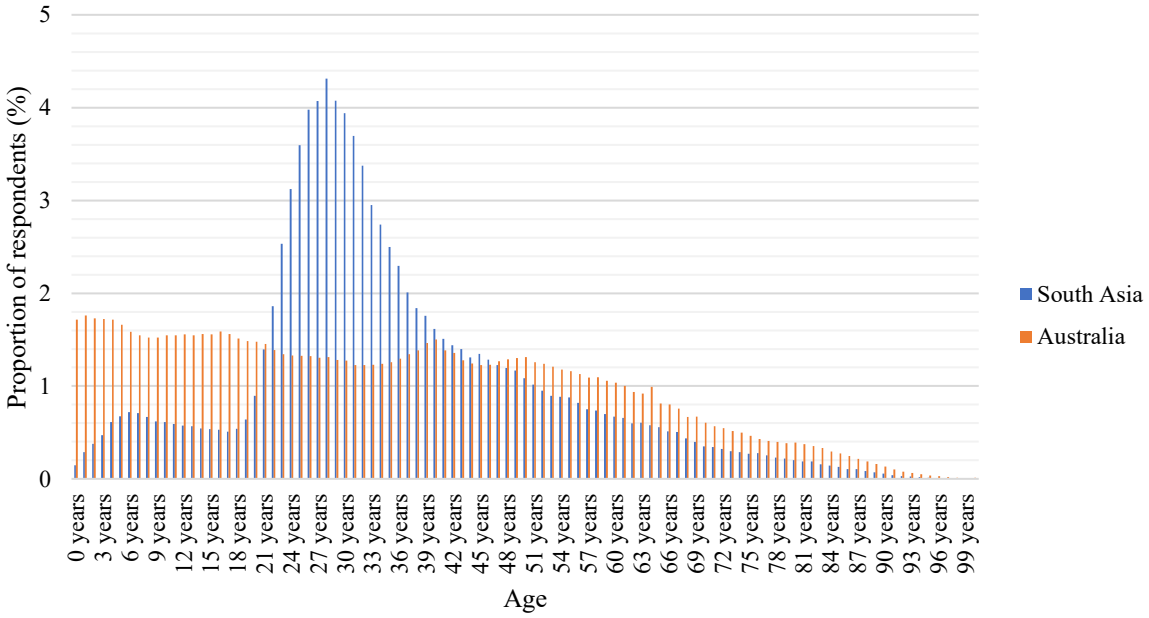


Figure 4-4 Age Comparison: South Asians vs Australians (Source: 2011 Census)

The Census data provides insight into the extent to which South Asians are concentrated into specific regions of Australian cities. Close to three quarters of South Asians live in Victoria (38% of South Asians) and New South Wales (36% of South Asians). South-East Melbourne and West Melbourne are home to 20% of native-born Australians in Victoria, but about 50% of South Asians in Victoria (a map of the concentration of South Asians in Melbourne was shown in Chapter 3). Parramatta, Inner South West and Blacktown regions of Sydney house 10% of Australians in NSW, but over 50% of South Asians in NSW. This may suggest the presence of ethnic enclaves in those states which are home to the greatest numbers of South Asians. Queensland shows slighted less geographic concentration. The SEQ HTS survey was based on residents in Queensland, which is home to less than 10% of all South Asians in Australia, while greater Brisbane houses about 7% of South Asians.

4.3.2 Education and work

A breakdown of the qualifications of Australians and South Asians is presented in Table 4-1. Over 70% of South Asians in Australia have advanced degrees, half of whom have bachelor's degrees or higher. These qualifications are, on average, much higher than people born in Australia.

Table 4-1 Comparison of Non-School Qualification: Level of Education (Source: 2011 census)[9]

	Born in Australia		**Born in South Asia**	
Highest Non-school qualification	Female (%)	Male (%)	Female (%)	Male (%)
Postgraduate Degree Level	4.80	4.81	23.69	27.11
Graduate Diploma and Graduate Certificate Level	4.85	2.47	3.10	3.07
Bachelor's degree Level	28.50	20.01	41.13	32.13
Advanced Diploma and Diploma Level	18.45	12.29	14.88	17.99
Certificate Level	29.38	49.88	8.42	12.17
Level of education inadequately described	2.99	1.90	3.11	2.63
Level of education not stated	11.04	8.63	5.69	4.92
Total	100	100	100	100

More South Asians aged over 15 are employed in full-time or part-time work than their Australian counterparts, while more Australians are not in the labour force, as presented in Table 4-2.

It should also be noted that more South Asians are professionals (engineers, health and ICT professional etc.) at 28% compared to Australians at 20% (table not presented).

Table 4-2 Labour Force Status (Source: 2011 census)

	Australian (%)	**South Asian (%)**
Employed, worked full-time	39.87	44.88
Employed, worked part-time	19.73	21.68
Employed, away from work	4.02	3.61
Unemployed, looking for full-time work	2.15	2.95
Unemployed, looking for part-time work	1.40	2.20
Not in the labour force	32.84	24.68
Total	100.00	100.00

Furthermore, at subpopulation levels, South Asian and Australian personal income levels are very similar, as shown by the income proportions represented in Figure 4-5. This represents the entire South Asian and Australian subpopulations, including those unemployed but not actively looking for work.

[9] The dataset represents 423,000 South Asians and 11,241,000 Australians.

Figure 4-5 Personal Income Comparisons between South Asians and Australians (Source: 2011 census)

The major different is in nil income and lower income categories between the two groups. Almost a quarter of South Asian females responded as having nil income (compared to less than 10% of Australian females) – this includes unemployed South Asian females, as well as those jobless not looking for work (e.g., stay-at-home moms, retirees, students). South Asian males have higher average incomes than their Australian counterparts, which is counterbalanced by the lower personal income levels of South Asian females (see Figure 4-6).

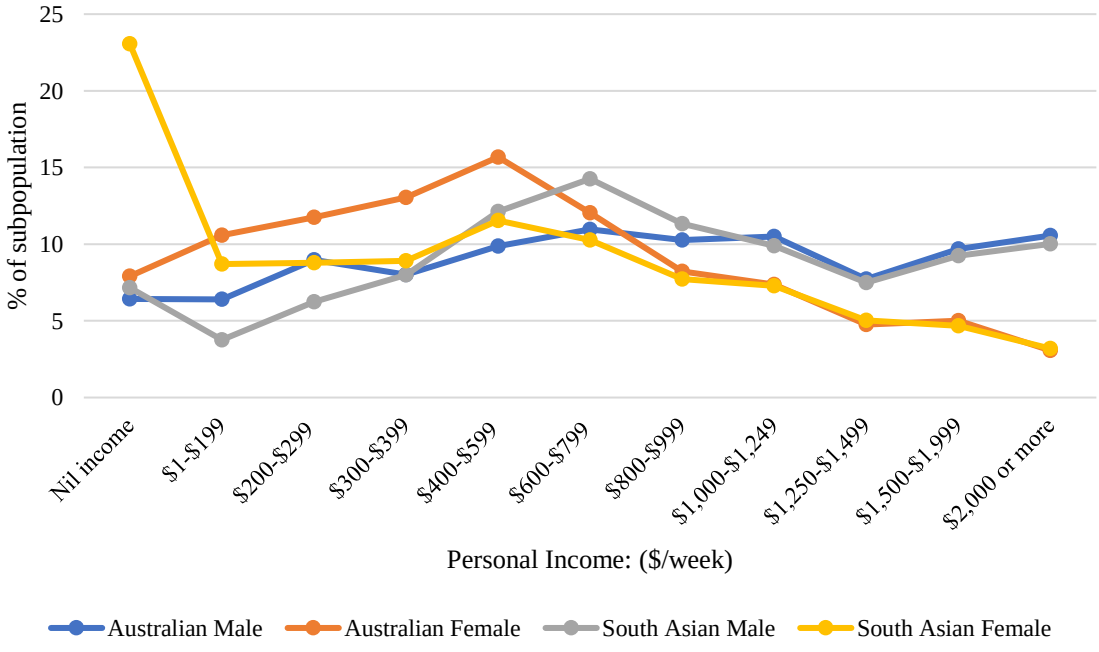


Figure 4-6 Weekly income comparison - male vs female, South Asians vs Australians (Source: 2011 census)

A second explanation for high rates of 'nil income' could be international students. A substantial proportion of recent South Asian immigrant groups arrived as students, as highlighted in Figure 4-7. Some international students may be financially supported by their family and therefore have no personal income. In fact, as of the 2016 census, over 70% of South Asians aged between 20 and 24 living in Victoria were identified as a student in some form (Australian Bureau of Statistics (ABS) 2016).

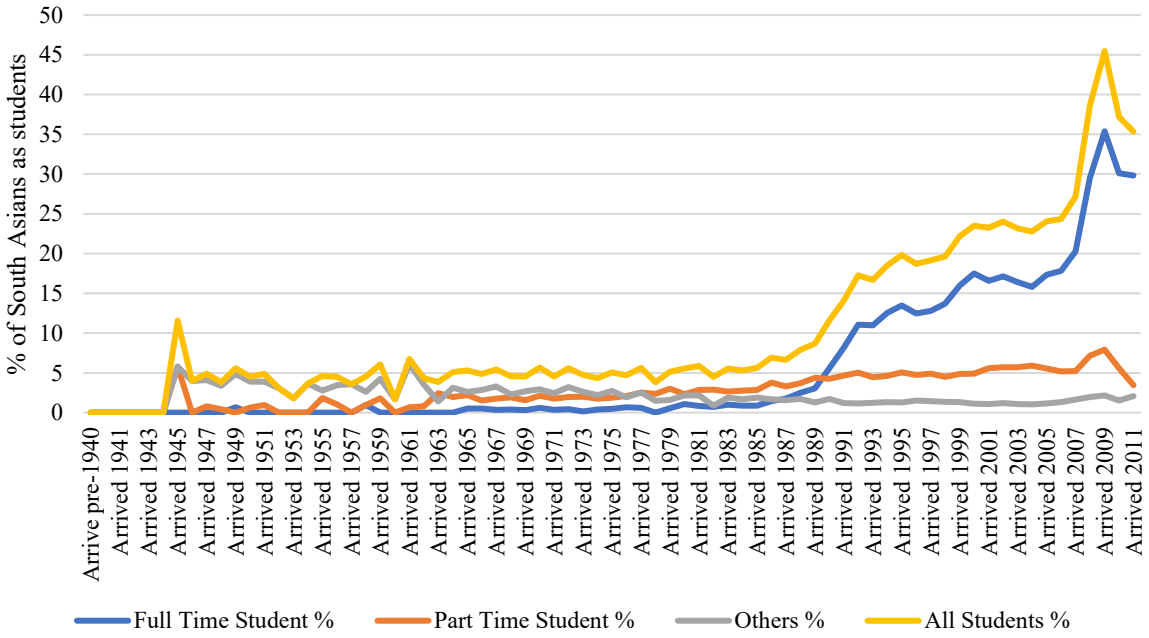


Figure 4-7 South Asian residents in Australia: student status (Source: 2011 census)

In SEQ HTS, a larger proportion of South Asians aged over 18 are studying (full-time or part-time) without work (full-time, part-time or casual) compared to Australians over 18, as shown in Table 4-3. This is also true for South Asians in Victoria as highlighted in the VISTA survey data, although the numbers are substantially lower. More South Asians are employed than Australians though, and fewer South Asians fall into the category of "No Work, No Study".

Table 4-3 Work/Study: Australians vs South Asians (Source: 2009 SEQ HTS, 2013 VISTA)[10]

	2009 SEQ HTS		2013 VISTA	
(Respondents % aged 18+ only)	Australians	South Asians	Australians	South Asians
Work, Study	5.8	10.5	5.3	4.0
Work, No Study	61.5	53.2	67.5	70.9
No Work, Study	2.7	9.9	0.1	0.3
No Work, No Study	30.0	26.3	27.0	24.9

[10] The dataset included 15,006 Australians and 171 South Asians in South East Queensland, and 5,029 Australians and 350 South Asians in Victoria.

4.3.3 Licensing and vehicle ownership

The census did not collect data on licensing rates or personal vehicle ownership. Vehicle ownership at a household level was collected but could not be linked to the nationality of individuals. Therefore, this section relies on household travel survey data.

Licensing rates amongst 21+ year olds[11] were analysed from the 2009 SEQ HTS (14,174 Australians and 168 South Asians) and the 2013 VISTA (5,011 Australians and 360 South Asians). In South East Queensland, a larger proportion of Australians had full licenses, at 92%, compared to South Asians, at under 77%. Only 68% of South Asian females over 21 had full licenses there, while the corresponding number for Australian females was 91%. The numbers are very similar in Victoria, where 87% of South Asian males had full licenses (compared to 91% of Australians) and 63% of South Asian females had full licenses (compared to 89% of Australian females).

Motor vehicle ownership rates at a household level were compared for the 2009 SEQ HTS and 2013 VISTA, and a summary is presented in Table 4-4. The proportions are not based on the number of households, but rather the number of people who provided income and motor vehicle ownership data of the households they live in. This table therefore contains household duplications, representing multiple people living in the same household. The findings from these datasets are:

- Australians live in households that have more motor vehicles on average. There is a significantly higher proportion of South Asian households with no motor vehicles.
- Although personal income levels are similar between Australians and South Asians, both surveys indicate a lower income for the latter on a household level. Income has been observed to be a key determinant for vehicle ownership for Australian and South Asian households alike.
- South Asians live in larger households, and very few of them live in single person households. Vehicle ownership amongst single-person South Asian households is significantly lower than corresponding Australian households.

Table 4-4 Household Income and Vehicle ownership characteristics (Source: 2009 SEQ HTS, 2013 VISTA)[12]

Person Count	2009 SEQ HTS		2013 VISTA	
Country	Australian	South Asian	Australian	South Asian
Average MV/HH	2.07	1.63	2.00	1.65
% of HH with no MV	2.81 %	13.16 %	3.71 %	6.99 %
Average HH Income (per week)	$ 1,822	$ 1,754	$ 2,180	$ 1,970
Average HH Size	3.31	3.44	3.30	3.38
% of people in single HH	7.10 %	4.21 %	8.87 %	3.61 %
% of single-person HH with 1+ MV	83.57 %	62.50 %	83.59 %	60.00 %
% of HH with 4+ people	46.18 %	51.05 %	47.80 %	49.64 %

MV = motor vehicles, HH = household

[11] Youngest age to obtain a full license under the graduated licensing system implemented in Victoria

[12] The dataset included 20,735 Australians and 190 South Asians for the 2009 SEQ HTS, and 7,422 Australians and 415 South Asians for the 2013 VISTA.

4.4 Travel Behaviour

This section provides the first evidence addressing RQ 1.1, how does short-term travel behaviour differ between South Asians and Australians. It also touches on RQ 2.3 by showing gender differences in travel behaviour. It finishes by exploring RQ 3.1, how mode use changes over time.

The census collects very limited information on travel patterns because it focuses solely on the journey to work on the day of the census and provides no insight into other trips undertaken on that day. Household size and vehicle ownership was recorded, but not segregated based on respondent nationality. The SEQ HTS and VISTA was tailored to focus on travel behaviour, but the sample representing South Asians is quite small.

4.4.1 Census method of travel to work (MOTW)

The census collected information on mode use for the journey to work on the census day (a Tuesday), as the mode use breakdown is presented in Figure 4-8. The figure also shows a comparison to the work-related trip data collected from 2009 SEQ HTS. The data has been segregated based on gender.

A couple of trends can be observed. More South Asians use public transport (PT) than Australians while more Australians drive to work. More South Asian females tend to be vehicle passengers than any other cohort while commuting, while South Asian males are lowest in that aspect.

Some differences in patterns are present between the two samples. The census, which should hold higher validity due to its national coverage, shows that females use public transport more for commute trips, and drive the least. The SEQ HTS, which has a smaller sample size, show that very few South Asian females use public transport to go to work, and a greater proportion of them drive when compared to males. VISTA, on the other hand, showed South Asians' inclination to choose motorized transport (public transport, car) over walking or cycling, and the mode use of South Asians show similar proportions to the census for trips to work.

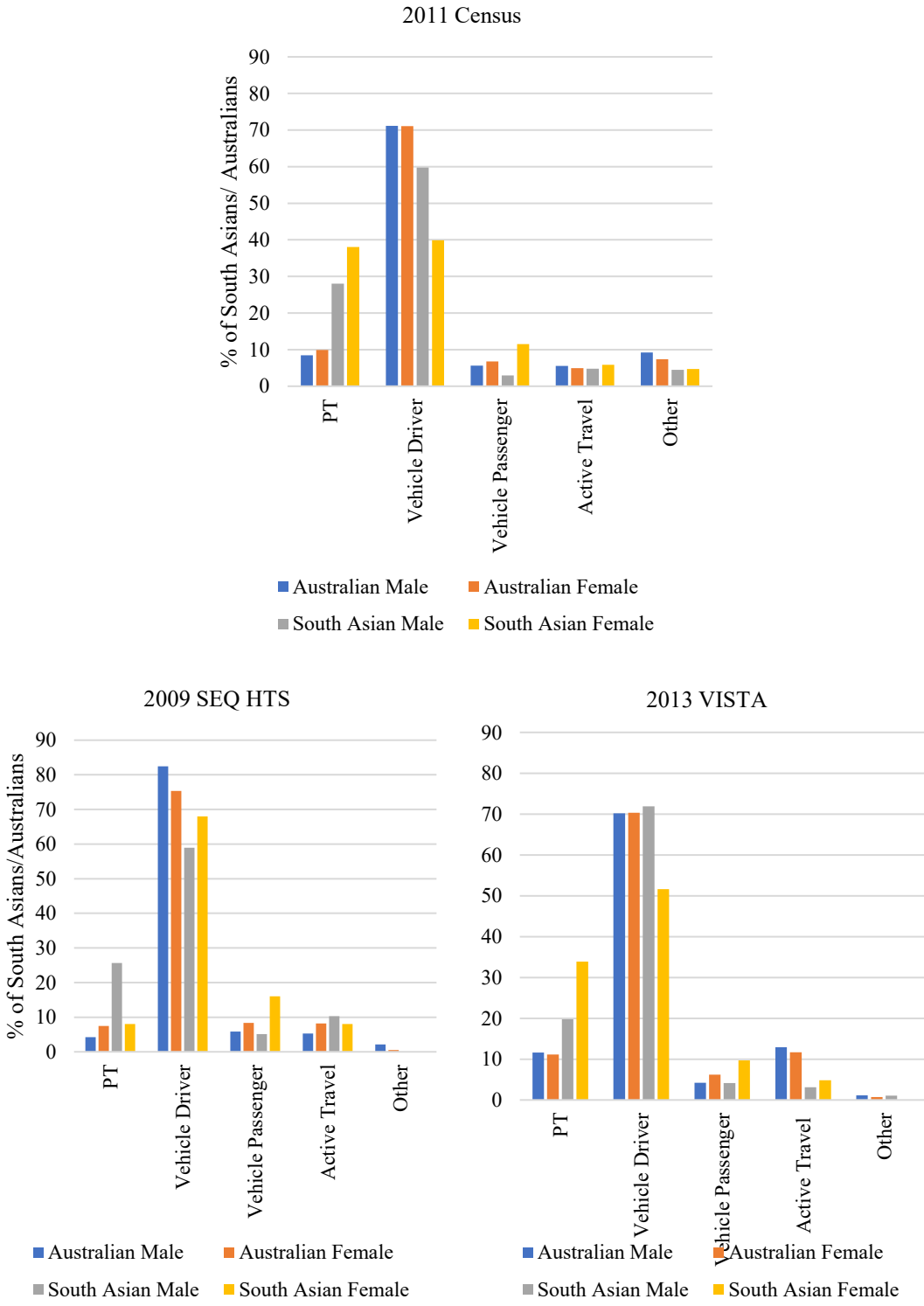


Figure 4-8 Method of travel to work: South Asians vs Australians (Sources: 2011 census, 2009 SEQ HTS, 2013 VISTA)[13]

[13] The dataset represents 7,444 trips by Australians (4,355 by males, 3,089 by females) and 64 trips by South Asians (39 by males, 25 by females) for SEQ HTS, and 2,662 trips trips by Australians (1,503 by males, 1,159 by females) and 158 trips by South Asians (96 by males, 62 by females) for VISTA

4.4.2 Trips for non-work purposes

Work trips are only one of many trip purposes (work-related trips accounted for only 12% of all trips in the SEQ HTS) and mode use likely differs depending on the trip purpose. The household travel surveys are used to compare mode use for different trip purposes. Purpose of trip proportions were very similar between Australians and South Asians.

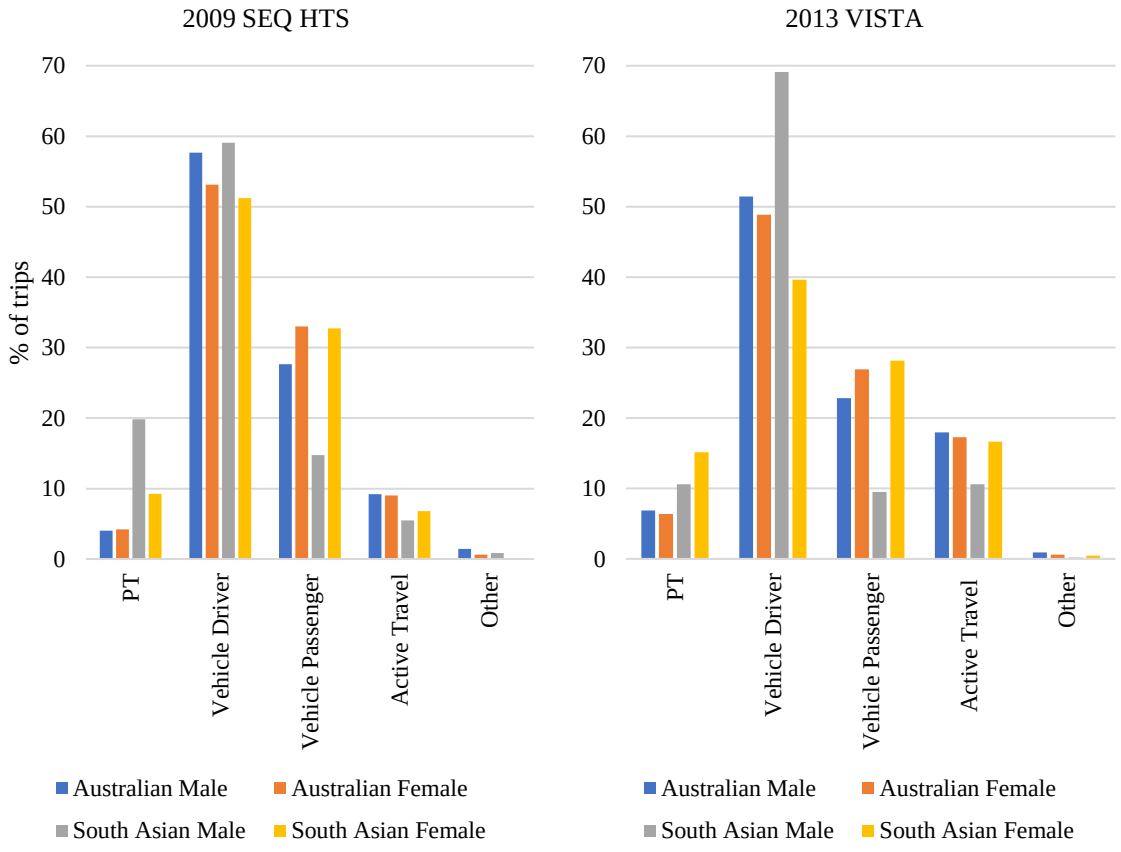


Figure 4-9 Travel Mode for all trips: Australians vs South Asians (Source: 2009 SEQ HTS, 2013 VISTA)[14]

Figure 4-9 suggests South Asians may drive more than the census suggests, but not necessarily for work. Proportionally, South Asian men drive the most, even more than Australians. However, this dataset includes respondents of all ages, while the census covers those above 15. This might explain the lower proportion of Australians who drive, and more vehicle

[14] The dataset represents 60,990 trips by Australians (28,370 by males, 32,620 by females) and 399 trips by South Asians (237 by males, 162 by females) for SEQ HTS, and 220,905 trips by Australians (9,751 by males, 11,154 by females) and 966 trips by South Asians (557 by males, 409 by females) for VISTA.

passengers. As shown in Figure 4-4, South Asians in Australia are more likely than Australians to be old enough to drive.

However, if trips are analysed for each purpose, the mode shares differ yet again, as presented in Figure 4-10 and Figure 4-11. When analysing the total number of trips by Australians and South Asians, and the trips purposes, several conclusions can be drawn.

- For social, recreational or shopping trips, mode choice is similar between South Asians and Australians.
- For education purposes, most Australians travel as a car passenger (60% of trips in SEQ HTS, 56% in VISTA). Most South Asians on the other hand get by with public transport (57%) according to SEQ HTS, whereas according to VISTA, a large proportion rely on a combination of getting lifts (36%) and public transport (36%).
- The figures highlight that South Asians make limited use of active travel, not unlike native-borns. However, when accompanying others, it is their preferred mode according to the SEQ HTS (52%). In contrast, over 80% of 'accompanying' trips by Australians are as the vehicle passenger according to this dataset. In VISTA, however, active travel is not the top modal choice. This could be due in part to the small sample size for this trip type[15].

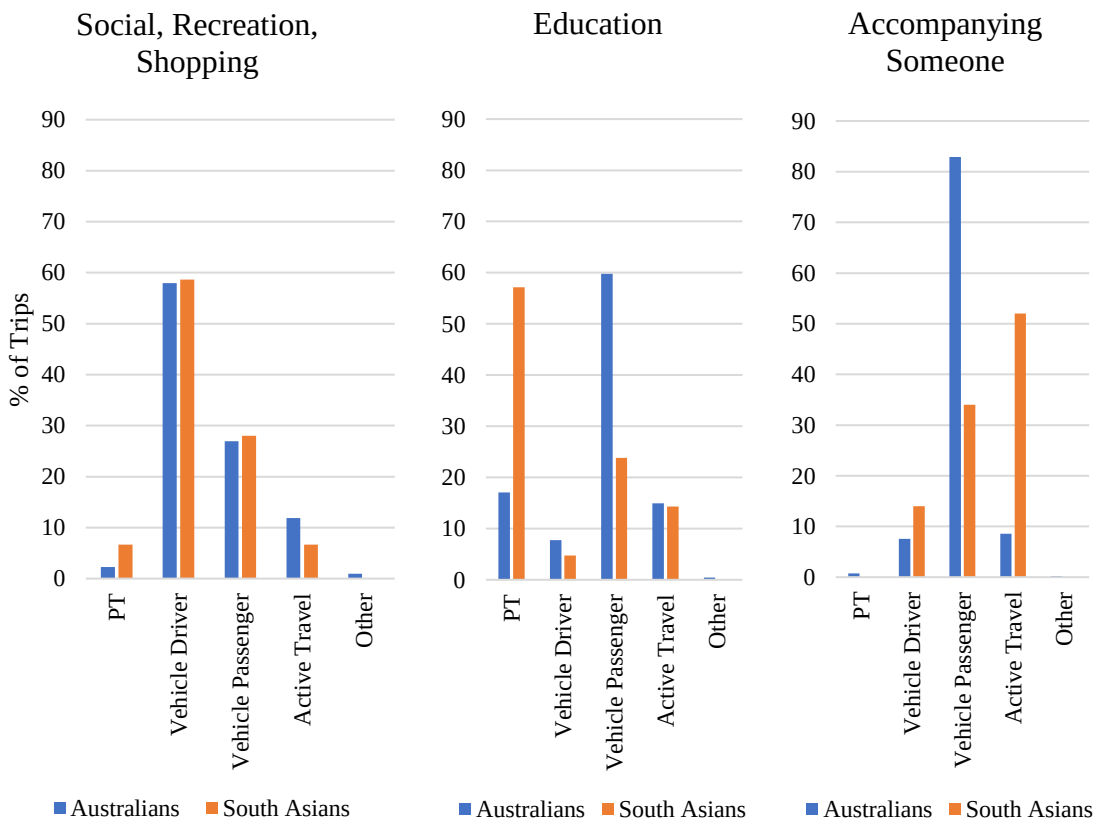


Figure 4-10 Mode split based on purpose of trips (Source: 2009 SEQ HTS)

[15] N (Australian) =2408, N (South Asian) = 25

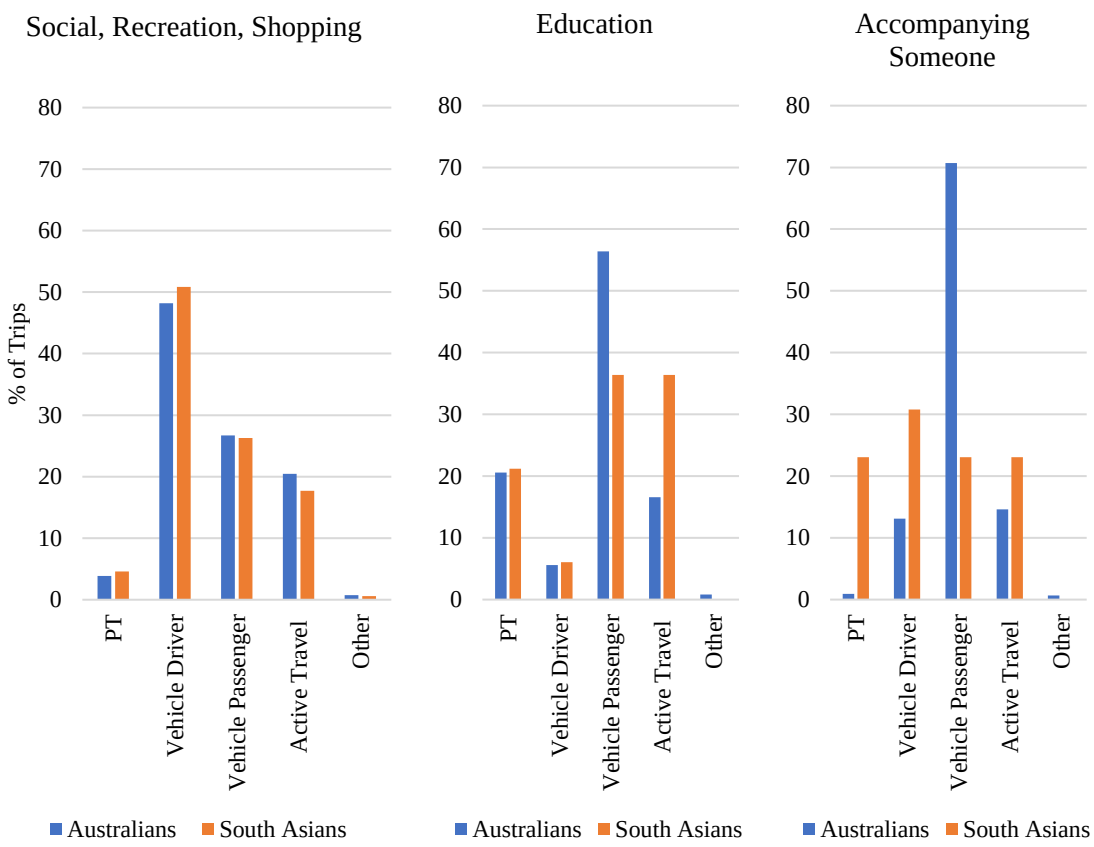


Figure 4-11 Mode split based on purpose of trips (Source: 2013 VISTA)

4.4.3 Evolution of travel habits over the years

As mentioned earlier, the Census only collects method of journey to work. However, because year of arrival is recorded on the dataset, it was possible to determine the trends of work-mode use by years lived in Australia amongst South Asian immigrants. For this we used data from the 2016 census (Australian Bureau of Statistics (ABS) 2016) – the most recent data available.

Figure 4-12 illustrates the journey to work mode choice amongst South Asian immigrant males and females by duration of residence in Australia. It can be seen that car dependency is lowest among recent arrivals, irrespective of gender. However, the initial rate of conversion is much higher amongst men compared to women; it plateaus after about 4 years for men and 8 years for women. Public transport use is highest among recent arrivals, especially South Asian women, and drops considerably. Active travel (walking and cycling) and other modes of travel (ferry, taxis, trucks, motorcycles) use is quite low to begin with and becomes even lower over time.

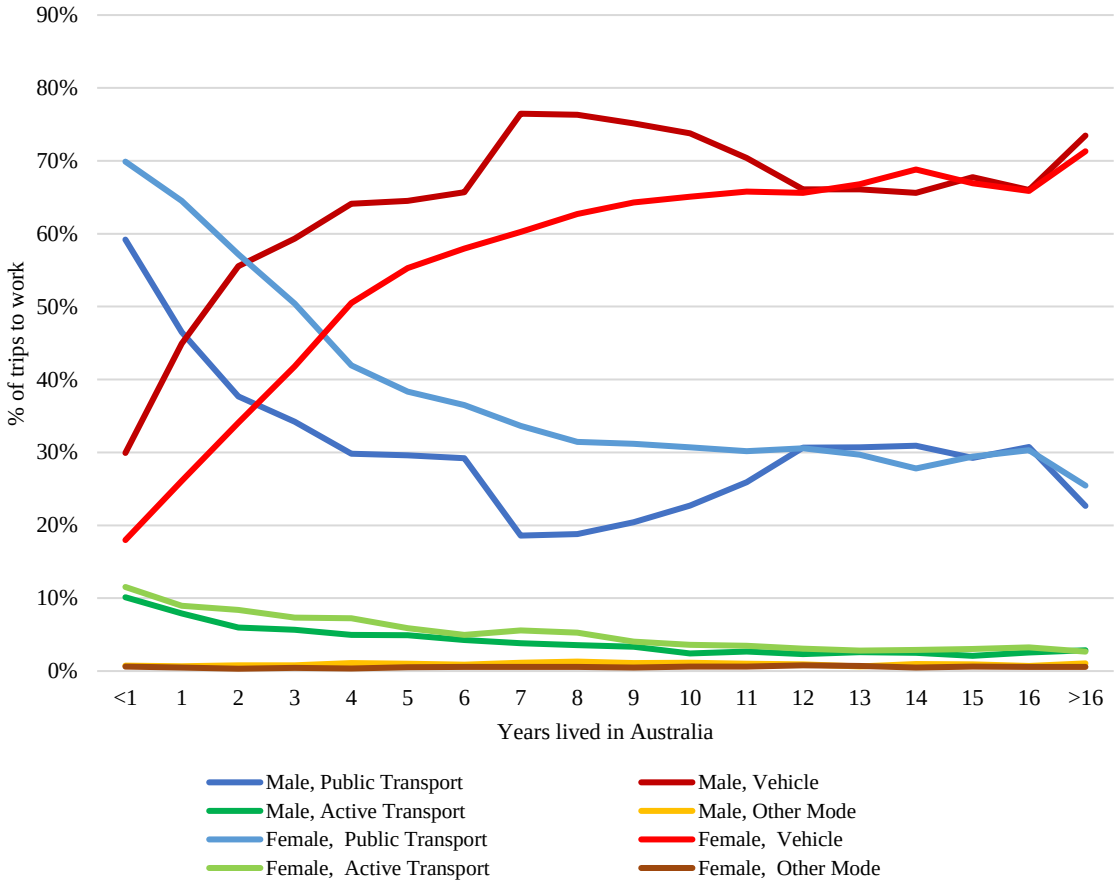


Figure 4-12 South Asian travel mode evolution (mode for journey to work) - males vs females (Source: 2016 Census)[16]

Figure 4-13 and Figure 4-14 compares this change in travel modes to native-born Australian counterparts (separate figures for each gender). It can be seen that South Asian men (Figure 4-13) reach car-dependency levels closer to Australian men compared to women. Active travel is initially higher for South Asians, but then over time becomes lower.

[16] The dataset represents 265,000 trips by South Asian males and 150,000 trips by South Asian females

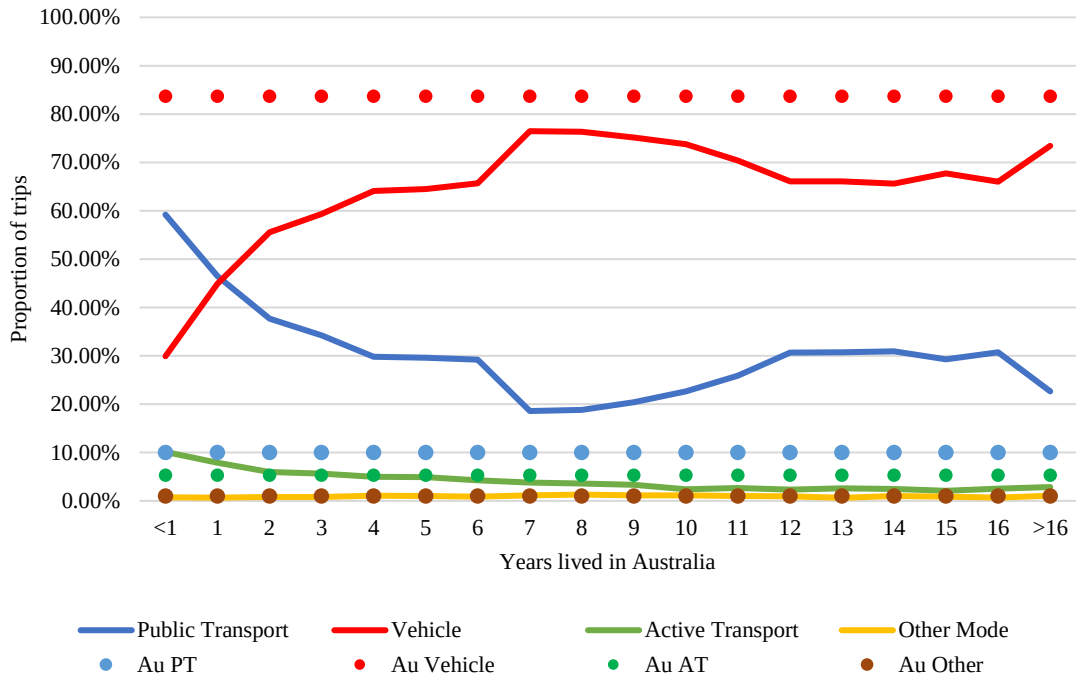


Figure 4-13 Mode of choice to work comparison between South Asian males compared to Australian (Au) men (Source: 2016 Census)[17]

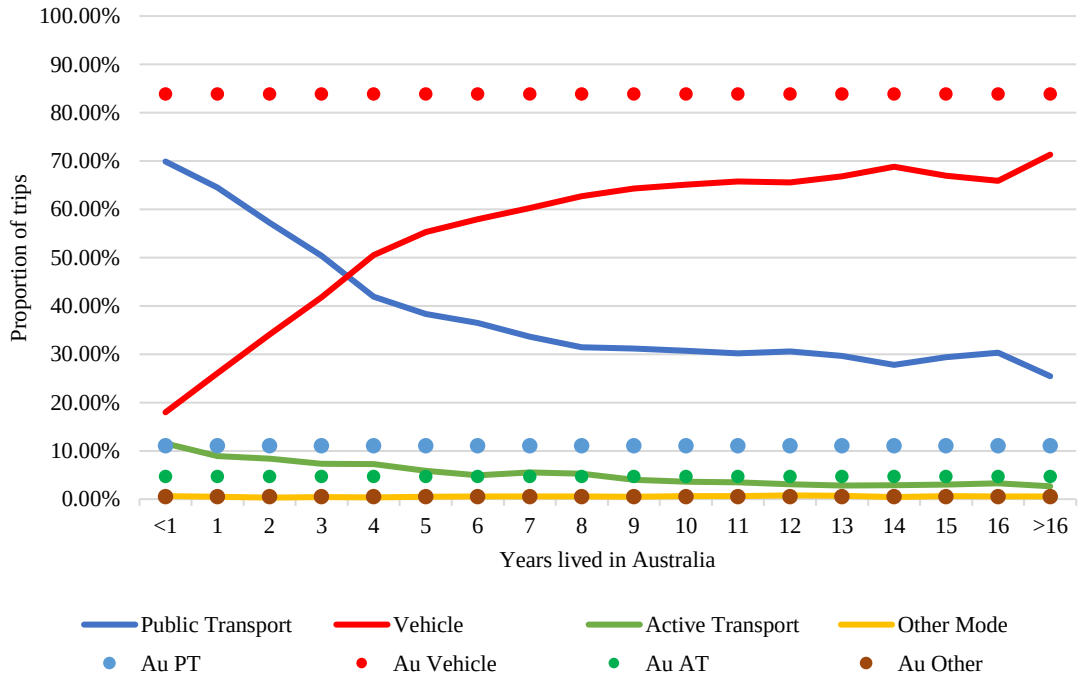


Figure 4-14 Mode of choice to work comparison between South Asian females compared to Australian (Au) women (Source: 2016 Census)[18]

[17] The dataset represents 265,000 trips by South Asian males and 3.3 million trips by Australian males

[18] The dataset represents 150,000 trips by South Asian females and 2.8 million trips by Australian females

4.5 Travel behaviour when controlling for demographic differences

To further highlight differences in travel behaviour between South Asians and Australians, we ran multinomial logistic regression models using the VISTA 2013 travel survey. Section 4.3 of this chapter showed clear demographic differences between South Asians and Australians (as well as between South Asian men and women). These demographic differences may explain the differences in travel behaviour (which were illustrated in Section 4.4); or perhaps other factors (such as attitudes, culture or past behaviour) play a role.

The model in this section uses a range of demographic variables to predict mode choice. In particular we were interested in whether gender and country of birth predicted mode choice even when controlling for other socio-demographic variables.

The unit of analysis for this model was to predict mode choice for a given trip[19]. For this analysis, only one trip could be analysed for each respondent to eliminate potential bias and remove duplication of demographic data. As a result, for reach travel survey respondent we randomly selected one trip from the dataset. This resulted in 274 trips by South Asian respondents and 3,730 trips by Australians. A full breakdown of the demographics of participants used in this model is presented in Table 4-5.

For the final set of regression models, the key variables of interest were country of birth (Australian or South Asian) and gender (male or female). We already observed gender-based differences amongst Australians and South Asians, and as such we had four cohorts[20] of subpopulations in the models. Other variables included age, gender and license status. Household income, the number of household members and motor vehicles in the household of the person making the trip has also been considered. Occupation was kept at an overview level, mainly distinguishing students from workers (and those doing both or neither). The location (inner, middle or outer Melbourne) of the household were also accounted for. As for the trips, we considered whether the trip was made on a weekend or weekday and the purpose of the trip. The mode 'car as driver' was set to zero as it was selected as the base case for all three modes.

[19] A trip is defined as a one-way travel movement from an origin to a destination for a single purpose, possibly using multiple modes. A stop is a place where any activity (including change of mode) is undertaken.

[20] Four cohorts include Australian males, Australian females, South Asian males, South Asian females.

Table 4-5 Demographics of dataset

Variables	Variable Categories	N	Percentage (%)
Age	*None: included as scale variable*		
Mode	Car as driver	2497	62.4
	Car as passenger	523	13.1
	Public Transport	430	10.7
	Active Travel	554	13.8
Country of Birth	South Asian	274	6.8
	Australian	3730	93.2
Gender	Male	1925	48.1
	Female	2079	51.9
License Status	Learner's or No License	356	8.9
	Probationary or Full License	3648	91.1
Main Activity	Other	547	13.7
	Full-time or Part-time Education	230	5.7
	PT/Cas Work	1052	26.3
	FT Work	2175	54.3
Household Income ($/wk)	Low (0-1100)	589	14.7
	Medium (1101-2250)	1505	37.6
	High (2251-7500)	1910	47.7
Household Location	Inner Melbourne	993	24.8
	Middle Melbourne	1096	27.4
	Outer Melbourne	1915	47.8
Number of People in Household	1	374	9.3
	2	1136	28.4
	3	833	20.8
	4	548	13.7
	5+	1113	27.8
Vehicles in Household	0	103	2.6
	1	975	24.4
	2	1086	27.1
	3+	1840	46.0
Trip Purpose	Social, Recreation, Shopping	550	13.7
	Education	1672	41.8
	Work, Business	111	2.8
	Others	1671	41.7
Weekday	No	921	23.0
	Yes	3083	77.0
Home Area Population Density (pp/km^2)	4001+	272	6.8
	2001-4000	1700	42.5
	0 - 2000	2032	50.7
Valid		4004	100.0
Missing		1581	-
Total		5585	-
Subpopulation		**3806**[a]	-

a. The dependent variable has only one value observed in 3735 (98.1%) subpopulations.

South Asians generally travelled less than Australians in terms of distance, as Table 4-6 below highlights. However, they travel longer than Australians in terms of time and make more stops within their trip.

Table 4-6 Distance travelled, time travelled and number of stops for trips

Country of Birth	Australia	South Asia
Distance Travelled (km)	38.94	31.14**
Time Travelled (mins)	26.82	27.51
Number of stops	1.27	1.43*

t-tests used to compare means
* = $p < 0.01$ ** = $p < 0.05$

The logistic regression model had a statistically significant chi-squared value, indicating that the parameters chosen for this model have a substantial impact on predicting mode choice. The Cox and Snell R^2 and Nagelkerke R^2 values were 0.352 and 0.398 respectively, as highlighted in Table 4-9. These values are typical for models predicting mode choice, particularly considering that the model did not include variables addressing availability public transport services, urban form or trip characteristics. Furthermore, almost every explanatory variable was a statistically significant predicter of mode choice (Table 4-10) using the traditional cut-off of $p \leq 0.05$. The exception was 'Population Density' at $p = 0.051$. However, given the theoretical importance of this control variable it was included in the final model (Thiese, Ronna et al. 2016, Wasserstein and Lazar 2016).

Table 4-7 Model fitting information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	8487.548			
Final	6753.091	1734.458	75	0

Table 4-8 Goodness of fit

Model	Chi-square	df	Sig.
Pearson	11506.031	11340	0.135
Deviance	6651.393	11340	1

Table 4-9 Pseudo R-square values

Pseudo R-Square	
Cox and Snell	0.352
Nagelkerke	0.398
McFadden	0.202

Table 4-10 Likelihood ratio tests - Significance of predictors/ parameters in multinomial logistic regression model

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	6753.091[a]	0	0	.
Age	6764.724	11.633	3	0.009
Country of Birth * Gender	6824.852	71.761	9	0.000
License Status	7113.496	360.405	3	0.000
Main Activity	6775.181	22.091	9	0.009
Household Income ($/wk)	6779.57	26.48	6	0.000
Household Location	6790.627	37.536	6	0.000
Number of People in Household	6797.486	44.396	12	0.000
Vehicles in Household	6895.361	142.271	9	0.000
Trip Purpose	7041.672	288.581	9	0.000
Weekday	6853.61	100.519	3	0.000
Home Area Population Density	6765.613	12.522	6	0.051

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

The final model(s) are relative to the mode "car as a driver", and have in presented in Table 4-11 (car as passenger), Table 4-12 (public transport) and Table 4-13 (active travel). The odds ratio (Exp. B column on the tables) is a quantity of association and shows the likelihood of change in the dependant variable with respect to a given independent variable, holding all other variables constant. Due to the data available, only associations could be explored; no conclusions could be made on the direction of causality.

Looking across the tables, most of the independent variables are acting in the predicted direction based on previous research. For example, having a full or probationary driving license[21] means that one is less likely to be driven in a car, use public transport or use active travel when compared to driving. Being in full-time work decreases the odds of getting a ride from someone or using active travel. One is more likely to use active travel or public transport if living in inner Melbourne. If the trip is on a weekend, it is less likely that the trip will be made on public transport, and more likely as a car passenger. If a household has no vehicles, it increases one's chances of using transit or active travel considerably. Living in a high-density area increases the odds of active travel as well.

The key focus of this thesis is on South Asians (and for this analysis, gender). Even when controlling for all other factors (income, household, age etc.), there are significant differences across the four cohorts (gender by country of birth). For Australia, only car as passenger trips were affected by gender, where males were half as likely as females to use this mode. Gender had no significant influence on active travel or public transport use amongst Australians.

For South Asians however, gender played a more critical role. Compared to Australian females, South Asian males were 5 times *less likely* to make car as passenger trips, while South Asian females were 2 times *more likely* to make such trips. South Asians females were also over 4 times more likely to use active travel compared to South Asian males. For public transport, all males (South Asians and Australians) *did not* significantly travel differently to Australian females when all variables were controlled for; however, South Asian females were over 2 times more likely to use public transport compared to Australian females.

It should be noted, however, that the number of South Asians using other modes in regression analysis (Tables 4-11 to 4-13) was quite small, with only 37 trips for car as passenger, 45 trips for public transport and 31 trips for active travel.

[21] Independent driving without supervision

Table 4-11 Multinomial Logistic Regression – Car as passenger (relative to car as a driver)

Mode[a]	Variables	Variable Categories	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
									Lower Bound	Upper Bound
Car as passenger	Intercept		-1.760	0.257	46.872	1	0.000			
	Age		-0.009	0.005	4.272	1	0.039	0.991	0.982	1.000
	Country of Birth * Gender	South Asian Male	-1.650	0.427	14.934	1	0.000	0.192	0.083	0.443
		South Asian Female	0.613	0.284	4.661	1	0.031	1.846	1.058	3.222
		Australian Male	-0.720	0.122	35.033	1	0.000	0.487	0.383	0.618
		Australian Female	0[b]	.	.	0	.	.	.	.
	License Status	Learner's or No License	3.852	0.306	158.814	1	0.000	47.111	25.876	85.769
		Probationary or Full License	0[b]	.	.	0	.	.	.	.
	Main Activity	Other	0.429	0.170	6.400	1	0.011	1.536	1.102	2.142
		FT/PT Education	0.386	0.271	2.039	1	0.153	1.472	0.866	2.501
		PT/Casual Work	0.099	0.139	0.507	1	0.477	1.104	0.841	1.449
		FT Work	0[b]	.	.	0	.	.	.	.
	Household Income ($/wk)	Low (0-1100)	-0.732	0.197	13.802	1	0.000	0.481	0.327	0.708
		Medium (1101-2250)	-0.522	0.125	17.549	1	0.000	0.593	0.465	0.758
		High (2251+)	0[b]	.	.	0	.	.	.	.
	Household Location	Inner Melbourne	0.119	0.188	0.401	1	0.527	1.126	0.779	1.629
		Middle Melbourne	-0.102	0.150	0.456	1	0.500	0.903	0.673	1.213
		Outer Melbourne	0[b]	.	.	0	.	.	.	.
	Number of People in Household	1	-1.264	0.352	12.902	1	0.000	0.282	0.142	0.563
		2	0.335	0.152	4.840	1	0.028	1.398	1.037	1.883
		3	-0.046	0.155	0.088	1	0.766	0.955	0.705	1.294
		5+	-0.129	0.174	0.555	1	0.456	0.879	0.625	1.235
		4	0[b]	.	.	0	.	.	.	.
	Vehicles in Household	0	1.528	0.578	6.987	1	0.008	4.610	1.485	14.319
		1	0.406	0.156	6.795	1	0.009	1.500	1.106	2.035
		3+	-0.066	0.134	0.239	1	0.625	0.936	0.719	1.219
		2	0[b]	.	.	0	.	.	.	.
	Trip Purpose	Others	-0.157	0.197	0.630	1	0.427	0.855	0.581	1.259
		Social, Recreation, Shopping	0.810	0.135	35.986	1	0.000	2.248	1.725	2.929
		Education	1.564	0.411	14.446	1	0.000	4.776	2.132	10.696
		Work, Business	0[b]	.	.	0	.	.	.	.
	Weekday	No	1.036	0.119	75.947	1	0.000	2.817	2.232	3.556
		Yes	0[b]	.	.	0	.	.	.	.
	Home Area Population Density (pp/km^2)	4001+	-0.356	0.304	1.371	1	0.242	0.700	0.386	1.271
		2001-4000	-0.146	0.144	1.022	1	0.312	0.864	0.652	1.147
		0-2000	0[b]	.	.	0	.	.	.	.

a. The reference category is: Car as driver.
b. This parameter is set to zero because it is redundant.
FT = Full Time PT = Part Time

Table 4-12 Multinomial Logistic Regression – Public Transport (relative to car as a driver)

Mode[a]	Variables	Variable Categories	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
									Lower Bound	Upper Bound
Public Transport	Intercept		-1.682	0.307	30.124	1	0.000			
	Age		-0.014	0.005	6.255	1	0.012	0.986	0.976	0.997
	Country of Birth * Gender	South Asian Male	-0.395	0.342	1.331	1	0.249	0.674	0.344	1.318
		South Asian Female	0.848	0.322	6.922	1	0.009	2.334	1.241	4.390
		Australian Male	-0.054	0.134	0.161	1	0.689	0.948	0.729	1.232
		Australian Female	0[b]	.	.	0	.	.	.	.
	License Status	Learner's or No License	3.864	0.316	149.294	1	0.000	47.635	25.632	88.529
		Probationary or Full License	0[b]	.	.	0	.	.	.	.
	Main Activity	Other	-0.137	0.242	0.320	1	0.572	0.872	0.543	1.401
		FT/PT Education	-0.007	0.317	0.000	1	0.982	0.993	0.533	1.850
		PT/Casual Work	-0.126	0.165	0.584	1	0.445	0.882	0.638	1.218
		FT Work	0[b]	.	.	0	.	.	.	.
	Household Income ($/wk)	Low (0-1100)	-0.255	0.215	1.400	1	0.237	0.775	0.508	1.182
		Medium (1101-2250)	-0.007	0.144	0.003	1	0.960	0.993	0.749	1.315
		High (2251+)	0[b]	.	.	0	.	.	.	.
	Household Location	Inner Melbourne	0.967	0.212	20.829	1	0.000	2.629	1.736	3.983
		Middle Melbourne	0.642	0.179	12.893	1	0.000	1.900	1.338	2.697
		Outer Melbourne	0[b]	.	.	0	.	.	.	.
	Number of People in Household	1	-0.759	0.272	7.804	1	0.005	0.468	0.275	0.797
		2	-0.050	0.182	0.076	1	0.782	0.951	0.666	1.358
		3	0.138	0.182	0.579	1	0.447	1.148	0.804	1.639
		5+	-0.036	0.215	0.029	1	0.865	0.964	0.632	1.470
		4	0[b]	.	.	0	.	.	.	.
	Vehicles in Household	0	4.092	0.504	65.898	1	0.000	59.866	22.289	160.793
		1	1.033	0.162	40.849	1	0.000	2.809	2.047	3.856
		3+	-0.412	0.179	5.265	1	0.022	0.662	0.466	0.942
		2	0[b]	.	.	0	.	.	.	.
	Trip Purpose	Others	-2.009	0.259	60.029	1	0.000	0.134	0.081	0.223
		Social, Recreation, Shopping	-1.427	0.167	72.655	1	0.000	0.240	0.173	0.333
		Education	1.747	0.373	21.972	1	0.000	5.737	2.763	11.909
		Work, Business	0[b]	.	.	0	.	.	.	.
	Weekday	No	-0.622	0.206	9.090	1	0.003	0.537	0.359	0.805
		Yes	0[b]	.	.	0	.	.	.	.
	Home Area Population Density (pp/km^2)	4001+	0.248	0.279	0.790	1	0.374	1.282	0.741	2.216
		2001-4000	0.199	0.168	1.408	1	0.235	1.220	0.878	1.695
		0-2000	0[b]	.	.	0	.	.	.	.

a. The reference category is: Car as driver.
b. This parameter is set to zero because it is redundant.
FT = Full Time PT = Part Time

Table 4-13 Multinomial Logistic Regression – Active Travel (relative to car as a driver)

Mode[a]	Variables	Variable Categories	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
									Lower Bound	Upper Bound
Active Travel	Intercept		-2.428	0.248	95.470	1	0.000			
	Age		0.003	0.004	0.457	1	0.499	1.003	0.995	1.011
	Country of Birth * Gender	South Asian Male	-0.873	0.361	5.865	1	0.015	0.418	0.206	0.847
		South Asian Female	0.729	0.294	6.145	1	0.013	2.072	1.165	3.686
		Australian Male	0.041	0.107	0.148	1	0.700	1.042	0.845	1.285
		Australian Female	0[b]	.	.	0	.	.	.	.
	License Status	Learner's or No License	3.048	0.314	94.312	1	0.000	21.078	11.393	38.994
		Probationary or Full License	0[b]	.	.	0	.	.	.	.
	Main Activity	Other	0.545	0.158	11.915	1	0.001	1.725	1.266	2.350
		FT/PT Education	0.642	0.267	5.801	1	0.016	1.900	1.127	3.204
		PT/Casual Work	0.202	0.130	2.416	1	0.120	1.224	0.949	1.581
		FT Work	0[b]	.	.	0	.	.	.	.
	Household Income ($/wk)	Low (0-1100)	-0.379	0.172	4.834	1	0.028	0.685	0.488	0.960
		Medium (1101-2250)	-0.170	0.117	2.110	1	0.146	0.844	0.671	1.061
		High (2251+)	0[b]	.	.	0	.	.	.	.
	Household Location	Inner Melbourne	0.748	0.170	19.362	1	0.000	2.112	1.514	2.947
		Middle Melbourne	0.364	0.145	6.333	1	0.012	1.440	1.084	1.912
		Outer Melbourne	0[b]	.	.	0	.	.	.	.
	Number of People in Household	1	-0.028	0.212	0.017	1	0.895	0.972	0.642	1.474
		2	0.148	0.146	1.026	1	0.311	1.160	0.871	1.544
		3	0.096	0.150	0.414	1	0.520	1.101	0.821	1.477
		5+	-0.095	0.180	0.277	1	0.599	0.910	0.639	1.294
		4	0[b]	.	.	0	.	.	.	.
	Vehicles in Household	0	2.681	0.479	31.277	1	0.000	14.593	5.704	37.337
		1	0.644	0.137	22.092	1	0.000	1.905	1.456	2.492
		3+	-0.088	0.138	0.405	1	0.524	0.916	0.699	1.200
		2	0[b]	.	.	0	.	.	.	.
	Trip Purpose	Others	-0.894	0.186	23.243	1	0.000	0.409	0.284	0.588
		Social, Recreation, Shopping	0.142	0.114	1.547	1	0.214	1.152	0.922	1.440
		Education	0.446	0.461	0.938	1	0.333	1.563	0.633	3.856
		Work, Business	0[b]	.	.	0	.	.	.	.
	Weekday	No	0.094	0.125	0.572	1	0.450	1.099	0.860	1.404
		Yes	0[b]	.	.	0	.	.	.	.
	Home Area Population Density (pp/km^2)	4001+	0.547	0.225	5.928	1	0.015	1.728	1.113	2.684
		2001-4000	0.070	0.137	0.264	1	0.608	1.073	0.820	1.403
		0-2000	0[b]	.	.	0	.	.	.	.

a. The reference category is: Car as driver.
b. This parameter is set to zero because it is redundant.
FT = Full Time PT = Part Time

Table 4-14 highlights the variables that are significant across these three modes (with respect to the mode car as driver), and whether the relationship is positively or negatively associated.

Table 4-14 Variable significance (and direction of relationship) for each mode

Variables	Variable Categories	Car as passenger	Public Transport	Active Travel
Age		-ve	-ve	n.s.
Country of Birth * Gender	South Asian Male	-ve	n.s.	-ve
	South Asian Female	+ve	+ve	+ve
	Australian Male	-ve	n.s.	n.s.
	Australian Female	-	-	-
License Status	Learner's or No License	+ve	+ve	+ve
	Probationary or Full License	-	-	-
Main Activity	Other	+ve	n.s.	+ve
	FT/PT Education	n.s.	n.s.	+ve
	PT/Casual Work	n.s.	n.s.	n.s.
	FT Work	-	-	-
Household Income ($/wk)	Low (0-1100)	-ve	n.s.	-ve
	Medium (1101-2250)	-ve	n.s.	n.s.
	High (2251+)	-	-	-
Household Location	Inner Melbourne	n.s.	+ve	+ve
	Middle Melbourne	n.s.	+ve	+ve
	Outer Melbourne	-	-	-
Number of People in Household	1	-ve	-ve	n.s.
	2	+ve	n.s.	n.s.
	3	n.s.	n.s.	n.s.
	5+	n.s.	n.s.	n.s.
	4	-	-	-
Vehicles in Household	0	+ve	+ve	+ve
	1	+ve	+ve	+ve
	3+	n.s.	-ve	n.s.
	2	-	-	-
Trip Purpose	Others	n.s.	-ve	-ve
	Social, Recreation, Shopping	+ve	-ve	n.s.
	Education	+ve	+ve	n.s.
	Work, Business	-	-	-
Weekday	No	+ve	-ve	n.s.
	Yes	-	-	-
Home Area Population Density (pp/km^2)	4001+	n.s.	n.s.	+ve
	2001-4000	n.s.	n.s.	n.s.
	0-2000	-	-	-

+ve (significant positive association), -ve (significant negative association), n.s.(not significant), - (reference parameter)

In an alternative analysis, we compared five cultural cohorts across five multinomial regression models. This analysis included Australians, South Asians, Southeast Asians[22], Chinese people and English/ New Zealanders, and has been presented in Appendix C. We found that South Asians were the *only* immigrant group for whom gender played a significant role in travel behaviour across all modes. This further highlights the strong possibility of cultural influences and /or past travel habits playing a role in travel behaviour.

It should also be noted that the sample size for Australian respondents was much larger than any of the other cohorts in the alternative analysis. The small sample size for the non-Australian cohorts meant that the model parameters were not statistically significant and consequently it was not possible to draw definitive conclusions. Although there were demographic differences between South Asian males and females, these models show that controlling for demographics is not enough to 'explain' the differences in travel behaviour. Country of birth and gender in this model possibly played the role of a proxy that represents a range of underlying cultural and psychosocial factors. These factors are precisely what we attempt to uncover over the next chapters of the thesis.

[22] comprises of the countries of Cambodia, Laos, Malaysia, Myanmar, Thailand and Vietnam

4.6 Key findings from Chapter 4

In summary, the analysis reported in this chapter has produced findings which relate directly to key research questions. The findings have been summarised by the research questions (highlighted in Figure 4-2 earlier in the chapter) this chapter intended to answer, and are outlined in Table 4-15 below.

Table 4-15 Chapter 4: Research questions and findings

Research question	Key findings from Chapter 4
RQ 1.1: How does short-term travel behaviour differ?	Despite lower levels of car ownership and licensing rates, car use levels were relatively high, especially amongst South Asian men. South Asians also used carpooling more than Australians, women even more so that men. Public transport use was higher amongst South Asians (especially for work-based trips). Generally, active travel was low for South Asians and Australians alike except although for some trip purposes it could be higher (such as education).
RQ 1.2: How do long-term mobility choices differ?	South Asians tend to live in larger households compared to native-born Australians in both Victoria and Queensland. However, South Asian motor vehicle ownership at a household level (despite the higher number of household members) is lower than Australian households. There was some evidence of South Asian ethnic enclaves existing in Victoria – most South Asian immigrants lived in particular regions in the state. This mirrors the situation in New South Wales, and to a lesser extent, Queensland.
RQ 2.3: How does gender influence travel behaviour?	Australian licensing rates were similar for men and women; on the other hand, South Asian men have much higher licensing rates than their female counterparts. South Asian males made the largest proportion of their trips as a driver, while women relied quite heavily on carpooling. Models controlling for demographic factors found that South Asian women are still less likely to drive and more likely to make active travel trips, use public transport and make car passenger trips compared to men. The influence of gender played a significant role amongst South Asians for all modes, while for Australians it only played a role in car passenger trips. However, it is unclear *why* gender plays a role (something that will be explored in later chapters).
RQ 3.1: How does mode use change over time?	There is evidence of travel assimilation occurring amongst South Asian immigrants in Australia. Longer-residing South Asian immigrants' travel habits are more similar to native-born Australians. This process appears to occur faster among South Asian men than among women. However even after 15 years of living in Australia, car use is still lower while public transport use is higher than for native-borns.

Due to the limitations of the secondary data available, this chapter focussed on exploring sociodemographic and economic influences on travel behaviour. The chapters that follow overcome this limitation by collecting primary quantitative and qualitative data. Collecting primary data allows us to explore the role of psychosocial and 'soft factors', such as attitudes and past habits.

5 University students and the role of past travel and attitudinal factors

The thesis structure highlighting Chapter 5 and the research questions answered in this chapter are presented in Figure 5-1 and Figure 5-2 respectively.

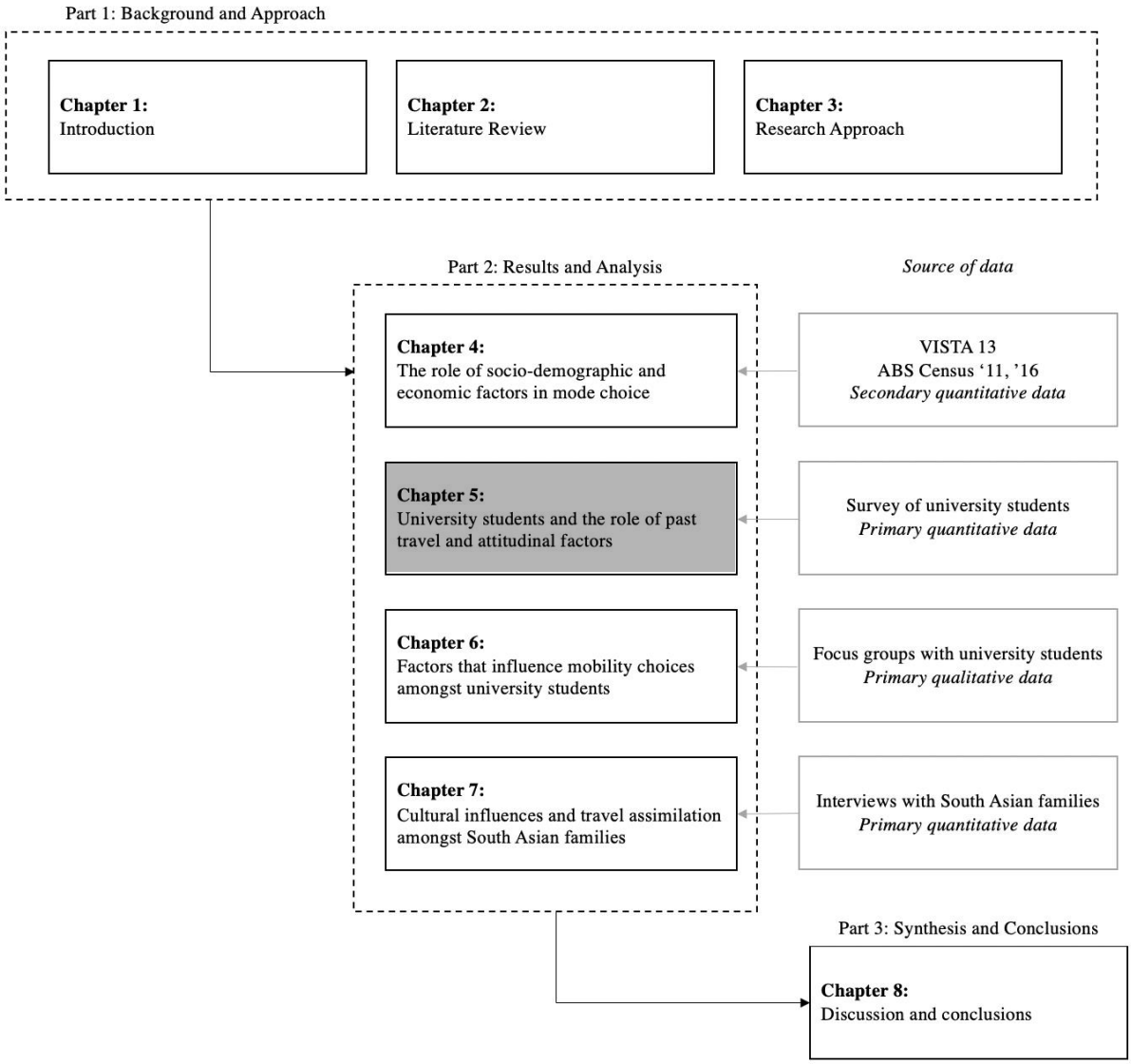


Figure 5-1 Position of Chapter 5 in thesis structure

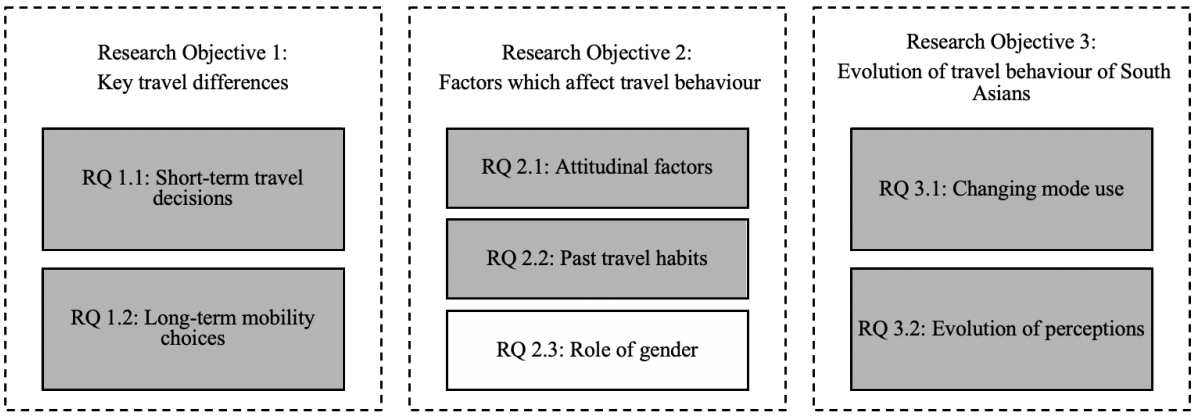


Figure 5-2 Thesis context: Chapter 5

5.1 Introduction

This chapter presents the findings of the third major task of this thesis, and the first that involved primary data collection. It uses a survey of domestic and international students at an Australian university to explore a broad range of factors that might influence travel behaviour, touching on almost every research question in the thesis (as highlighted in Figure 5-2). In Chapter 3: Research Approach, we discussed in-depth the motives behind doing this survey and the survey methods.

Although the thesis primarily focuses on immigrants from South Asia, the number of South Asian international students in our survey was smaller than we had hoped. Therefore, for this chapter, the scope has been expanded to include students from developing Asian countries more broadly. The descriptive results in this chapter include both immigrant groups (all Asian and South Asian only); however, modelling was conducted on all Asian students.

Some of the results presented in this chapter, particularly around the role of attitudes, were published in a journal paper (Shafi, Delbosc et al. 2020).

5.2 Task objectives

To recap from Chapter 3: Research Approach, the survey presented in this chapter asked questions about university students' demographics, mode use, attitudes and past travel habits (the full survey can be found in Appendix B1). These questions provided insights into the differences between native-born students and international students from developing Asian countries more generally and South Asia in particular. Specifically, by the end of this chapter, we will have covered the following research questions (see also Figure 5-2):

- Research Objective 1: Identify key travel behavioural differences between South Asians in Australia and native-born Australians
    - RQ 1.1: How does short-term travel behaviour differ?
    - RQ 1.2: How do long-term mobility choices differ?
- Research Objective 2: Understand the factors which affect travel behaviour of South Asians and Australians
    - RQ 2.1: What role do attitudes play in shaping travel behaviour?
    - RQ 2.2: How important are past travel habits in present day mode use?
- Research Objective 3: Understand how South Asian immigrants' travel behaviour evolves during their time in Australia
    - RQ 3.1: How does mode use change over time?
    - RQ 3.2: How do attitudes towards travel modes change over time?

While the survey enabled us to cover a range of the research questions, additional data collection was required to obtain deeper understanding of the underlying factors driving behaviour. The analysis reported in this chapter provided insight that helped guide the design of the focus groups which are discussed in the next chapter (Chapter 6: Focus groups with university students). The chapter workflow is illustrated in Figure 5-3 below.

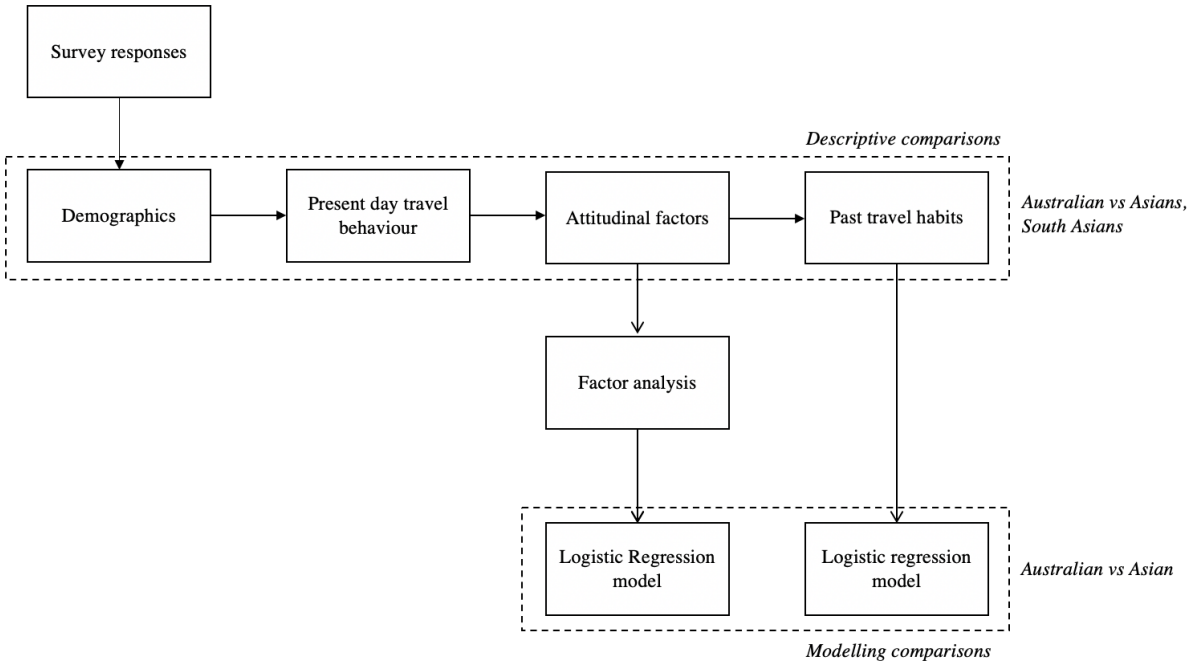


Figure 5-3 Chapter 5 workflow

The chapter has four major components. Firstly, there is a comparison of the demographics between Australian and Asian students. This provides some context for the rest of the chapter. Secondly, we explore the present-day travel behaviour of the respondents. This was measured in two ways: mode choice and mode use frequency. The third and fourth sections explore the role of attitudes and past travel habits. Separate regression models were run using attitudes and past habits to predict travel behaviour.

Several of the survey responses used for the regression analyses were recoded into fewer categories. For example, licensing was recoded to two categories (none/learners or probationary/full). Country of birth and years lived in Australia were recoded to three categories: born in Australia, Asians living in Australia for less than 2 years and Asians living in Australia for more than 2 years. In some analyses and illustrations, some travel modes were have been aggregated. For example, car-based trips (driver or passenger) were have been aggregated as simply car trips whereas walking or cycling were aggregated into 'active travel'.

5.3 Socio-demographic characteristics of respondents

This analysis began by considering descriptive statistics for a range of variables. To some extent, this section touches on RQ 1.2 by showing differences in car ownership and home location among international students. Table 5-1 presents the socio-demographics of Australian, Asian[23] and South Asian survey respondents. The demographics of Asian and South Asian students were broadly similar except where noted below.

Compared to the Australian students, Asians in this study were older, more likely to be doing a postgraduate degree and have a driver's license. The latter could be explained by the age difference, or be further evidence of recent studies where Australians are delaying getting their licenses (Delbosc and Currie 2014), a trend unlikely to be shared by their Asian counterparts based on the literature explored on South Asia. However, Asian respondents were less likely to have access to a car compared to Australians. There was a gender overrepresentation of males amongst Asians (particularly South Asians) and females among Australians compared to the census (Australian Bureau of Statistics (ABS) 2016).

As expected, Australians were more likely to live with family (common amongst university students in Australia), whereas Asians were more likely to live with friends/roommates off-campus. More Australians had access to cars and were financially supported more by their families with regards to housing and necessary expenses. More Asians on the other hand were supported financially for their education by their parents which is unsurprising given the high tuition fees for international students. More Australians worked than Asians, although this could be because many of the latter might be on postgraduate scholarships (not asked in the survey).

While about 43% of Asian students had car access, there is a large discrepancy between recently arrived and longer-residing Asian students (not presented in Table 5-1). For instance, 85% of Asian students living in Australia for more than 5 years had car access; this dropped to only 27% for those living in Australia for less than a year.

[23] Asians include all South Asians as well – due to the smaller respondent pool, we expanded our *South Asian* cohort to include Asian students from developing countries. This has been outlined in Chapter 3 – Research Approach.

Table 5-1 Socio-demographic characteristics of respondents

			Australians		Asians[a]		South Asians	
			N	%	N	%	N	%
			174	*100*	154	*100.00*	72	*100.0*
Age			*Mean* = 21.8		*Mean* = 23.4		*Mean = 24.07*	
Parents	Both born overseas		37	*21.3*	152	*98.7*	72	*100.0*
	One born overseas		50	*28.7*	2	*1.3*	-	-
	Both born in Australia		87	*50.0*	-	-	-	-
Degree enrolled in	Diploma or Bachelor's Degree		160	*91.9*	103	*66.9*	39	*54.2*
	Postgraduate (Master's/ PhD)		14	*8.1*	51	*33.1*	33	*45.8*
University Campus[b]	Clayton	Middle Mel	123	*70.7*	116	*75.3*	48	*66.7*
	Caulfield	Inner Mel	50	*28.7*	22	*14.3*	11	*15.3*
	Peninsula	Outer Mel	6	*3.5*	1	*0.7*	1	*1.4*
	Parkville	Inner Mel	1	*0.6*	-	-	-	-
	Monash Other	Inner Mel	3	*1.7*	-	-	-	-
	Other	Inner Mel	6	*3.5*	19	*12.3*	13	*18.1*
		Middle Mel	3	*1.7*	1	*0.7*	1	*1.4*
		Rural Mel	-	-	1	*0.7*	1	*1.4*
Years in Australia	Less than 2 years		-		84	*54.5*	39	*54.2*
	2 years or more				70	*45.5*	33	*45.8*
Gender	Male		71	*40.8*	93	*60.4*	55	*76.4*
	Female		102	*58.6*	61	*39.6*	17	*23.6*
	Prefer not to say[c]		1	*0.6*	-	-	-	-
Financial support; parents pay for:	Housing	All/most of it	132	*75.9*	107	*69.5*	41	*56.9*
		None/some of it	42	*24.1*	47	*30.5*	31	*43.1*
	Food and utilities	All/most of it	123	*70.7*	98	*63.6*	37	*51.4*
		None/some of it	51	*23.3*	56	*36.4*	35	*48.6*
	Education	All/most of it	45	*25.9*	124	*80.5*	53	*73.6*
		None/some of it	129	*74.1*	30	*19.5*	19	*26.4*
Work	No		26	*14.9*	51	*33.1*	17	*23.6*
	Yes		148	*85.1*	103	*66.9*	55	*76.4*
License	Provisional or full license		127	*73.0*	125	*81.2*	61	*84.7*
	Leaner's permit or none		47	*27.0*	29	*18.8*	11	*15.3*
Own /have car access	Yes		134	*77.0*	66	*42.9*	41	*56.9*
	No		40	*23.0*	88	*57.1*	31	*43.1*
Household Structure	Alone on-campus		11	*6.3*	21	*13.6*	8	*11.1*
	Alone off-campus		5	*2.9*	19	*12.3*	6	*8.3*
	Off-campus with friends/roommates		21	*12.1*	78	*50.7*	41	*56.9*
	With family		124	*71.3*	27	*17.5*	12	*16.7*
	With my partner/spouse		10	*5.8*	5	*3.3*	3	*4.2*
	Other		3	*1.7*	4	*2.6*	2	*2.8*

a. This column combines all students from developing Asian countries, including South Asia
b. Total percentage greater than 100% because students were attending more than one campus
c. Not used in further analysis

Most Asian (and South Asian) students have also clearly expressed their desire to settle in Australia after their studies. For South Asians in particular, less than 6% have decided to never settle in Australia. This is consistent with another survey at Monash University, where over 70% of international student participants have stated their intention to work in Australia after their studies (Delbosc 2018).

Table 5-2 Future intentions of Australian, Asian and South Asian students

		Australians	Asians	South Asians
Future intentions: Car purchase and settle in Australia *(in %)*				
Buy a car	Already completed	*47.1*	*26.6*	*41.7*
	Before finishing my studies	*12.6*	*13.6*	*18.1*
	After my studies	*28.2*	*34.4*	*25.0*
	Undecided	*12.1*	*21.4*	*12.5*
	Never	*0.0*	*3.9*	*2.8*
Settle in Australia	Already completed	-	*7.8*	*6.9*
	Before finishing my studies		*1.9*	-
	After my studies		*39.6*	*44.4*
	Undecided		*43.5*	*43.1*
	Never		*7.1*	*5.6*

5.4 Present day travel behaviour

This section addresses RQ1.1, differences in short-term travel behaviour, and RQ 3.1, changes in mode use over time. Table 5-3 below compares present day mode use frequency for university and non-university trips. It can be seen that Asian students generally drive less and rely on active travel (particularly walking) more. South Asian students follow the same pattern although not all of the differences are statistically significant (perhaps due to the smaller sample size). These differences are likely due to a range of factors such as household location, car access or years lived in Australia – factors we will consider later in the chapter.

Table 5-3 Present day travel behaviour (mode use frequency)

		Australians	Asians	Difference[a] (Compared to Australians)	South Asians	Difference[a] (Compared to Australians)
Proportion with car access		*77.0%*	*42.9%*	-	*56.9 %*	-
Present Travel Behaviour[b]						
University trips	Drive or Driven	2.82	2.08	-0.74**	2.31	-0.51*
	Public Transport	2.88	2.84	-0.04	2.89	0.01
	Walking	1.57	3.13	1.56**	2.79	1.22**
	Cycling	1.23	1.50	0.27*	1.42	0.19
Non-university trips (incl. work, recreation, family trips)	Drive or Driven	3.25	2.49	-0.76**	2.90	-0.35
	Public Transport	2.70	3.37	0.67**	2.96	0.26
	Walking	1.82	2.39	0.57**	2.22	0.40*
	Cycling	1.30	1.43	0.13	1.49	0.19

a. Difference with independent samples t-test; Significance (2-tailed): * = $p < 0.05$ ** = $p < 0.005$
b. Scores recorded on a scale of 1 to 5, where 1 = Never and 5 = Always

Figure 5-4 presents how Asian international students travel depending on how long they have been in Australia. It can be seen from Figure 5-4 that Asians who have lived for a longer period of time in Australia drive more and walk less compared to students who arrived recently. Public transport shows a slight increase in use initially, before it decreases again, suggesting increased familiarity with the system initially before it is eventually replaced with car use. Cycling use was low for both Asians and Australians with no noticeable difference between the groups. It suggests that over time, Asians may drive at similar (or even higher) levels than Australian students. Reasons may include higher car access, greater financial freedom and increased familiarity with the system.

The trends are similar when the graphs are only plotted for South Asians compared to Australian students, as presented in Figure 5-5. As with Asian students, South Asians who have been in Australia longer drive more and walk and use transit less than recent arrivals. One exception is that South Asians who have been in Australia over three years are more likely to cycle than Australians, although this may be because of a small sample size in this category (17 South Asian students).

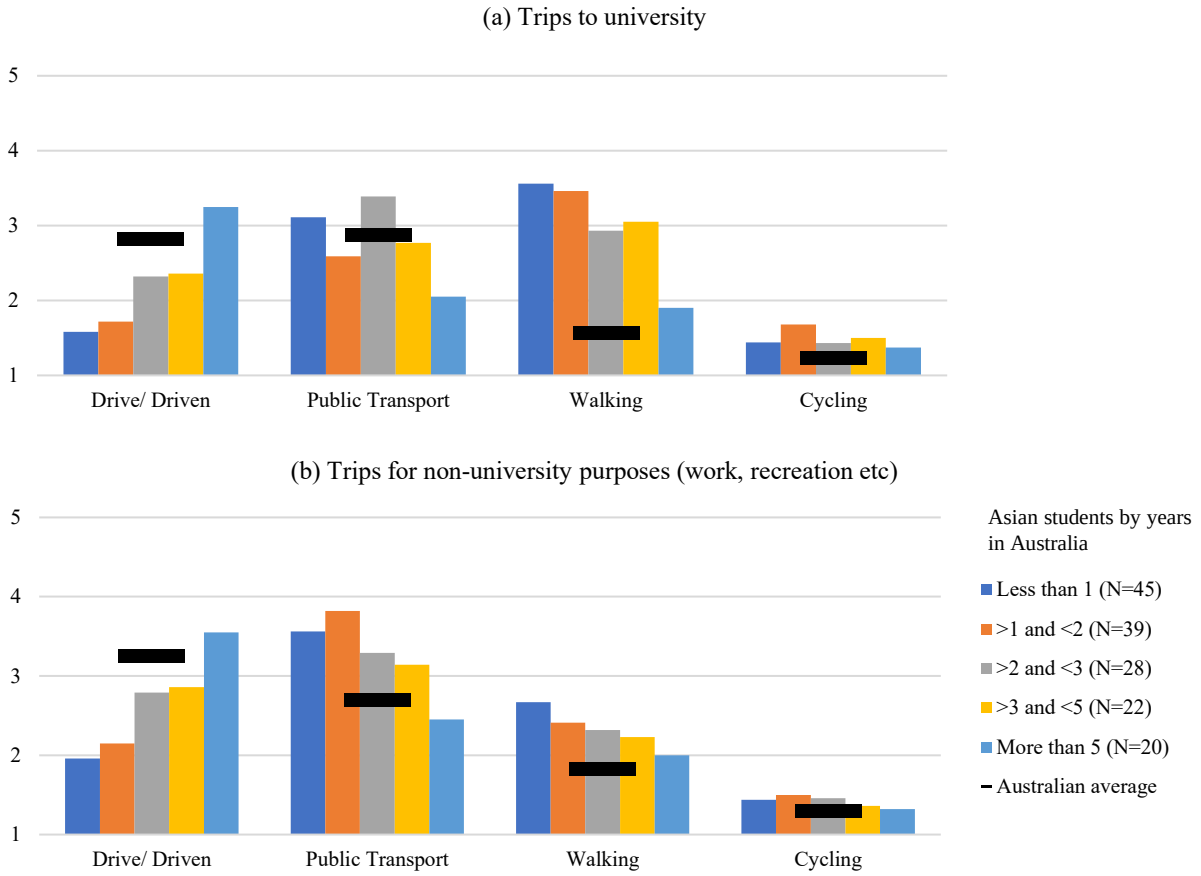


Figure 5-4 Frequency of mode use by years by Asian students lived in Australia for (a) university and (b) non-university trips compared to Australian students

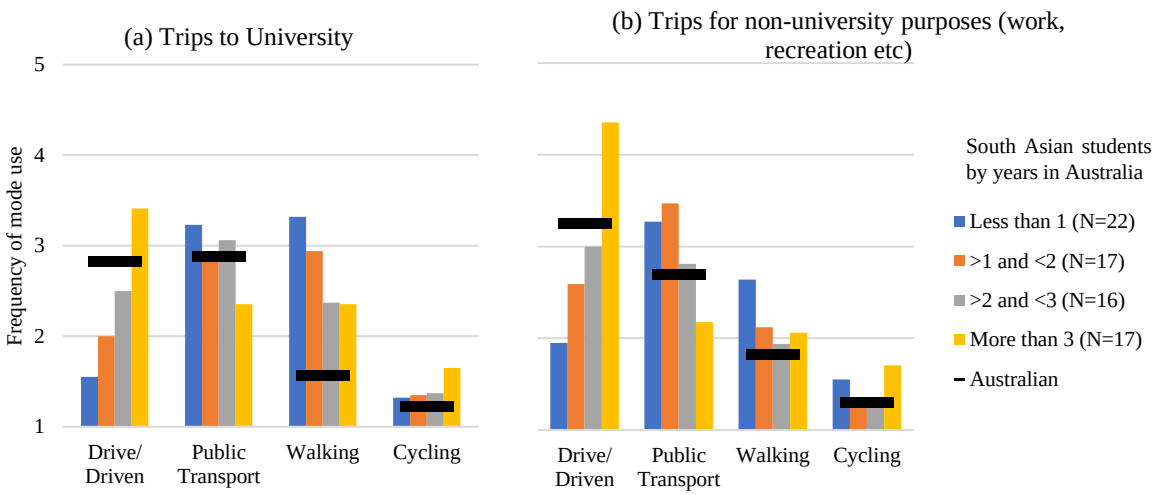


Figure 5-5 Frequency of mode use by years by South Asian students lived in Australia for (a) university and (b) non-university trips compared to Australian students[24]

[24] Due to a much smaller sample size for South Asians, the longest residing cohort included all participants living for greater than three years in Australia (see Figure 5-5). This was not necessary in the illustrations for all Asian students (see

Survey participants were also asked to share their mode use using a slightly different question: they selected one 'main' mode that they usually used for education, work, recreation and other purposes. The proportion of participants who chose a particular mode for each purpose is outlined is presented in Figure 5-6[25].

The figure highlights how this mode use changes between recent Australians, recently arrived Asian students and Asian students who have been in Australia for more than 2 years (Figure 5-6a). Furthermore, Figure 5-6b shows these results only for students who have access to a car. For education-based trips, international students are more likely to walk or cycle, likely because they are more likely to live on-campus, as shown in Table 5-1, or in shared accommodation nearer to campus than Australians. Being driven by someone else is a relatively popular mode amongst Asians, even after controlling for car access (Figure 5-6b).

However, when only comparing students with car access (Figure 5-6b), Asian students make a similar (if not higher) proportion of car-based trips as Australians. Active travel for those with car access drops for non-education trips, especially when comparing Australians and Asians > 2. The difference between education, work and recreational trips' mode choice was deemed to be significantly different (Pearson Chi-Square significant at $p < 0.05$ level) for all participants between the three groups. However, with car access controlled for, only education-based trips were significantly different even though sample sizes were small.

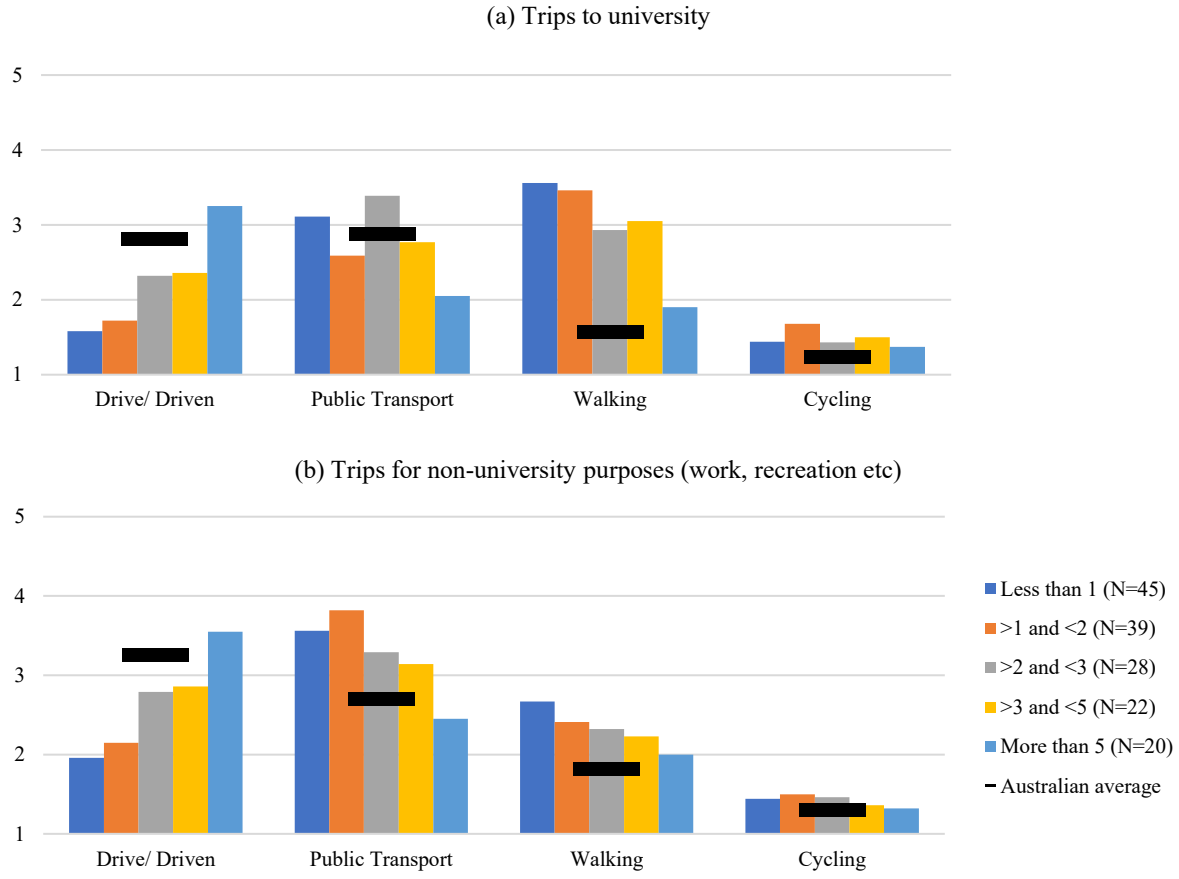
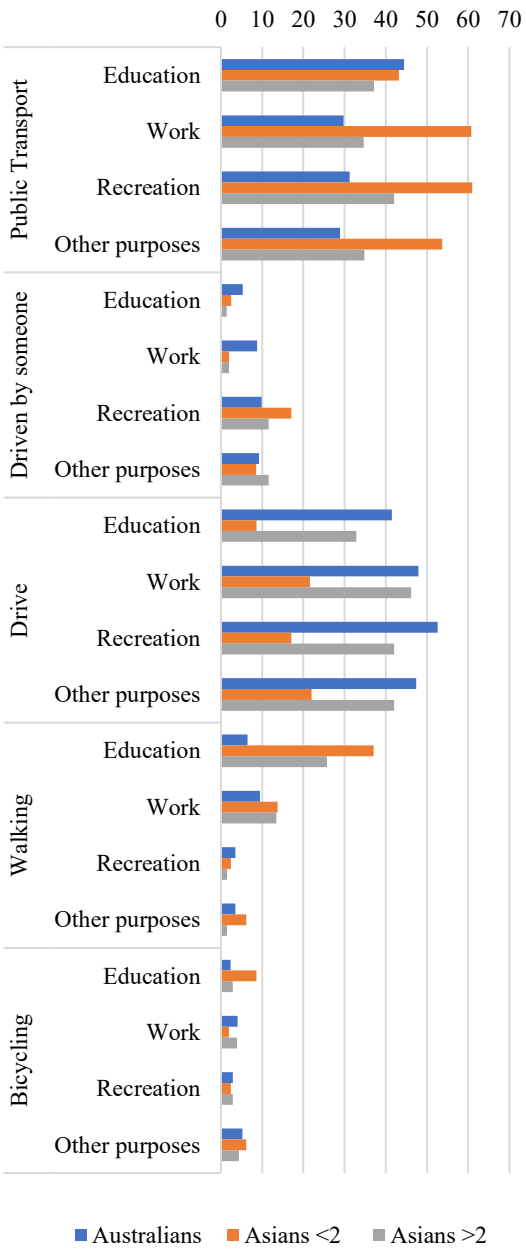


Figure 5-4), where only students residing in Australia for greater than 5 years were aggregated.

[25] We excluded South Asians in this figure because of the small sample size, as discussed earlier.

(a) Main mode of choice - all participants



(b) Main mode of choice - own or have access to a car

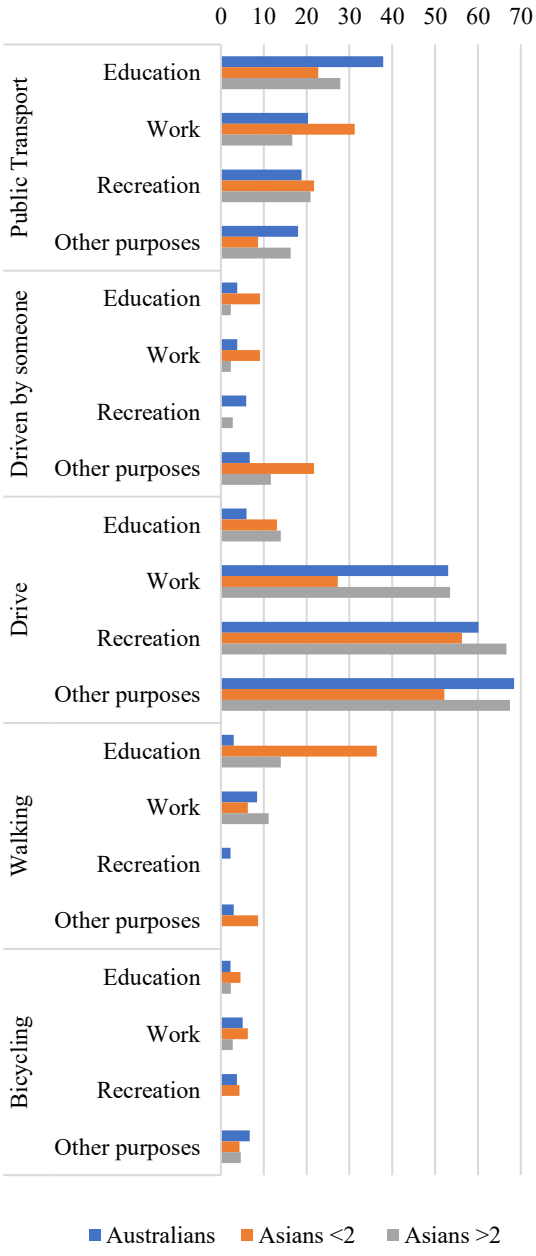


Figure 5-6 Main mode choice by trip purpose for (a) all participants and (b) those with car access[26][27]

5.5 The role of attitudes

This section addresses RQ 2.1, the role of attitudinal factors in mode choice, and RQ 3.2, how attitudes evolve over time. The results from this section of the chapter were published in a journal paper titled "Travel attitudes and mode use among Asian international students at an Australian university", published in Transportation Research Part D (Shafi, Delbosc et al. 2020). This section presents the key analysis that was undertaken in that paper.

5.5.1 Comparing attitudes between Australian, Asian and South Asian students

The survey asked questions on university students' attitudes and perceptions towards different modes. Table 5-4 presents the attitudinal statements asked in the survey, and how responses compared between Australian and Asian students. A separate comparison was also made between Australian and South Asian students. From Table 5-4, it can be seen that in most regards, differences between Australians and Asians, and difference between Australians and South Asians are quite similar across statements.

While all groups generally had positive feelings associated with car ownership and use, Asians (including South Asians) were more pro-car in general. Asians felt that car ownership leads to a better quality of life; Australians were generally neutral on this attitude. Australians did not associate car ownership with success and securing high paying jobs, whereas Asians were neutral. Asians generally enjoyed walking less than Australians. All participants responded negatively to notions of public transport being uncool or unsafe.

In response to RQ 3.2, Asian students were divided into 2 groups to determine whether attitudes differed depending on how long they had been in Australia. Because attitudes were quite similar between all-Asians and South Asians (Table 5-4), and due to the sample size, only the all-Asian results are shown in Table 5-5.

The differences in attitudinal scores are generally greatest between Asians who had been in Australia less than 2 years ('Asians < 2') and Australians, with Asians who had lived in Australia over 2 years ('Asians 2+') somewhere in between. The only group who felt strongly about car ownership being a symbol of wealth were Asians < 2, while Asians 2+ and Australians both disagreed. For non-car modes, it is Australians and Asians < 2 who are more alike, while Asians 2+ have attitudes that point to future car dependency. Australians and Asians both felt strongly that public transport was cost-effective, that time on public transport was productive, and that walking was enjoyable; however, Asians 2+ did not support those statements as strongly. It appears that attitudes are changing over time, although this was not a wave panel study, so there is a chance that the more recent Asian cohort differs from Asian students who arrived more than 2 years ago.

[26] retrieved from Shafi, R., A. Delbosc and G. Rose (2020). "Travel attitudes and mode use among Asian international students at an Australian university." Transportation Research Part D: Transport and Environment 80: 102259.

[27] comparison excludes participants who either chose a mode other than the ones presented or responded stating that they did not have to travel for the purpose(s) listed.

Table 5-4 Comparing attitudes between Australian, Asian and South Asian students[28]

	Australians (N = 174)	Asians (N = 154)	Asians compared to Australians (difference)	South Asians (N = 72)	South Asians compared to Australians (difference)
Attitudes to car ownership					
Owning a car means someone is successful in life	-0.49	-0.06	0.43**	-0.03	0.46*
Car ownership is a symbol of wealth	-0.12	0.05	0.17	0.03	0.15
People who own a car have a better quality of life	-0.06	0.47	0.53**	0.53	0.59**
A car opens up more work opportunities	1.32	1.33	0.02	1.51	0.19
Owning a car allows you to secure high-paying jobs	-0.40	-0.08	0.32*	0.03	0.43*
My family thinks I should drive to places	0.52	0.16	-0.36**	0.09	-0.43*
My friends think having a car is important	0.59	0.78	0.19	0.93	0.34*
Attitudes to car use					
Travelling by car is more comfortable than other travel modes	1.45	1.51	0.06	1.60	0.15
A car is faster than other modes of travel	1.09	1.39	0.30**	1.54	0.45**
I feel Victorian roads are generally safe for driving	1.07	1.09	0.02	1.24	0.17
Attitudes to public transport use					
Public transport is cost-effective	0.89	0.65	-0.24	0.68	-0.21
Public transport means I can be more productive while travelling	0.36	0.24	-0.12	0.26	-0.10
Taking public transport means you aren't successful in life	-1.45	-1.21	0.24*	-1.15	0.30*
I feel safe on public transport in Victoria	0.80	1.13	0.33**	1.25	0.45**
My friends think public transport is uncool	-1.14	-0.76	0.38**	-0.60	0.54**
My family thinks public transport is unsafe	-0.31	-0.68	-0.37*	-0.76	-0.45*
Attitudes to walking and cycling					
I enjoy walking to places	0.91	0.68	-0.23*	0.72	-0.19
I feel it is safe to walk around where I live	1.23	1.04	-0.19*	1.10	-0.13
My family thinks I should avoid walking to places	-0.67	-0.62	0.05	-0.75	-0.08
I enjoy riding a bike	0.27	0.19	-0.08	0.25	-0.02
I feel cycling is safe around where I live	0.67	0.66	-0.01	0.68	0.01
My family thinks I should avoid cycling to places	-0.53	-0.50	0.03	-0.63	-0.10

Scores recorded on a scale of -2 to 2, where -2 = Strongly Disagree and 2 = Strongly Agree
Independent samples t-test; Significance (2-tailed): * = $p < 0.05$ ** = $p < 0.005$

[28] retrieved from Shafi, R., A. Delbosc and G. Rose (2020). "Travel attitudes and mode use among Asian international students at an Australian university." Transportation Research Part D: Transport and Environment 80: 102259.

Table 5-5 One-way ANOVA between Australia, recently arrived Asian and longer-residing Asian students

	Australians	Asians	
		<2 years	2+ years
	(N = 174)	(N = 84)	(N = 70)
Attitudes to car ownership			
Owning a car means someone is successful in life	**-0.49** [a]	**0.11** [a]	**-0.27**
Car ownership is a symbol of wealth	**-0.12** [a]	**0.29** [ab]	**-0.24** [b]
People who own a car have a better quality of life	**-0.06** [ab]	**0.50** [a]	**0.44** [b]
A car opens up more work opportunities	1.32	1.3	1.37
Owning a car allows you to secure high-paying jobs	**-0.40** [a]	**0.00** [a]	**-0.17**
My family thinks I should drive to places	**0.52** [a]	**0.13** [a]	**0.2**
My friends think having a car is important	0.59	0.73	0.84
Attitudes to car use			
Travelling by car is more comfortable than other travel modes	1.45	1.43	1.61
A car is faster than other modes of travel	**1.09** [a]	**1.51** [a]	**1.24**
I feel Victorian roads are generally safe for driving	1.07	1.12	1.06
Attitudes to public transport use			
Public transport is cost-effective	**0.89** [a]	**0.92** [b]	**0.33** [ab]
Public transport means I can be more productive while travelling	**0.36**	**0.48** [a]	**-0.04** [a]
Taking public transport means you aren't successful in life	-1.45	-1.19	-1.23
I feel safe on public transport in Victoria	**0.80** [a]	**1.27** [a]	**0.96**
My friends think public transport is uncool	**-1.14** [a]	**-0.70** [a]	**-0.83**
My family thinks public transport is unsafe	**-0.31**	**-0.68**	**-0.67**
Attitudes to walking and cycling			
I enjoy walking to places	**0.91** [a]	**0.81**	**0.51** [a]
I feel it is safe to walk around where I live	1.23	1.11	0.96
My family thinks I should avoid walking to places	-0.67	-0.5	-0.76
I enjoy riding a bike	0.27	0.2	0.19
I feel cycling is safe around where I live	0.67	0.81	0.47
My family thinks I should avoid cycling to places	-0.53	-0.38	-0.66

bold = ANOVA, means are different at p = 0.05 level
a. Corresponding means significantly different at p = 0.05 level
b. Corresponding means significantly different at p = 0.05 level
Means compared using: Tukey's HSD test (homogenous variances) or Games-Howell test (heterogeneous variances) as shaded

5.5.2 Factor analysis on attitudinal parameters

In order to reduce the number of attitude parameters for modelling, the 22 attitude variables were put through a factor analysis approach which is described in Chapter 3: Research Approach. The sample was adequate, as represented by a Kaiser-Meyer-Olkin of 0.749 (KMO > 0.6 is generally acceptable) for the final iteration, and Bartlett's Test of Sphericity showed statistical significance (Sig. at 0.000) and had many degrees of freedom (df = 78).

The resulting four factors, as identified in Table 5-6 below, present the 13 variables that loaded appropriately on each factor. These factors are broadly associated with aspects of travel independence and attitudes towards particular modes.

All variables had high component loadings of with their respective factors. It should be noted that only factor loadings greater than 0.3 are displayed in Table 5-6 (loadings < 0.3 are presented as blanks). The factors cumulatively were able to explain 64.4% of variance amongst the variables.

Table 5-6 Factor analysis of travel attitudes – communalities and rotated component matrix[29]

	Communalities	Component			
		1	2	3	4
Owning a car allows you to secure high-paying jobs	0.687	0.818			
People who own a car have a better quality of life	0.666	0.801			
Car ownership is a symbol of wealth	0.640	0.790			
Owning a car means someone is successful in life	0.636	0.787			
My family thinks I should avoid walking to places	0.714		0.825		
My family thinks I should avoid cycling to places	0.609		0.767		
My family thinks public transport is unsafe	0.636		0.752		
My family thinks I should drive to places	0.573		0.741		
I feel it is safe to walk around where I live	0.673			0.813	
I feel cycling is safe around where I live	0.618			0.785	
I feel safe on public transport in Victoria	0.568			0.711	
I enjoy riding a bike	0.673				0.805
I enjoy walking to places	0.682				0.799

The factors were given the following titles based on their underlying themes.

- Factor 1: Car ownership as a status symbol
    - Cronbach's Alpha of 0.82
- Factor 2: Family prefers driving over other modes
    - Cronbach's Alpha of 0.82
- Factor 3: Perceived safety of non-car modes
    - Cronbach's Alpha of 0.68
- Factor 4: Enjoyment of active travel
    - Cronbach's Alpha of 0.48

Factor 3 had a marginal Cronbach's Alpha of 0.68; the typical acceptable threshold is 0.70, but exceptions can be made for factors with few variables (Peterson 1994). However, Factor 4 had a very low Cronbach's Alpha of 0.48, so although it is presented below it *was not included* in later modelling. Factor scores were calculated as standardised z-scores using the Anderson-Rubin method; a comparison of the four factor scores amongst the three primary groups is presented in Figure 5-7 below.

More recent arrivals, i.e. those who have lived in Australia for less than 2 years, have the highest positive feelings towards car ownership, as interpretation of Table 5-4 had earlier confirmed. The enjoyment of active travel decreases significantly for Asians who have lived in Australia for greater than 2 years (although this finding should be viewed with caution due to the low Cronbach's alpha). Lastly, parents of Asians do not seem to strongly prefer driving while Australian parents do. This finding is somewhat counter-intuitive compared to how cars are viewed in many developing Asian countries (see Chapter 2, Section 2.5.1).

[29] retrieved from Shafi, R., A. Delbosc and G. Rose (2020). "Travel attitudes and mode use among Asian international students at an Australian university." Transportation Research Part D: Transport and Environment 80: 102259.

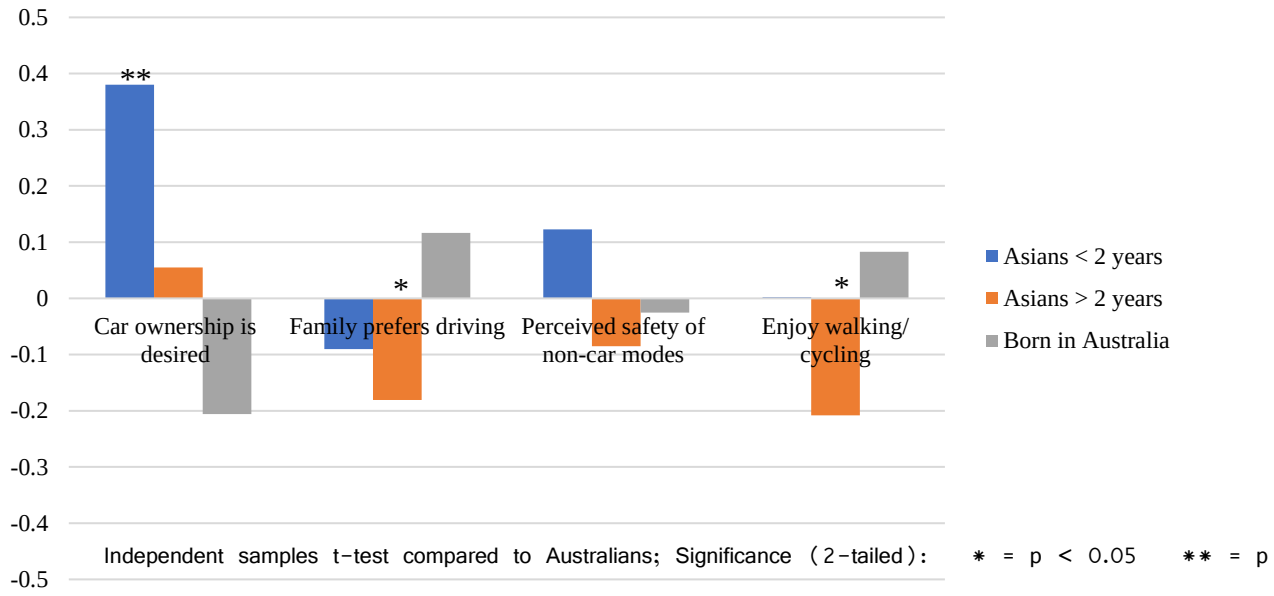


Figure 5-7 Attitude factor score comparison between Asian and Australian students[30]

5.5.3 Relationship between attitudinal factors and mode use frequency

The previous sections demonstrated significant differences in attitudes between Australian and Asian international students. However, RQ 3.1 asks whether differences in attitudes play a role in explaining differences in mode use between Asians and Australians. Therefore, the final step of this analysis involves combining the socio-demographic and attitudinal variables in multivariate logistic regression models predicting mode use frequency.

Due to the limited number of responses recorded, the analysis was performed for international students from developing Asian countries and compared to Australian students. Because attitudes and mode use change depending on how long an Asian student has been in Australia, student background was divided into Asians < 2 years in Australia, Asians 2+ years in Australia and native-born Australians.

As noted in Chapter 3, this analysis focused on non-university trips and modal use frequency was coded as either "frequent" or "infrequent". *Frequent users* of any given mode were defined as those who "always" or "mostly" used the respective modes, while *infrequent users* were defined as the other three categories on the scale ("never", "rarely" and "at times"). Separate models were developed to predict driving, public transport, walking or bicycling frequency.

Crucially, the logistic regression models were run in two steps. The base logistic regression models included only socio-demographic explanatory variables which are typically considered in research on immigrant travel behaviour. The second modelling step introduced three of the four attitude factors shown in Section 5.5.2, to test whether adding attitudes significantly improves the model fit. The overall goodness-of-fit summaries of the four regression analyses are presented in Table 5-7.

[30] retrieved from Shafi, R., A. Delbosc and G. Rose (2020). "Travel attitudes and mode use among Asian international students at an Australian university." Transportation Research Part D: Transport and Environment 80: 102259.

Table 5-7 Binary logistic regression models predicting mode use using attitudes: overall goodness of fit comparison

	Model Summary	Cox & Snell R^2	Nagelkerke R^2	Omnibus Tests of Model Coefficients		
				p-value	Chi-square	df
Driving frequency	Base model: Socio-demographic factors only	0.427	0.572	0.000*	182.270	9
	Extended model: Attitudinal factors added	0.442	0.592	0.039*	8.384	3
Public transport use frequency	Base model: Socio-demographic factors only	0.307	0.416	0.000*	119.719	9
	Extended model: Attitudinal factors added	0.32	0.433	0.104	6.154	3
Walking frequency	Base model: Socio-demographic factors only	0.146	0.215	0.000*	51.786	9
	Extended model: Attitudinal factors added	0.154	0.227	0.387	3.032	3
Cycling frequency	Base model: Socio-demographic factors only	0.071	0.171	0.004*	24.074	9
	Extended model: Attitudinal factors added	0.095	0.227	0.039*	8.372	3

* = statistically significant models
Shading = attitudinal factors add significantly to the model at p = 0.05 level

All four base models were statistically significant. The inclusion of the attitudinal variables produced relatively small but statistically significant improvements in model performance for driving and cycling modes. Although the R^2 values also increased in the public transport and walking models, these changes were not statistically significant. Overall, the model was able to correctly classify large proportions of infrequent users of any given mode, as Table 5-8 shows. Overall success rates were generally very high (between 75% and 100%).

Table 5-8 Binary Logistic regression models: classification tables

Observed outcomes	Predicted outcomes											
	Driving			Public Transport			Walking			Cycling		
	I	F	% correct	I	F	% correct	I	F	% correct	I	F	% correct
I	144	38	79.12	166	33	83.42	224	19	92.18	300	0	100.00
F	21	124	85.52	40	88	68.75	53	31	36.90	23	2	8.00
Overall %			81.96			77.68			77.98			92.92

I = infrequent users of particular mode
F = frequent users of particular mode

It should be noted, however, that the model could not successfully predict frequent active travellers (walking/ cycling); this is possibly due to the small number of active travel trips (as evidenced by Figure 5-6) and/or a lack of active travel-related variables in the model compared to driving or public transport. This is further evident when the sensitivity, specificity, false positive rate and false negative rate for each model (four models for four corresponding modes) is calculated (Wuensch 2014), as presented in Table 5-9. It can be seen that specificity (percentage of observed frequent users correctly predicted by the model) was quite low for walking and cycling, which is likely a result of the small proportion of participants who responded to using those modes.

Table 5-9 Sensitivity, specificity, false positive rate, false negative rates

		% for each mode			
		Driving	Public Transport	Walking	Cycling
Sensitivity of prediction	% of observed infrequent users correctly predicted	79.12	83.42	92.18	100.00
Specificity of prediction	% of observed frequent users correctly predicted	85.52	68.75	36.90	8.00
False positive rate	% of infrequent users incorrectly predicted	12.73	19.42	19.13	7.12
False negative rate	% of frequent users incorrectly predicted	23.46	27.27	38.00	0.00

Furthermore, it should also be noted that the default SPSS cut-off point of 0.5 was used to predict outcomes; this means that if the estimated probability is greater than 0.5, the outcome would be considered "frequent user". This can be changed to reflect better accuracy rates in Table 5-8, but the model was considered acceptable for the purpose of this study.

Table 5-10 presented below presents the significance and odd ratios (Exp(B)) of each variable analysed in this study (full results including standard errors can be found in Appendix A). The odds ratio is a quantity of association and shows the likelihood of change in the dependant variable with respect to a given independent variable, holding all other variables constant. Due to the data available, only associations could be explored; no conclusions could be made on the direction of causality.

The effects of the socio-economic and demographic variables are consistent with expectations; for example, having a car means one is significantly more likely to be a frequent car user, infrequent PT user and infrequent walker. The same can be said for having a driving license. In addition, if one is working, it means that he or she is 5x more likely to be a frequent car user even after controlling for car access. This could be a result of needing to travel longer distances or having greater purchasing power, but sufficient data was not collected to answer that. Age and gender only play a significant role in predicting frequent/infrequent cyclists – a female is 3.4 times less likely to be a frequent cyclist compared to a male. For age, the data suggests someone who is older can be up to 20% more likely to be a frequent cyclist.

Table 5-10 Binary logistic regression models summary including attitudes: frequent users of each mode relative to infrequent users[31]

Frequent group (Compared to infrequent group)	Driving		Public Transport		Walking		Cycling	
	Sig.	Exp (B)	Sig.	Exp (B)	Sig.	Exp (B)	Sig.	Exp (B)
Student background								
Born in Australia	0.417		0.010		0.091		0.899	
Asians living <2 years	0.774	1.155	0.003	3.488**	0.043	2.235*	0.647	1.366
Asians living >2 years	0.192	1.771	0.089	1.951	0.090	1.905	0.897	1.082
Demographics								
University degree enrolled in (Postgraduate compared to undergraduate)	0.652	0.785	0.605	0.786	0.381	1.453	0.138	0.354
Gender (Female compared to males)	0.067	1.900	0.175	1.511	0.635	0.869	0.028	0.298*
Age (Scale from younger to older)	0.541	1.040	0.372	0.947	0.646	0.974	0.035	1.186*
Car access	0.000	23.822**	0.000	0.124**	0.000	0.242**	0.145	0.414
Driving license (Yes compared to no)	0.000	9.579**	0.033	0.467*	0.777	1.107	0.300	2.466
Live on campus	0.326	0.504	0.231	1.831	0.845	0.916	0.821	0.838
Work (Yes compared to no)	0.000	4.966**	0.387	1.348	0.412	0.767	0.058	4.564
Attitudes								
Attitudinal Factor 1: Car ownership is desired (z-scores from negative to positive)	0.444	1.145	0.543	1.092	0.455	0.897	0.026	1.810*
Attitudinal Factor 2: Family prefers driving (z-scores from negative to positive)	0.017	1.515*	0.179	1.216	0.727	0.952	0.314	1.243
Attitudinal Factor 3: Perceived safety of non-car modes (z-scores from negative to positive)	0.165	1.251	0.049	0.754*	0.120	0.804	0.176	1.397
Constant	*0.000*	*0.003*	*0.165*	*5.389*	*0.649*	*0.588*	*0.033*	*0.021*

* = $p < 0.05$ ** = $p < 0.005$

Even when all other socio-demographic variables in this study are controlled for, some of the attitudinal factors play a significant role in predicting mode use frequency. Factor 2 (family prefers driving) is a significant predictor for car use frequency – one is 1.5 times more likely to be a frequent car user when his/her family prefers driving. Those who are frequent cyclists are also 1.8 times more likely to believe that car ownership is desirable. Those who perceive non-car modes to be safe are 25% less likely to be a frequent public transport user. However, this may be a proxy for those who substitute PT for cycling.

Finally, even after controlling for the attitudinal, socio-economic and demographic factors in this study, Asians living in Australia for less than 2 years are significantly more likely to use public transport and walk (3.5 times and 2.4 times respectively) compared to native-born Australians. Such cannot be said about Asians 2+. No such statistical relationship could be established for frequent driving and cycling users, meaning that the other variables in this study accounts for the travel differences arising due to country of birth.

[31] retrieved from Shafi, R., A. Delbosc and G. Rose (2020). "Travel attitudes and mode use among Asian international students at an Australian university." Transportation Research Part D: Transport and Environment 80: 102259.

5.6 Past travel habits

This section explores two research questions: RQ 2.2, how important are past travel habits in present-day mode use and RQ 1.2, how do long-term mobility choices differ?

To address RQ2.2, we compared high school travel habits of Asian (along with South Asian) international and Australian university students. For most Asian students, this would represent their travel patterns 'back home' during secondary school although some international students may have completed their high school in in Australia. However, given the Asian respondent pool were all defined as "international students" by their country of birth, and none of the Asian participants had both their parents born in Australia, this is unlikely.

5.6.1 Comparing past travel habits between Australian, Asian and South Asian students

Table 5-11 compares past travel habits between Australian, international Asian and international South Asian university students.

Despite the much lower average car ownership levels in developing Asian countries compared to Australia (as identified in Chapter 2: Literature Review), Table 5-11 shows that Asian students were quite dependent on cars from a young age. This is because most Asian (and South Asian) students came from car-owning households, not unlike the Australians who participated in this study. Public transport use was lower for school for international students for school trips, but higher for recreational trips (especially for South Asian students). Cycling was also higher for international students, especially for South Asians who cycled more during high school than Australian students for any given trip purpose.

Table 5-11 Past travel habits

		Australians	Asians	Difference[a] (Compared to Australians)	South Asians	Difference[a] (Compared to Australians)
Growing up in household with cars		*99.4%*	*87.7%*	-	*86.1%*	-
Past Travel Habits[b]						
School	Drive or Driven	2.73	3.09	0.36*	2.93	0.2
	Public Transport	2.87	2.13	- 0.74**	2.19	-0.68**
	Walking	1.76	2.01	0.25	2.18	0.42*
	Cycling	1.27	1.41	0.14	1.57	0.30*
Recreational activities	Drive or Driven	3.49	3.29	- 0.20	3.40	-0.09
	Public Transport	2.40	2.27	- 0.14	2.31	-0.09
	Walking	1.85	1.95	0.10	2.13	0.28*
	Cycling	1.33	1.52	0.19*	1.68	0.35*
Family outings	Drive or Driven	4.26	3.62	- 0.64**	3.64	-0.62**
	Public Transport	1.59	1.94	0.35**	2.00	0.41*
	Walking	1.64	1.58	- 0.05	1.76	0.14
	Cycling	1.17	1.35	0.18*	1.44	0.27*

a. Difference with independent samples t-test; Significance (2-tailed): * = $p < 0.05$ ** = $p < 0.005$
b. Scores recorded on a scale of 1 to 5, where 1 = Never and 5 = Always

5.6.2 Relationship between past travel habits and mode use frequency

The previous section showed some differences in past travel habits between Australian and Asian international students. RQ 2.2 asks whether these past habits are important in explaining differences in present-day mode use. To explore this question, another set of binary logistic regression models was run where the variables for attitudes were replaced with variables for past habit use for each mode. The average for each mode for all purposes was used as a variable, alongside a variable asking participants if they grew up in a household with cars. Table 5-12 and Table 5-13 present the findings of all eight models – four for each mode, and two sets for two groups of students defined by country of birth.

Table 5-12 Binary logistic regression predicting mode use using past travel habits: overall goodness-of-fit comparison

Mode	Group	Model Summary	Cox & Snell R^2	Nagelkerke R^2	Omnibus Tests of Model Coefficients			
					p-value		Chi-square (df)	
					block	model	block	model
Driving/ driven	Australian	Base: Socio-demographics	0.254	0.339	0.000	0.000	50.759(5)	59.774 (7)
		Extended: Past habits	0.292	0.390	0.011*		9.016 (2)	
	Asian	Base: Socio-demographics	0.488	0.672	0.000	0.000	103.174 (6)	109.221 (8)
		Extended: Past habits	0.508	0.699	0.049*		6.047 (2)	
Public Transport	Australian	Base: Socio-demographics	0.194	0.281	0.000	0.000	37.204 (5)	45.39 (7)
		Extended: Past habits	0.231	0.335	0.017*		8.188 (2)	
	Asian	Base: Socio-demographics	0.314	0.419	0.000	0.0000	58.099 (6)	63.044 (8)
		Extended: Past habits	0.336	0.448	0.084		4.945 (2)	
Walking	Australian	Base: Socio-demographics	0.082	0.144	0.011	0.001	14.864 (5)	25.581 (7)
		Extended: Past habits	0.137	0.241	0.005**		10.717 (2)	
	Asian	Base: Socio-demographics	0.140	0.191	0.001	0.000	23.217 (6)	32.569 (8)
		Extended: Past habits	0.191	0.260	0.009*		9.352 (2)	
Cycling	Australian	Base: Socio-demographics	0.053	0.157	0.095	0.029	9.368 (5)	15.649 (7)
		Extended: Past habits	0.086	0.258	0.043*		6.281 (2)	
	Asian	Base: Socio-demographics	0.079	0.162	0.051	0.002	12.556 (6)	24.696 (8)
		Extended: Past habits	0.150	0.306	0.002**		12.140 (2)	

* = past habits add significantly to the model at p = 0.05 level
** = past habits add significantly to the model at p = 0.005 level

Although the justification for running these models was similar to the models in Section 5.5.3, models were run separately for Asian and Australian students. This was done to ensure that

the model directly tested whether past habits influenced present-day behaviour for Asian students. It could be that past habits have little effect in the new environment of living in Australia for Asian students, while playing a greater role for Australian students who grew up in a similar environment to where they attend university, while for Asian students, habits were influential to only active modes of travel. University degree enrolment was also excluded from this iteration of the models as it was (a) not found to be significant in the previous models presented in Section 5.5.3 and (b) it isn't theoretically expected to be a strong predictor in understanding the link between past and present travel behaviour.

From Table 5-12, it can be seen that every model is statistically significant. The R^2 values are relatively robust (ranging from 0.241 to 0.699 for the final models) considering that many mode use predictors (such as network accessibility, cost and travel time) were not collected for this study. More notably for this study, adding past habits significantly improved the models at $p<0.05$ level (identified with * or ** in Table 5-12) for almost every model, with the only exception being Asians' use of public transport. This suggests that generally, even among international students, past travel behaviour is an important and significant predictor of present-day mode use frequency. The Exp(B) and Standard Error values for each model are presented in Table 5-13.

Table 5-13 Binary logistic regression models summary including past habits: frequent users of each mode relative to infrequent users

	Driving/ driven		**Public Transport**		**Walking**		**Cycling**	
Exp(B) value (Standard error)	Australians	Asians	Australians	Asians	Australians	Asians	Australians	Asians
Gender Female, compared to Male	1.37 (0.37)	1.06 (0.57)	1.06 (0.42)	3.26* (0.44)	1.42 (0.50)	0.92 (0.40)	0.66 (0.81)	0.22 (0.85)
Age Scale compares older to younger	0.98 (0.06)	1.29* (0.11)	0.91 (0.08)	0.90 (0.07)	1.08 (0.08)	0.98 (0.06)	1.22* (0.09)	0.91 (0.12)
Car access Yes, compared to No	18.64** (0.59)	63.10** (0.70)	0.11** (0.45)	0.08** (0.48)	0.19** (0.50)	0.22** (0.46)	0.60 (0.95)	0.73 (0.74)
Work Yes, compared to No	5.10** (0.58)	7.07** (0.66)	0.90 (0.59)	1.45 (0.45)	0.69 (67)	0.58 (0.40)	7.5E7 (7.7E3)	3.60 (0.83)
Live on-campus Yes, compared to No	1.03 (0.95)	0.93 (1.04)	1.50 (0.80)	1.50 (0.66)	0.00 (1.2E4)	1.66 (0.52)	5.27 (1.31)	1.16 (0.96)
Years lived in Australia Ordinal variable; compares long-term (2+ years) to short-term (<2 year) residents	-	0.98 (0.16)	-	0.91 (0.13)	-	0.85 (0.13)	-	0.67 (0.27)
Grow up in household with cars Yes, compared to No	0.00 (4.0E4)	0.24 (1.16)	0.00 (4.0E4)	0.24* (0.69)	0.00 (4.0E4)	0.39 (0.62)	1.02 (4.1E4)	2.45 (0.83)
Past travel habit of corresponding mode Scale compares more frequent to less	1.81* (0.22)	1.46 (0.21)	1.94* (0.245)	1.35 (0.20)	2.52** (0.29)	1.95** (0.23)	3.46* (0.48)	2.55** (0.31)
Constant	2.1E7 (4.0E4)	0.00** (2.72)	4.4E9 (4.0E4)	43.24* (1.79)	1.6E8 (4.0E4)	25.08 (1.73)	0.00 (4.3E4)	10.89 (3.04)

* = $p < 0.05$ ** = $p < 0.005$

Note: Standard errors shown in parentheses

*Past habits factors in **bold***

Here, it can be seen that the effects of typical socio-demographic factors behaved were as expected and in a similar manner to the models using attitudes (Table 5-10). Having car access meant participants were significantly more likely to be a car-user, and less likely to use public transport or active travel. Some factors were unique to one group or the other: for example, older Asian students were more likely to be car-dependent compared to younger Asians, while older Australian students were more likely to cycle compared to their younger counterparts. Gender only played a key role amongst Asians using public transport when other socio-demographic factors are controlled for. Living on-campus was not a significant predictor for any of the modes. It is not unexpected considering we were modelling for non-university trips and is consistent with the findings from the previous models (Table 5-10). Those working were more likely to be car-dependent compared to those not working, which could be either because (a) they work at a time or location where public transport access is poor and they have little option but to or (b) working grants them financial independence for car expenses.

It was previously presented in Figure 5-4 and Figure 5-5 that Asian students' mode use may be different depending on how long they lived in Australia, and this was confirmed in the regression model predicting mode use using attitudes (Table 5-10). Yet in this regression model, years lived in Australia did not significantly predict present-day mode use (Table 5-13). There are two likely explanations. One reason could be the exclusion of Australians in the same model and doing separate regression modelling for that cohort. The second could be that the combination of demographics *and* past habits are able to sufficiently explain the difference, as the latter in particular has been found to significantly improve the model fit.

Within the past travel habit block in Table 5-13, growing up in households with cars meant Asians were significantly less likely to be transit oriented. However, this variable did not have an effect for other modes, nor was it related to mode use among Australians.

Among Australian students, past travel habits play significant roles in whether students are frequent users of a particular mode at present. For example, those who cycled more during high school are more likely to be a frequent cyclist at present. Among Asian students, past habits only played a role in present-day use of active travel (walking and cycling). Past car and transit habits did not predict present use of cars or public transport.

5.7 Key findings from Chapter 5

In summary, there were several important findings that were uncovered through the analysis reported in this chapter. The findings have been restructured around the research questions (highlighted in Figure 5-2 earlier in the chapter) this chapter intended to answer and is outlined in Table 5-14 below, along with the key, relevant findings. In the next chapter (Chapter 6), we examine these issues more deeply drawing on qualitative data from a series of focus group sessions conducted with Australian and South Asian university students.

Table 5-14 Chapter 5: Research questions and findings

Research question	Key findings from Chapter 5
RQ 1.1: How does short-term travel behaviour differ?	South Asian students, especially recent arrivals, walked more than Australian students and drove less. Even when attitudes and demographics are accounted for, recently arrived Asian students walked and used public transport more than Australian students. In terms of mode use, the patterns of findings were similar to the VISTA or Census findings presented in Chapter 4.
RQ 1.2: How do long-term mobility choices differ?	International students are more likely to live near university, and less likely to have car access, partly due to not having family or a similar support system as Australian students do. They are also more likely to be dependent on parents for their education-related expenses, while Australian students are able to rely on their families for accommodation. As a result, international students tend to choose closer to university, while their Australian counterparts are more likely to live farther away.
RQ 2.1: What role do attitudes play in shaping travel behaviour?	Attitudes have been found to be significantly associated with mode choice for all students *despite* controlling for socio-demographic and economic variables such as car access or work status. There is a significant difference in attitudes between Australian and Asian students, as well as differences between recently arrived Asian students and longer-residing international students. Asian students generally have stronger pro-car views, while their views on active travel and public transport are generally negative.
RQ 2.2: How important are past travel habits in present day mode use?	There were similarities in the past travel habits of Asian and Australian students. Past travel habits have been found to be significant for Australian students for any given mode, and this has a profound effect on present travel mode use. For Asian students however, only past active travel was found to be significant, perhaps because of the vastly difference transport systems between South Asia and Australia.
RQ 3.1: How does mode use change over time?	This chapter suggests there *may be* some change to attitudes across years of residency in Australia amongst international students, although the findings are cross-sectional and not longitudinal. The analysis presented in this chapter suggests that recently arrived students are more likely to use active travel and less likely to drive compared to their counterparts who have been residing in Australia for a longer duration. The overall result is an increase in car-dependency amongst Asian (and South Asian) students as duration of stay increases, eventually reaching similar if not higher levels when compared to Australian university students.
RQ 3.2: How do attitudes towards travel modes change over time?	Attitudes vary across students who have resided in Australia for different periods of time. Recently arrived Asian students had stronger pro-car views compared to Australians, but it has been found that such views start resembling to that of Australian students as they live in the country for longer. Their views on public transport also become more negative over time.

6 Factors that influence mobility choices amongst university students

The thesis structure highlighting Chapter 6 and the research questions answered in this chapter are presented in Figure 6-1 and Figure 6-2 respectively.

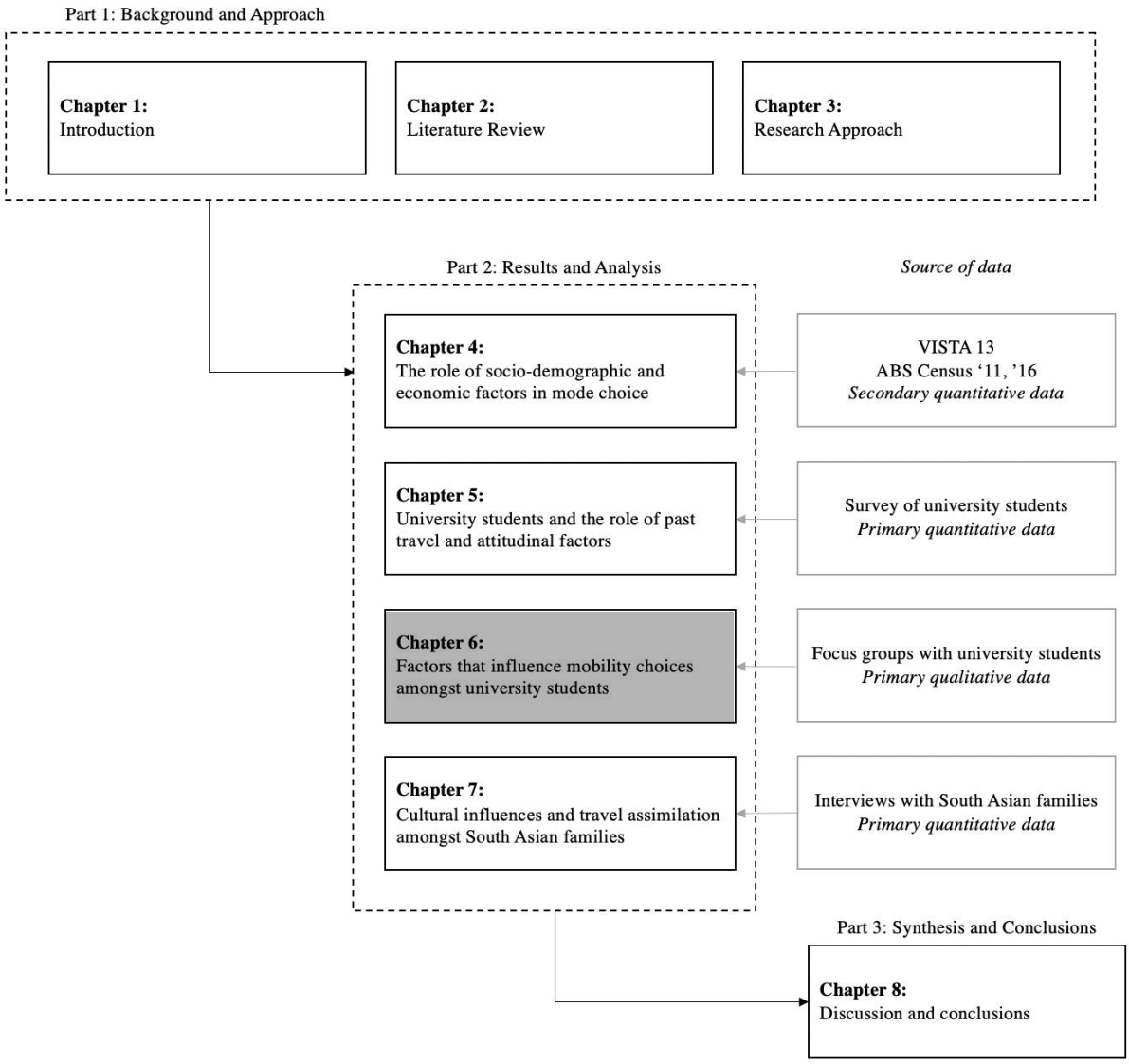


Figure 6-1 Position of Chapter 6 in thesis structure

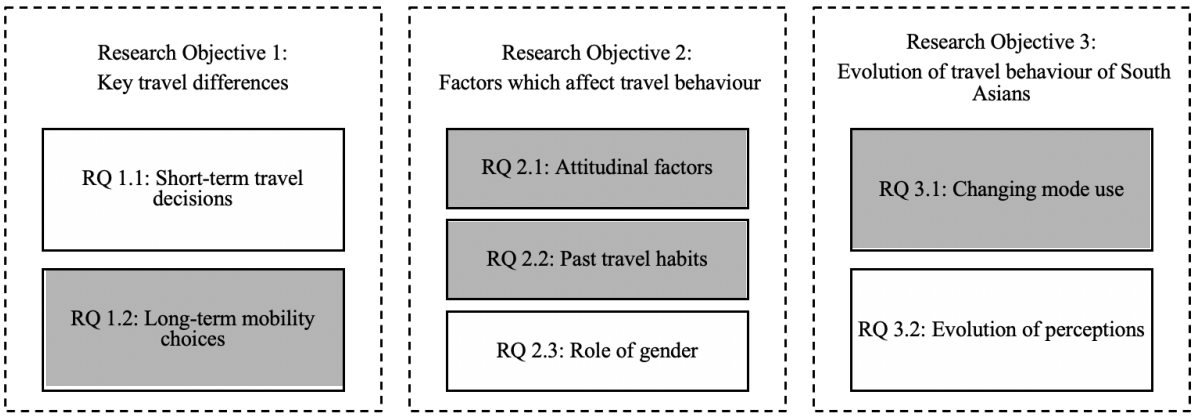


Figure 6-2 Research Questions: Chapter 6

6.1 Introduction

This chapter presents the findings of the fourth major task of this thesis, and the first that involved qualitative data collection and analysis. It presents the results of focus groups with domestic (Australian) and South Asian (international) students from Monash University. In Chapter 3: Research Approach, we discussed in-depth the motive behind doing focus groups in this particular approach.

The chapter begins with a brief overview of the research approach before describing the characteristics of the participating students. It then presents the key themes that arose from the focus groups, including a comparison of responses between Australian and South Asian students. The chapter finishes by summarising the findings relative to the research questions.

Papers presented at the 41st Australasian Transport Research Forum (ATRF) (Shafi, Delbosc et al. 2019) and the Transportation Research Board (TRB) 99th Annual Meeting (Shafi, Delbosc et al. 2020) drew on results presented in this chapter.

6.2 Overview of research approach

By the end of this chapter, we will have added further insight in response to the following research objectives and questions (see also Figure 6-2):

- Research Objective 1: Identify key travel behavioural differences between South Asians in Australia and native-born Australians
    - RQ 1.2: How do long-term mobility choices differ?
- Research Objective 2: Understand the factors which affect travel behaviour of South Asians and Australians
    - RQ 2.1: What role do attitudes play in shaping travel behaviour?
    - RQ 2.2: How important are past travel habits in present day mode use?
- Research Objective 3: Understand how South Asian immigrants' travel behaviour evolves during their time in Australia
    - RQ 3.1: How does mode use change over time?

The chapter workflow is presented in Figure 6-3. As discussed in Chapter 3: Research Approach, the focus groups sessions involved questions about university students' attitudes and mode perceptions, travel habits and intentions (past, present and future) and the perceptions of their friends and family toward various modes. A sample interview guide can be found in Appendix B1. The semi-structured nature of the questions meant that it was slightly modified between sessions and allowed time to probe into various latent factors raised by students that were not previously identified in our literature review or the earlier components of this study.

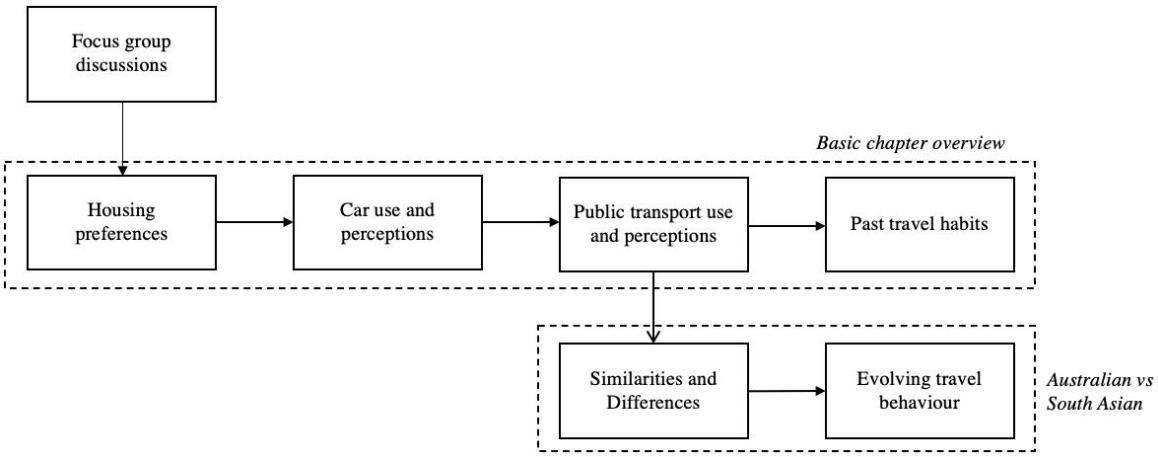


Figure 6-3 Chapter 6 workflow

Through the interviews we were able to gain a deeper understanding into the latent factors that influence travel and residential decisions amongst international South Asian university students and native-born students. While some of the findings confirmed (or re-iterated) what is stated in literature, there were some new insights as well – all of which will be presented in this chapter. We primarily relied on thematic analysis along with other qualitative techniques at different stages of the analysis, as described in Chapter 3: Research Approach.

6.3 Focus group participants

Table 6-1 presents a full breakdown of participants (16 South Asian and 13 Australian students) by their demographics. In total, 29 participants were recruited for the focus groups; 28 of them studied at the Clayton Campus, while one participant studied at the nearby Monash Caulfield campus (also in a suburban environment). Participants were initially recruited for follow-up discussions from the survey we distributed in Task 3. South Asian (registered as international students) or Australian-born students who completed the survey and gave their consent to be contacted for further research were invited to attend these focus groups. Initial invitations were met with low response rates, so further targeted recruitment was used through social media (student groups on Facebook) and snowballing techniques.

Table 6-1 Participant demographics

			Australia	**South Asia**
Type of Enrolment	Coursework Degree		12	12
	Research Degree		1	4
Primary Campus of Enrolment	Clayton (Middle Melbourne)		13	15
	Caulfield (Inner Melbourne)		-	1[d]
Gender	Male		8	10
	Female		5	6
Country of Birth of Parents	Both in Australia		8	0
	One/ both overseas		5	16
Years lived in Australia	Less than 2 years		N/A	10
	2 years or more			6
Location of Residence	On-campus		3	2
	Walking/ Cycling distance		0	9
	Driving/ transit distance		10	1
Car access (for driving)	Owns car		6	6
	Access to car(s)		2	2
	No car access		4	8
Financial Support from family	Tuition	Full	0	12
		Partial	0	0
		None/ Loan/ Scholarship	13	4
	Living Costs	Full	0	3
		Partial[a]	12	6
		None/ Loan/ Scholarship	1	7
Work	Yes[b]		12	13
	No		1	3
Driving Licence	Provisional/ Full License[c]		10	16
	Learner's permit		2	0
	None		1	0
Want to live in Australia after education	Yes		N/A	12
	Not Sure			4
	No			0
Total			*13*	*16*

a. Partial also if participant lives with parents rent-free

b. Excludes scholarships covering living costs

c. Includes overseas license

d. Used to study at Clayton campus; still lived near Clayton Campus at time of focus group

Enrolment was defined by whether the student was in a coursework or a research degree, as coursework students (undergraduate and postgraduate) pay considerable tuition fees whereas research students generally had scholarships. The Australian students mostly tended to live with family, often further away from university compared to the South Asian students. However, they were not supported financially by their parents for their education like the South Asians in this study, rather they were mostly using student loans. Most of the South Asians in this study stated they want to settle in Australia after their studies.

When using quotes from the transcriptions, we will identify the source with the naming convention Gender, Group (South Asian or Australian-Born). For example, a male student born in South Asia would be M – SA; a female student born in Australia would be F – AB. Figure 6-4 below illustrates the location of the two Monash campuses relative to the Melbourne CBD (or city centre).

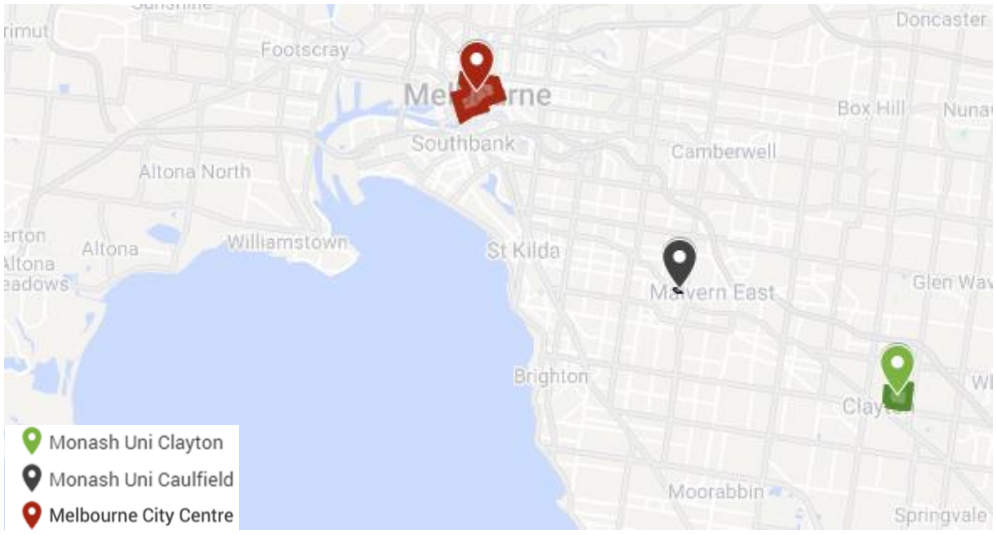


Figure 6-4 Map of Victoria with Melbourne city centre and the Monash University Clayton and Caulfield campuses

6.4 Theory underpinning research

Previously in Chapter 3: Research Approach, we outlined theoretical frameworks and qualitative analysis tools that were utilized throughout this thesis. The questions presented in the interview guide (Appendix B1) were inspired by the Theory of Planned Behaviour (TPB) (Ajzen 1991). That theory articulates the relationships between perceptions and travel behaviour.

Yet as the focus groups progressed and the transcripts were analysed, many themes emerged that were relevant to the hierarchical choice structure of mobility and travel, as shown in

Figure 6-5 (Salomon and Ben-Akiva 1983). All participants were university students; therefore "life-style choice" presented as Level I in the model is consistent amongst participants.

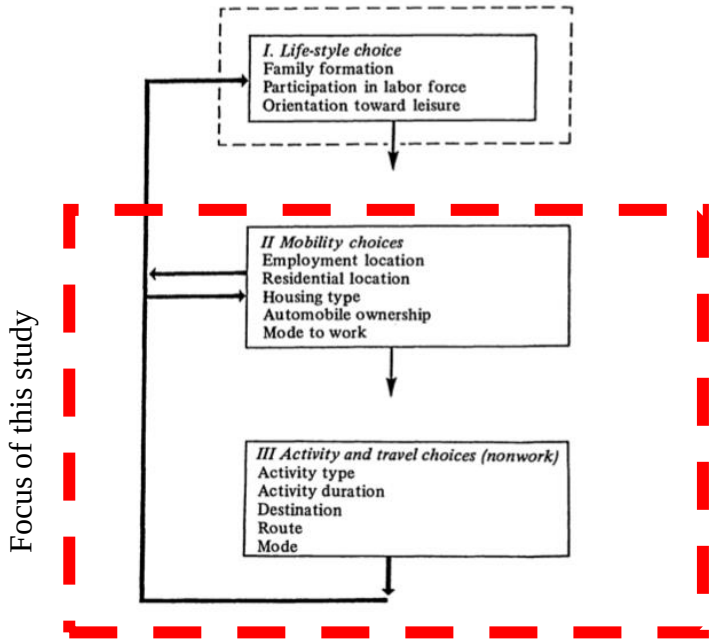


Figure 6-5 Hierarchical choice structure of mobility and travel (Salomon and Ben-Akiva 1983)

In contrast, Level II, mobility choices, varied amongst participants and will be discussed in the findings related to household location and car ownership. Level III, activity and travel choices picked up on the participants' attitudes and perceptions towards different travel modes. It was found through this study that a relationship between these two levels played a role in shaping the travel behaviour of participants of this study and is also likely to affect their mobility choices in the future.

The next four sections present the key findings of this study.

6.5 Key findings

The next four sections present the key themes that were identified out of the focus groups. They include discussions of where students choose to live (which sets the context for their travel behaviour), car ownership and use, attitudes to public transport and early childhood experiences of travel.

6.5.1 Housing Preferences

A lot of travel decisions were influenced by where participants lived and who they lived with. Australian students tended to live with their families until they find work or can live independently. South Asians were more likely to consider living with friends, relatives and near places of cultural significance.

Most Australians in this study lived with family or on-campus; they lived with family even if that was far away from campus.

> *"If I have to, then I will look for another place. But why would I want to pay rent? I live with my parents at the moment."*
>
> M – AB

The only reason to leave the family home was if home was "too far" (as described by a participant whose family lived a three-hour drive away). For these Australian students their philosophy was to more efficiently use their time and they would rather live where daily commuting becomes shorter - of those Australians who did move away from family while studying in university, many chose to live in on-campus accommodation (not unlike South Asian students).

Compared to Australians, there was a general agreement amongst South Asians that it is more important to stay near friends or family. When they first arrived in Australia, most South Asians started by living on or near campus because of unfamiliarity with their surroundings, before they moved to a place of their liking. This is a result of knowing a suburb better, forming friendships and social ties, or in some cases, seeking lower rent. According to the participants however, there were also former South Asian international students who kept living near the university campus after their studies due to their increased familiarity with the surroundings and the contacts established. Many of them were participants' friends, some even housemates.

Other changes in circumstances, such as buying a car, change in study location or finding new work, *did not* seem to influence those students to change their residential location, especially if they had friends nearby. In fact, the only participant studying at the Monash University Caulfield campus (Table 6-1) decided to continue living at Clayton campus despite his campus changing during his studies.

Some South Asians had friends or relatives living in Victoria prior to arriving; those participants chose to live with or near them. This resulted in longer commute times (upwards of 40 minutes' drive in some instances), often in suburbs where public transport is infrequent, and a car becomes a necessity to travel to university.

When asked about future residential preferences during the focus groups, *"not wanting to move"* was a common theme amongst South Asians. Those stating their willingness to move would do so because of friends or familiarity of another place (mainly because of cultural interests).

> *"I would prefer to live in the Western Suburbs [1hr+ away from current location]. I have plenty of relatives, and many people of my background live there."*
>
> M – SA

South Asians' reluctance to move away from friends and families often lead to greater car dependency. But this doesn't necessarily result in car ownership, as presented in the next section.

6.5.2 Car ownership, car use and carpooling

The literature suggested that South Asians viewed cars as a symbol of status and wealth. Yet when asked about whether participants thought of cars as a "social status symbol", the response was a resounding "no" across all discussion sessions. For the South Asians, this is likely a result of coming from high-income households where they were accustomed to car ownership. For the Australians, they did not face any social pressure to using cars when growing up or at present. As a result, both groups focussed on the utilitarian and convenience aspect of cars.

> *"It is really convenient, getting to university and back, doing chores, meeting friends. It's a lot of freedom"*
>
> M – AB

For the Australians, generally their parents bought or gave them a car because they tended to live some distance away from university campus where using public transport on a regular basis was difficult due to long commutes and service unreliability (issues explored further in the following section). Most of the participants living on-campus also owned cars, either to visit family regularly or for work. For the South Asians with a car in this study, the purchase was financed by a combination of savings through work and parental support.

However, car ownership did not necessarily translate into regular car use. Amongst the participants, Australian car owners and South Asian car owners use cars differently, with the former making a lower proportion of trips with cars than the latter. Australian car-owners still made trips by public transport (mostly train) to avoid driving long distances, and often relied on multi-modal travel (e.g. driving to the train station, then using public transport). The South Asian car owners, on the other hand, were mostly car dependant for their trips. *"Everything is done by car" (M-SA),* as they put it. The exceptions to this were those who lived within walking distance of the university or on those occasions where making trips into the city centre where driving a car would be a *"hassle" (M – SA)*.

All South Asians in the focus groups possessed a driver's license, even those who rarely drove in their home countries or here in Australia. They often relied on their friends driving them around or were equally comfortable driving their car when needed. This helped form a unique carsharing and carpooling culture amongst the South Asian students that was not evident amongst Australians. In fact, South Asians stated they *"prefer to have friends [with them]" (M – SA*) even when driving.

"I really don't use public transport even though I don't have a car. I use my friend's car. We live in the same house."

F – SA

Willingness to use a car over other modes was also quite high amongst the South Asians, including those not owning a car, despite the acknowledged higher cost of car ownership and use. Beyond convenience, South Asians felt carpooling (even with ridesharing services such as Uber) was cheaper than using public transport for short trips. Australians who didn't own cars, on the other hand, mostly relied on public transport. They rarely carpooled amongst friends and family. Only those who lived with their families had access to a car to drive. However, it was an option rarely chosen. Car-owning Australians were generally not comfortable giving their car to someone else, even amongst *"family and select friends" (M – AB)*.

As to why they used cars, it mostly came down to the shortcomings of public transport, as the following section examines in more detail.

6.5.3 Public transport: mostly problems that promote cars

All participants complained about the transit system's shortcomings in suburban Melbourne. In a suburban setting like Monash University (where accessing the campus requires a bus to connect to the train or tram network), public transport was regarding as having many limitations.

The one problem which directly resulted in car ownership and dependency were the typically long travelling times with public transport can be replaced with shorter drive. With long waiting time between transfers and infrequent services, most participants felt driving was the faster and more comfortable choice.

"I am pushing to get my license because when you try to get the train on Sunday, it's 40 minutes between trains."

F – AB

"In Australia, I am dependant on the public transport and if it is late by 30 minutes, I am late. I don't have a car now, but I am planning to buy one."

M – SA

On top of infrequent services, there are regular service interruptions, service delays and cancellations. For students, this resulted in being late or missing classes or work.

Beyond these common problems, there were other concerns raised which were exclusive to either group. Australians for example felt that public transport was less safe compared to cars. South Asians did not raise safety as a concern; rather, some thought it was safer when compared to South Asian standards.

"Trains are safer [compared to India]. After 6 o'clock, there are security officers."

F – SA

However, South Asians also felt that public transport in South Asia was better with respect to service frequency, especially late at night.

> *"It's 2 A.M. in the night, and I have to get medicine. In Australia, I have to call an Uber. Back home, I can still use public transport."*
>
> M – SA

Australians thought public transport services in Victoria was poor. Crowding is a common problem that makes using public transport, especially during peak hours, very difficult. Using public transport during the summer is also uncomfortable. South Asians, on the other hand, thought exactly the opposite: they thought the *"Facilities in public transport in Australia [are] good (M – SA)"*. They are also comfortable using public transport in the summer because *"the public transport is air-conditioned (M – SA)"*. Again, a lot of such comments would appear to be in comparison to South Asian standards. However, South Asians thought public transport can be quite expensive, especially over short trips (such as grocery shopping, recreational trips, etc.).

There were some commonly-discussed benefits of using public transport: good service going to and coming from the city where driving can be time-consuming, expensive and a *"hassle" (M – SA; M - AB)*. Melbourne's train network is a radial system catering to the city centre, which is also home to an extensive tram network. Consequently, transit was considered "a more convenient choice" when going to and from the city centre by both groups. But that is where, for South Asians, the discussion of benefits ended.

Australians, in contrast, tended to discuss a broader range of benefits to using public transport. They found public transport to be the cheaper alternative, especially over longer distances. Australians more often relied on multi-modal travel (driving to a train station, taking the train to university). Productivity is another reason why public transport was chosen – participants could do anything they wish when commuting. Public transport was also faster during peak hours, and had perceived environmental benefits, especially over cars.

> *"Looking objectively [at cars], it is bad for the environment, it's really expensive when you include fuel and insurance for your car. I personally don't see that many attractions in a car."*
>
> M – AB

South Asians did not make such claims and, assumedly, did not consider these as motivators for using public transport.

6.5.4 Growing up: early childhood and high school

Every Australian participant lived with their parents when growing up, and most still continued to do so. The same was the case for South Asians, with exceptions being undergraduate students who had to relocate for their university. Despite overall lower car-ownership rates (World Heritage Encyclopedia 2016) and lower incomes (United Nations Development Programme (UNDP) 2016) in South Asia compared to Australian, both groups' early childhoods were heavily car-dependant; trips to school and family trips to shopping and events were almost always by car. Among the South Asians, this is likely reflective the immigration system which only allows entry to Australia for those meeting skill, financial or educational requirements, and a privileged financial background relative to the 'average' resident of their home country.

However, travel behaviour differed once the two groups started attending high school (or equivalent). All participants (from both groups) in this study came from car-owning households; yet most of the Australians did not have a car available for them during high school or did not have their parents drive them. As a result, Australians had to adapt and learn to use other modes of travel. Public transport was their main mode of independent travel over longer distances; this was naturally accompanied with increased active travel. None of the Australians experienced any social stigma from using transit and were comfortable and familiar with transit from a relatively young age. In contrast, South Asians were still driven around through their high school back home.

6.5.4.1 Door-to-door services: a different definition of public transport

From a very young age through to high school, and continuing up until coming to Australia, South Asians commuted predominantly using door-to-door travel modes which often involved very little active travel. While most of the Australians were learning to travel without a car during their high school years, South Asians were still dependant on cars and other door-to-door modes thanks to their chauffeur-driven culture. This was generally true as long as they lived with their parents, which was in most cases. The only exception was if they had to re-locate to attend university (not unlike some of the Australians in this study), where they were still supported by families by being provided with cars or motorbikes, or at the very least, allowances for travel.

Furthermore, in their teenage years they avoided buses and trains because of the social stigma surrounding those choices, especially from family and friends. This also meant their past travel behaviour often involved very little active travel (walking and bicycling). However, when family cars were being used by other members of the household, they chose taxis or similar taxi-based services as discussed in the literature review. South Asian participants also commented on the differences in social stigma around public transport or cycling back home, and how they found some cultural cues in Australia interesting. For example, they found it interesting to see *"many office-going people cycling" (M – SA)*. Or put more bluntly:

> *"I have seen a lot of people [in Australia] using public transport going to work. Back in India, no."*
>
> M – SA

6.6 Comparing South Asian and Australian students

Several key concepts emerged from the focus group discussions. This section presents a summary of results.

Table 6-2 outlines a list of barriers and motivators to using public transport and cars (including carpooling/ carsharing). It can be seen that from this synthesis, Australians generally discussed a wider range of benefits *and* concerns than South Asians when discussing public transport. South Asians on the other hand, focussed more on the benefits of car use. They saw very few barriers to car use, and very few motivators for using public transport in Australia. They did discuss a few advantages of using public transport in Australia compared to South Asia (such as safety and better infrastructure); however, these could not be labelled as 'motivators' for South Asian students to use public transport over cars.

Table 6-2 Motivators and barriers of using public transport and car in Australia

Motivators for using public transport		**Motivators for using cars**	
Both groups • Easier than driving near CBD • Shorter travel times		*Both groups* • Unaffected by weather • Flexible route planning • Convenience and comfort	
Australians • Environmental benefits • Productivity • Cheaper	*South Asians* • None unique to South Asians	*Australians* • None unique to Australians	*South Asians* • Cheaper when travelling with multiple people
Barriers of using public transport		**Barriers of using cars**	
Both groups • Longer journey times • Safety • Service availability		*Both groups* • Cost of car ownership • Difficulty of driving in/ near CBD • Parking unavailability in/near CBD	
Australians • Lack of comfort • Service unreliability • Congestion on vehicles	*South Asians* • Cost over short trips	*Australians* • Not productive • Poor for the environment	*South Asians* • None unique to South Asians

Table 6-3 presents a summary of the findings from the previous sections (Sections 6.5.1 to 6.5.4), comparing the situation and preferences of the South Asian and Australian students in this study.

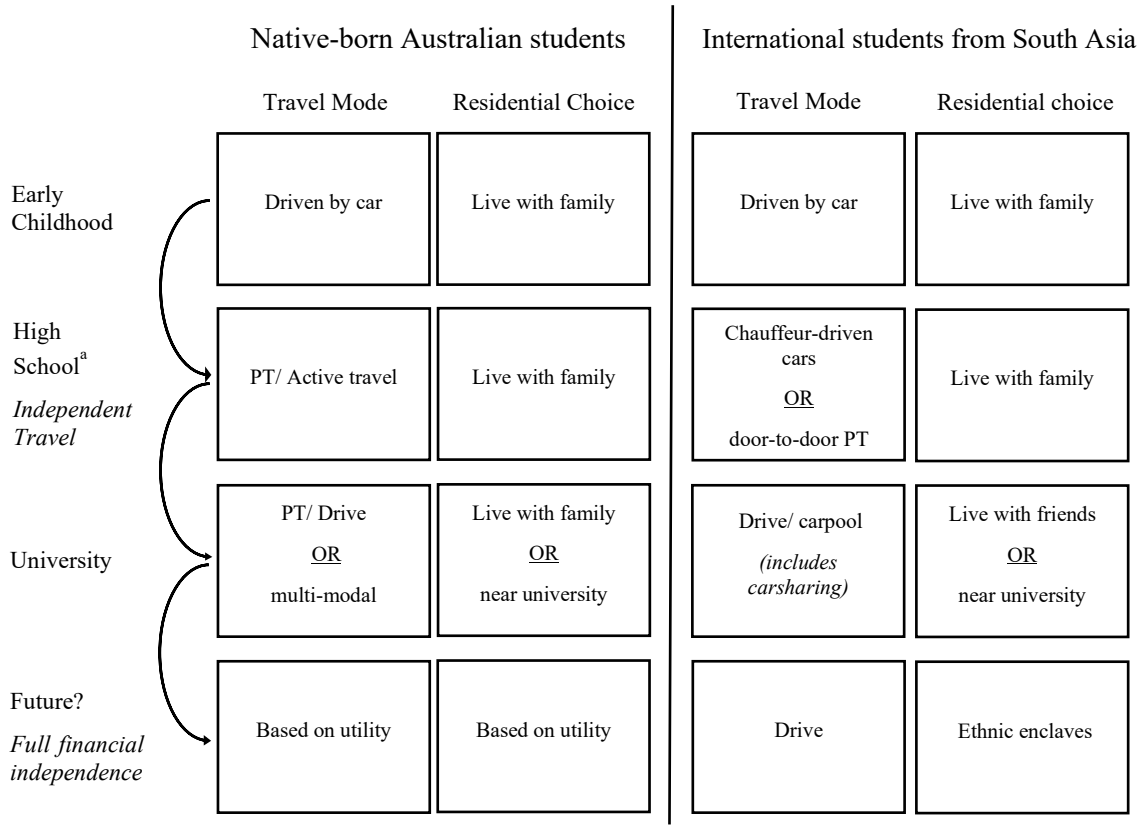
Table 6-3 Similarities and differences between South Asian and Australian university students

Theme	Similarities	Differences	
		South Asians	Australians
Past travel habits (childhood/ high school)	Travel during childhood (middle-school and earlier) was car-dependant; not too much freedom in choosing PT or other modes. Trips with families were almost exclusively by car.	High schoolers often got driven in cars (by chauffeurs) or used other modes of "public transport" such as rickshaws (three-wheeled taxis). Buses and trains rarely used.	Reach a stage in the teenage years when they can travel independently but cannot drive. Gave them experience in using public transport and active travel.
Housing preferences	Few similarities were evident.	Living near other members of their cultural group was a much stronger motivation, even if it meant longer travel	Often anchored to home at first, but after that they use a more diverse set of motivations (travel distance, work location); family connections less important
Car use and car ownership	Most convenient mode of travel. Not viewed as social status symbols.	Carpooling and carsharing very common amongst South Asians. There is also social pressure from friends and families back home that encourages car ownership.	Carpooling and carsharing very rare. No strong views from society or family car use.
Public Transport (PT) perceptions and use	Service is considered unreliable. Commuting times are quite long, especially in suburban areas. However, it is the best option when going to and from the city.	Infrastructure quality and comfort is good and safe. However, service frequency (in suburbs and at night) is poor compared to South Asian standards.	Uncomfortable, due to crowding and hot weather during summer. Personal safety concerns have been raised. However, there are environmental benefits to using PT and it allows some participants to be productive during commute.

South Asians had a low tolerance level to the shortcomings of transit services. They did not see many benefits associated with transit use and were not consciously considering the disadvantages of car-use (environmental impacts and cost for example). South Asians are introduced to car use in Australia even before owning one through carpooling and/or carsharing, and eventually some go on to car ownership. Some South Asian participants stated outright that they will own a car, regardless of other modes available. Some even said that their parents *"push" (F – SA)* them to buy a car.

> *"Even if it was the best public transport in the world, I would keep a car."*
>
> M – SA

This is neither because South Asians view cars as social symbols, nor because of the stigma surrounding transit (in Australia, at least). Rather, they saw cars as the most convenient mode of travel, and the only mode practical over long distances that offers door-to-door services. This is what they were used to back in South Asia (as shown in Figure 6-6), and unsurprisingly, this is what they still preferred. While the Australians had the opportunity to use transit when they started travelling independently, South Asians always had cars with chauffeurs, or cheap, readily available ridesharing services (like rickshaws or auto-rickshaws) to use. The South Asian participants in this study never needed to choose a mode of travel that involved walking or commuting alongside other passengers.



a. *Also includes those South Asians who undertook undergraduate courses in South Asia*

Figure 6-6 Evolution of travel habits and residential choices: Australians vs South Asians

It should be reiterated that South Asian participants in our study believed that transit has serious shortcomings and would have to improve if it were to be a competitive alternative to car use. As of now, the future, especially for South Asian students seeking to work here after their studies, looks very car-dependant, as illustrated in Figure 6-6.

South Asians preferred to live near friends and families, near their favourite stores or simply in a neighbourhood they liked or are familiar with, even if it meant sacrificing better transit and longer journey times. They have always lived with family and chose to live with friends (or near them) when they are in Australia since being with family was not an option. It would appear that this is a feeling they would carry into potential future relocations, leading to them moving to suburbs further away from the city so that they can be nearer to community members and places of cultural interest.

Australians lived, or wish to live, near their everyday destination like work or university. While this may result in living further away from family or friends in some instances, it is the most "convenient" day-to-day solution in terms of commuting.

6.7 Key findings from Chapter 6

In summary, these focus groups provided insights into the factors which affect the travel behaviour of South Asians and advanced understanding how South Asians' travel behaviour evolves during their time in Australia. Table 6-4 outlines the key findings relative to the four Research Questions this chapter addresses.

Table 6-4 Chapter 6: Research questions and findings

Research question	Key findings from Chapter 6
RQ 1.2: How do long-term mobility choices differ?	South Asians tend to live near university, or friends and community members. Australians on the other hand mainly lived with family; those choosing to move cited convenience factors and lived closer to university. Generally South Asian students had lower levels of car-ownership and had lower access to a car. Partly this is due to living independently unlike Australian students living with family, where the presence of family-owned vehicles is more likely.
RQ 2.1: What role do attitudes play in shaping travel behaviour?	Social status was not found to influence the travel choices amongst the South Asian international students in this study. Instead cars are seen as the more convenient, comfortable, and in most instances, quicker mode of travel. Many travel decisions made by students revolved around negative perceptions of public transport. In particular, South Asian international students didn't see as many advantages to using public transport as native-born students may do. As a result, South Asian students are often reliant on cars (drive, carpool, carsharing, even taxis), whereas Australian students are much more open to using various modes (including multi-modal travel) that suit their travel needs.
RQ 2.2: How important are past travel habits in present day mode use?	Past travel habits appeared to have some impact on present-day travel habits. South Asian students' overall lack of exposure to traditional public transport modes (bus, train, trams) and reliance on door-to-door services such as chauffeured-driven cars, rickshaws, taxis meant public transport in Australia does not meet their expectations. Active travel was also a rarity amongst these students at present, especially for non-university trips, as they didn't engage in this mode back in South Asia. For Australian students, travel independence (especially during high school) greatly shaped the fact that they are comfortable choosing between different modes.
RQ 3.2: How does mode use change over time?	All students tend to become more car-dependant over time. Frustrations surrounding public transport issues resulted in these participants buying a car or having clear motives to do so in the future. While Australian students may choose to live near their places of interest (e.g. work) for shorter and more reliable commuting, social contacts and cultural interests mean South Asians are willing to live further away from their places of interest, leading to even greater dependency on cars.

In the next chapter (Chapter 7), we further examine underlying factors influencing mobility choices by drawing on interviews conducted with South Asian families.

7 Cultural influences and travel assimilation amongst South Asian families

The thesis structure highlighting Chapter 7 and the research questions answered in this chapter are presented in Figure 7-1 and Figure 7-2 respectively.

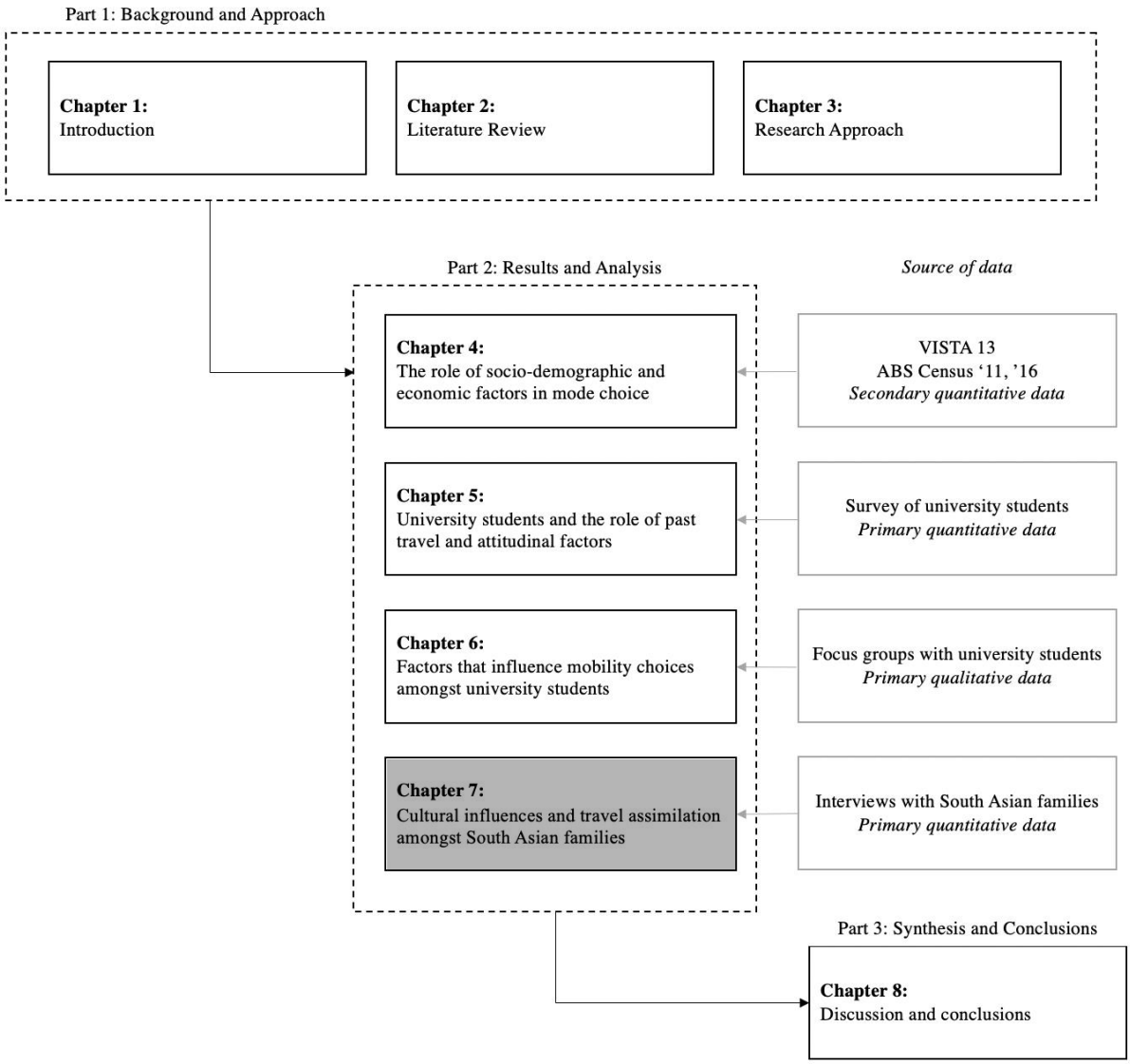


Figure 7-1 Position of Chapter 7 in thesis structure

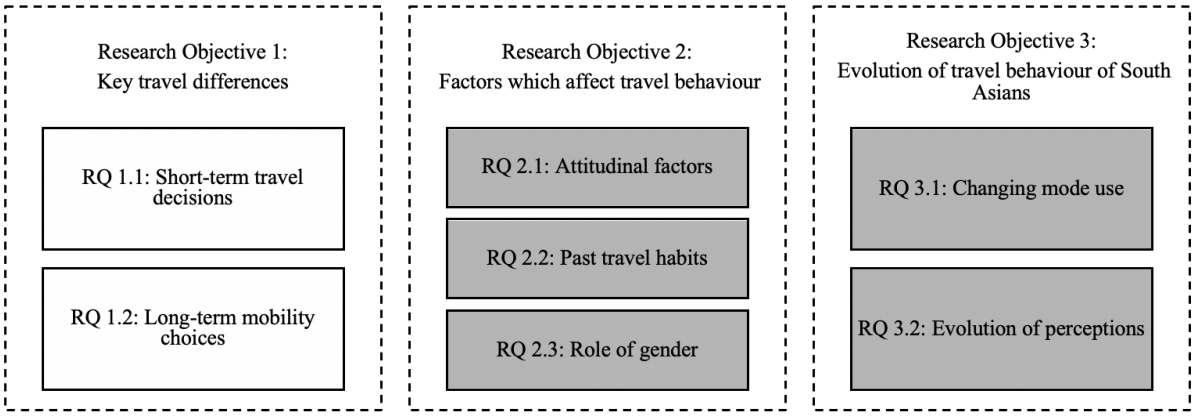


Figure 7-2 Research Questions: Chapter 7

7.1 Introduction

This chapter presents the findings of the fifth major task of this thesis, and the last that involves data collection and analysis. It presents the results of interviews with South Asian families living in Melbourne. In Chapter 3 (Research Approach), we discussed in-depth the interview approach and analysis method. This chapter focuses on the results of the analyses that were performed, relative to our research questions.

The chapter begins with a brief overview of the research approach before describing the characteristics of the participating households. It then presents the key themes that arose from the interviews. The chapter finishes by summarising the findings relative to the research questions.

7.2 Overview of research approach

By the end of this chapter, we will have touched on the following research objectives and questions (see also Figure 7-2):

- Research Objective 2: Understand the factors which affect travel behaviour of South Asians and Australians
    - RQ 2.1: What role do attitudes play in shaping travel behaviour?
    - RQ 2.2: How important are past travel habits in present day mode use?
    - RQ 2.3: How does gender influence travel behaviour?
- Research Objective 3: Understand how South Asian immigrants' travel behaviour evolves during their time in Australia
    - RQ 3.1: How does mode use change over time?
    - RQ 3.2: How do attitudes towards travel modes change over time?

The chapter workflow is presented in Figure 7-3 below:

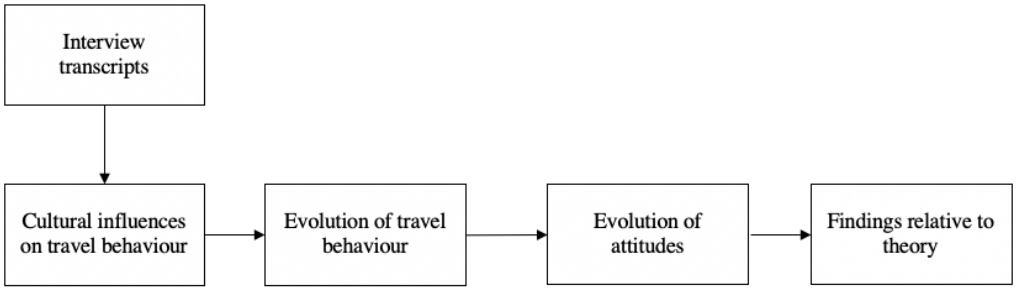


Figure 7-3 Chapter 7 workflow

As introduced in Chapter 3: Research Approach, the interviews were structured broadly into three key sections as listed below.

- Past travel habits and mobility choices
- Present day mobility choices
- Future travel habit intentions and evolution

The initial design was guided by theoretical frameworks – a lot of questions asked related to attitudes, social norms and perceived behavioural control, which are all constructs of the Theory of Planned Behaviour. However, questions were modified in between sessions; a sample discussion guide used for data collection is presented in Appendix B2. As discussed in Chapter 3: Research Approach, for this chapter we relied heavily on a phenomenological approach to guide the discussions – identifying phenomena (events) that influenced shifts in attitudes and/ or travel behaviour. Unlike Chapter 6, this analysis utilised a more inductive approach in formulating concepts and analysis. Beyond the transcript text, we also considered non-responses, attempts at redirecting questions, tone and body language.

7.3 Households and participants

Table 7-1 presents an overview of the participating household's characteristics. We interviewed 11 males and 9 females, representing 13 households altogether. Only the household head(s) ("father" and/or "mother") were interviewed, not the children in the household.

In all our households, participants arrived either on permanent visas (as skilled immigrants), or initially arrived as students before applying for permanent residency. The participants we recruited were all born and raised in South Asian countries, although some had the experience of living elsewhere prior to arriving in Australia (Column 3, "Country of Origin" on Table 7-1).

Table 7-1 Characteristics of participating households

Household #	Year of arrival to Australia	Country of Origin	Residency status during arrival[a]	Household structure	Cars in household	Australian Full License Holder	Participants in this interview[b]
1	2018	India (IN)	PR	3 2 adults; 1 child <18	1	M	M
2	2009 (M) 2017 (F)	Bangladesh (BD)	PR (M) Spouse (F)	3 2 adults; 1 child <18	1	M	M
3	2007 (M) 2019 (F)	India (IN)	Student (M) Spouse (F)	3 2 adults; 1 child <18	1	M	B
4	2007 (M) Post-2007[e.] (F)	India (IN)	Student (M) Spouse (F)	4 2 adults; 2 children <18	1	B	B
5	2007	India (IN) (arrived from Singapore)	PR	4 2 adults; 2 children ≥18	3	B	B
6	2006	Sri Lanka (SL)	Students	3 2 adults; 1 child <18	1	M	M
7	2005[d]	India (IN)	PR	3 1 adult, 2 children <18	1	F	F
8	2001 (M) 2005 (F)	Bangladesh (BD)	Student (M) Spouse (F)	4 2 adults, 2 children <18	2	B	B
9	2001	India (IN) (arrived from United Arab Emirates)	PR	4 2 adults; 2 children <18	2	B	M
10	2000	India (IN) (arrived from Kenya)	PR	4 2 adults; 2 children ≥18	2	B	B
11	1996 (M) 2006 (F)	Pakistan (PK) (previously resided in UK)	PR (M) Spouse (F)	4 2 adults; 2 children <18	2	B	B
12	1995	India (IN)	PR	3[c] 2 adults, 1 child ≥18	1	B	F
13	1992	Sri Lanka (SL)	PR	4 2 adults, 2 children ≥18	3	B	B

a. For families arriving as permanent residents (PR) together, the main applicant, male (M) of female (F) was not identified.
b. Participants in this household refer to whether the male (M) or female head (F), or both (B), of the household participated
c. Assuming household of 3 adults; living arrangement was unclear from conversation; husband often travels interstate for work
d. Arrived with partner from India, now separated and living in single-parent household
e. Arrived after male participant, exact year not recorded.

All participating households owned cars; all households except one (HH-7) were conjugal families (married couples with children). Although our qualitative analysis was designed to uncover themes and factors rather than ensuring representativeness, there was diversity within the existing dataset – it includes families of South Asian origin but arriving in Australia from non-South Asian countries (Singapore, Kenya, UAE, UK), one single-parent household, and a range of years when participants arrived (between 1992 and 2018). Figure 7-4 presents the location of all the participating households in Melbourne, with the Melbourne City Centre in the centre (red marker). It can be seen that the participants are from the southeast regions, or the west. As discussed in Chapter 4, these suburbs are home to a large proportion of South Asians.

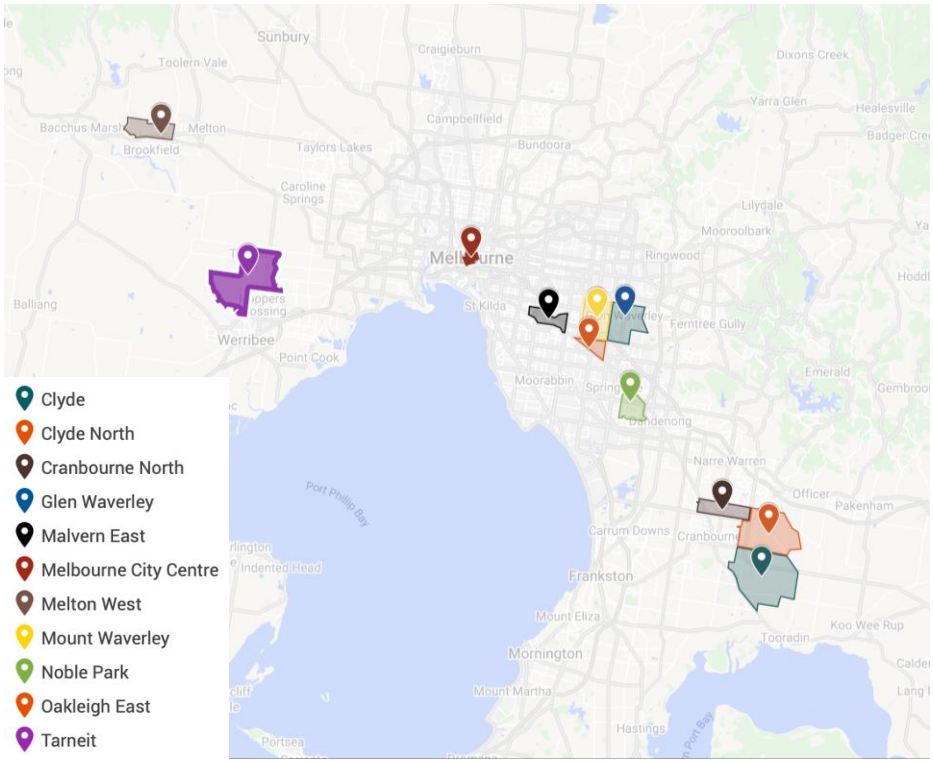


Figure 7-4 Location of participating households in Melbourne, Australia

When using quotes from our transcriptions, we will address the source with the naming convention HH-#, Gender, Country. For example, the male member of Household 11 from Pakistan would be written as HH-11, M, PK.

7.4 Impact of cultural influences and past experiences on mobility choices

While socioeconomics and demographics are commonly associated with short-term (trip choice and characteristics) and long-term (residential preferences) travel behaviour, the influence of culture is seldom considered in the context of travel behaviour in Australia. Our interviews allowed us to uncover new insights into the cultural influences on mobility choices.

7.4.1 Importance of proximity to friends and fellow community members

Because of the role that home-location plays in determining travel behaviour, we wanted to learn more about how households chose their home location. All participating households lived in detached, single-family homes; the general locations were shown in Figure 7-4.

In this study, all participants were either homeowners or outlined clear intentions to purchase a home in the future. Home ownership is considered very important mainly for financial and asset building purposes, an opinion which also resonated amongst non-owners.

> *"Owning a property is very important. Cause otherwise if you are in rent, that money whatever you pay, it's not going to be any productive anyways so the money you pay for rent, you will get nothing back after. But if you have a property even for a long mortgage, it's very reliable at the moment, it's very favourable"*
>
> HH-6, M, SL

A range of factors influenced the choice of home location. Most important to many households was the location and neighbourhood characteristics. For recently arrived immigrants, who generally tended to live further away from the city centre, they cited the importance of having friends and relatives nearby. One participant discussed how he chose a location *solely* based on his friends and fellow community members buying houses in the same area.

> *"Because of the community . . . there are a lot of Indians in this area, a lot of friends who are also buying in this particular area, so we just went with the majority with whatever everyone is doing."*
>
> HH-3, M, IN

Longer-residing immigrants on the other hand have a more ethnically diverse range of contacts (although still predominantly South Asian) compared to recent arrivals. This is partly due to the much smaller South Asian population when they first arrived.

Another very important consideration for older arrivals, particularly those with school or university-going children, was the proximity of educational facilities and healthcare.

The cost of housing was not brought up as an influencing factor. Public transport connectivity, (e.g. nearest bus stop or train station) or road connectivity (e.g. nearest freeway, distance to city centre) were also not raised by the participants.

7.4.2 The role of gender in employment, licensing and travel behaviour

We found that gender played a prominent role in the travel behaviour within a household. In general, we found that women worked less than their male partners. All the men worked full-time (or owned businesses which they were committed to on a full-time basis). Of the nine women we spoke to, two stayed at home and four worked part-time or casual hours; the rest were full time employees. This appeared to be because the women almost always assumed greater responsibility for their children's upbringing and education, and also maintaining contacts with other friends and families. These different household responsibilities influenced travel habit differences between men and women, as we address below.

Amongst the 13 women who were represented in the dataset, nine had full licenses, while three were on learner's permits. Secondary data analysis has highlighted how South Asian women tend to have lower licensing rates than South Asian men *and* native-born Australians. However, this didn't necessarily stop women from relying on cars. Carpooling is quite common, and multimodal trips generally include picking up from or dropping off at a train station. Women who could drive tended to drive shorter distances for work, often seeking employment closer to their place of residence as a result.

> *"I am working very close, like 4 km for me. My husband drives 40 minutes from my home to work. And my son is going, 45 km, it's very far."*
>
> HH-5, F, IN

Even those with full licenses generally shy away from driving on family trips, with the father or the adult child usually the one behind the steering wheel. The concept of 'males driving' stemmed from their childhood desire of owning and driving a car one day.

The differences outlined earlier could potentially be traced back to gender-based travel habit differences back in South Asia. All men, irrespective of coming from car-owning households in South Asia, could drive – a common cultural practice in South Asia. However, amongst the women, it was a different story; most of them never drove back in South Asia citing difficulties navigating through heavy traffic and availability suitable alternative modes (such as paratransit services, more in Section 7.4.3). As such, most women learnt how to drive, obtain a license and actually drive *after* coming to Australia. This meant that, compared to men, women took longer in getting their full licenses in Australia. Some women (at the time of the interviews) were still on their learner's permits despite living in Australia for years.

> *"I think it's easier to driver here [in Australia] rather than there [in South Asia], but still, like more road rules you need to follow here"*
>
> HH-7, F, IN

The 'fascination' of driving seemingly never appealed to women; only men, many of whom dreamed of car ownership and driving.

> *"Unofficially I learnt to drive my car when I was 16 because I always used to be fascinated [with driving]. I used to sit beside him [my friend(s)]and used to watch him drive like any young boy who wants to drive."*
>
> HH-3, M, IN

Beyond differences in past habit experiences by gender, there were no overt religious or cultural barrier preventing greater workforce participation or licensing that was apparent from our conversations. Nor were there any strong socio-demographic or economic factors behind this difference. The female participants spoke fluent English and were highly educated (in some cases, women were more qualified and were raised in wealthier households than their husbands). Perhaps passive, underlying cultural principals encouraged the female participants to focus more of their time on household responsibilities. This is perhaps beyond the scope of this thesis We did not probe further into gender-based mobility and employment as such questions made some participants uncomfortable.

7.4.3 Travel experiences in South Asia

There are major differences in the transport infrastructure and congestion between Australia and most large South Asian cities. The traditional definition of public transport in Melbourne, i.e. bus, train, tram, is often expanded in South Asian cities to include informal paratransit services such as rickshaws, minibuses and other small vehicles. Amongst non-car modes, informal public transport modes such as rickshaws and autorickshaws often preferred over traditional modes of public transport such as bus, train or tram. These modes offered the typical door-to-door convenience and travel times of taxis while being more affordable. They provide privacy, safety and autonomy in trip planning, similar to private vehicles. It should be noted that such modes do not exist in Australia.

> *". . . used to travel by sometimes with the buses and auto rickshaws. But obviously the bus is more like crowded so I try to use the autos."*
>
> HH-7, F, IN

> *"Obviously if you have your own vehicle, people will love it, but everybody can't afford it. So usually [I used] taxis, but these taxis are not like here. It's like tricycle but run by petrol."*
>
> HH-8, F, BD

The parents of the participants in this study, all still residing in South Asia at the time of the interviews, generally seemed to have little influence over their travel behaviour growing up, especially amongst the men. However, car owning households preferred travel by cars, and as a result, many participants were exposed to carpooling and carsharing growing up. In fact, non-car owners even occasionally drove their friends' or relatives' car(s) and relied on their family for car-based family trips. Discussions several families in particular suggested that there may be *prestige* or *social status* values tied to car ownership.

> *"I can sense that some people (in India) think that it's like a status symbol - to go in their own car or go in a certain car like luxury car than going in a bus or train."*
>
> HH-4, F, IN

> *"Everyone, including myself, wanted to have one [car], if not during that time [while growing up], but when we start working"*
>
> HH-9, M

There were some concerns about safety using public transport growing up, particularly amongst women. Motorcycles were quite popular for South Asians for independent motorised travel, with women in particular often being 'pushed' by parents to use scooters to travel to places.

> *"I think girls [referring to females] don't like to go on public transport, especially on night-time cause especially buses because it is not considered safe because of the crimes that have been happening in India. So, I mean personally I think it's not safe."*
> HH-3, F, IN

Other issues raised by participants which acted as barriers for them to use public transport or active travel modes included poor weather conditions, pollution and road space congestion. Women and children in particular were generally uncomfortable travelling on public transport or even active travelling in South Asian metropolitans according to some participants due to safety concerns and poor past experiences. Most participants were unable to ride a bicycle, and never learnt to do so in South Asia. This also meant that none of the adult participants could cycle at the time of the interview.

Travel experiences in South Asia also differed by the generation of immigrants arriving. Infrastructure in South Asia has been rapidly evolving, leading to attitudes and past habits 'evolving' as well. Older immigrants discussed how cars were a rare sight growing up – perhaps this is why they were revered and symbolised high status.

> *"Yeah, in our place, very few people had a car there – very small percentage, so mainly most of the people were using public transport. So we don't consider this [public transport] as anything bad or good, that's the only way to go for most of, more than 95 percent of the people use either bus or train. That's all we got, public transport."*
>
> HH-13, M, SL

At the same time, 'westernization' in South Asia seems to be speeding up immigrants' assimilation in Australia, leading to a change of perceptions, including mobility choices. While recent arrivals were less bothered about social status symbolism around cars than prior arrivals, there were also more determined to buy their own car because 'everyone else did'. A reason for that is potentially the higher socioeconomic conditions that recent arrivals are more likely to come from, and the rapid economic progress in South Asia.

7.4.4 Parental influence on children's travel habits and perceptions

We also wanted to explore if cultural influences were 'transferred over' to children. There were two parts to this – how the parents of participants influenced their travel decisions when they were younger, and how the participants themselves exercised an influence on their children. From the interviews, it was unclear whether the parents of adult participants played an important role in shaping travel behaviour in South Asia growing up. We also asked our participants about the travel behaviour of *their* children, all of whom were brought up in Australia and many were born here. Note that we did not interview these children directly, so this section reflects the parents' perspective on their children.

It would appear that participants' attitudes toward travel are not necessarily transferred over to the participants' children. While the parents (our participants) preferred cars for comfort, travel times and freedom, their children choose whatever is 'more convenient' (echoing the attitudes of Australian students expressed in Chapter 6). This also included occasionally preferring public transport over cars. This also extends to cycling; the inability to ride a bike and unwillingness to learn among parents did not seem to influence their children cycling.

> *"I don't know how to cycle. My son has learnt it."*
>
> HH-8, F, BD

It appears from our interviews that our participants had very little influence, if any, on the way their children interacted with and thought about the different travel modes in Australia. To some parents even, this was 'fascinating'.

> *"If I am going to work and they [children] are going to the uni [university] at the same time, I will offer them to drop them off at the uni, but they will prefer to use public transport rather than come with me. That kind of arrangement is fascinating"*
>
> HH-9, M, IN

Although not measured directly, this suggests that second-generation South Asians may have attitudes and travel behaviour that is quite similar to other Australians.

7.5 Carpooling and the assimilation towards car dependence

As discussed in Section 7.4, South Asians were highly dependent on cars for their habitual long-distance trips. All of the participating households owned cars, and were reliant on cars for making trips. This, in turn, was strongly influenced by underlying cultural principals and beliefs which guided their residential (Section 7.4.1) and travel choices (Section 7.4.2). During the interviews, it became clear this was not an instantaneous process from the moment they arrived in Australia, but rather one that developed over the duration of their residency in the country in a process commonly referred to as 'assimilation'. This also led to the said beliefs changing due to newly acquired travel experiences. This section explores the interplay between carpooling and car-driving that occurred in many of the households interviewed.

7.5.1 Dependence on interhousehold carpooling

Carpooling could be defined in at least two levels in our interviews – intrahousehold carpooling and interhousehold carpooling.

Intrahousehold carpooling is where carpooling occurs amongst members of the household (commonly referred to as family trips). This played an important role in the travel behaviour of households, especially among the women and children in the family. Continuing from Section 7.4.2, women are generally less willing to drive, usually drive shorter distances and take longer to acquire a full license. Children were unable to travel independently in most cases. As a result, they were being driven for family trips and sometimes even work trips, meaning they were dependant on car-based travel without actually driving.

> *"Yeah I have many times dropped [my wife] to work if she doesn't want to go by bus"*
>
> HH-6, M, SL

While intrahousehold carpooling is not unexpected and quite common across many families in Australia, there is also a high level of interhousehold carpooling – carpooling across families, households and within the community more broadly. Often this type of carpooling began very early upon their arrival in Australia. Most participants had someone (a friend, a contact, a fellow community member) who they could rely on to show them around the neighbourhood, teach them about the public transport system and drive them around.

> *"Mainly it was like . . . he [referring to a known contact] helped me initially just to go to some restaurants or to just buy some groceries and stuff for our house. And also, that time I didn't have a car with me, and also I didn't know how to get to the shops here so couple of times they helped me to do that."*
>
> HH-1, M, IN

This early stage is when South Asian immigrants were the most reliant on their peers helping them; this is also the period they are *least* likely to own their own car. This means that recently arrived South Asian immigrants are never completely independent of the car. When their economics permit them to do so, they purchase a car to continue this lifestyle, which results in more car dependency. Becoming car-dependent is a one-directional lifestyle choice amongst immigrants (as illustrated in Figure 7-5), which participants see as inevitable.

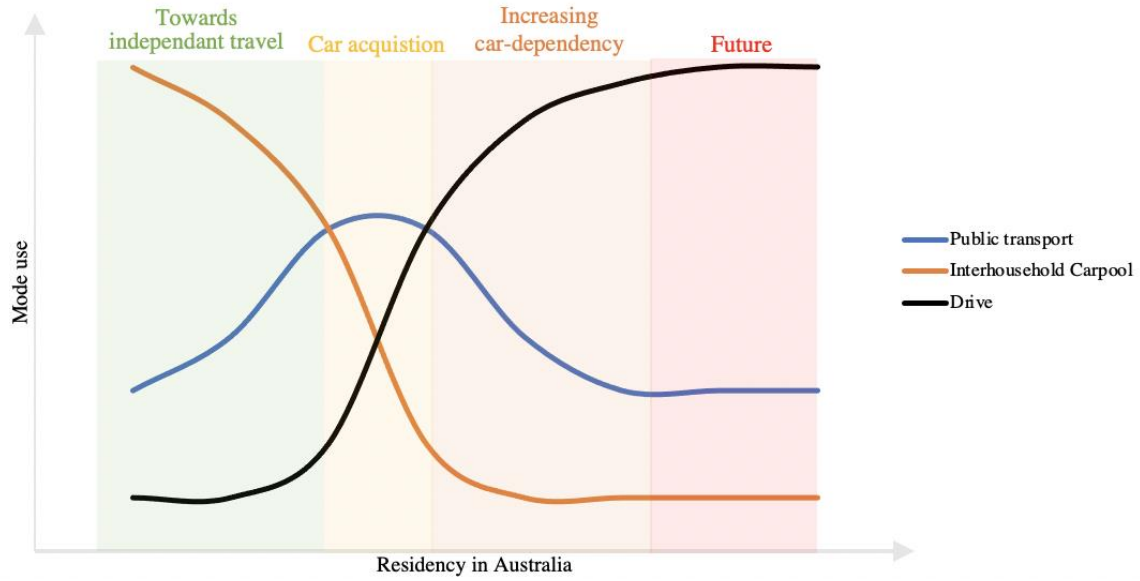


Figure 7-5 The evolution of mode use by South Asian immigrants in Australia at a household level[32]

It can be seen that initially, public transport use increases, while carpooling decreases – this is the time period immigrants are trying to learn how to navigate their environment and independently travel without the help of friends or family. This period also sees no driving because they don't yet own a car; they may be familiarizing themselves with road rules or in the process of obtaining a license. When they acquire a car, public transport use remains constant, while they are in the process of replacing carpool trips with trips by driving. From then onwards, public transport use decreases while car dependency increases. The small proportion of public transport trips are usually reserved for trips to the city, or for women who may not want to drive every day or need to commute longer distances.

7.5.2 Prior arrivals facilitating faster assimilation across generations

The pattern of carpooling and independent driving illustrated in Figure 7-5 plays out between households as new waves of immigrants arrive. Once one household establishes themselves and purchase one or more cars, they are then able to help new households that arrive from their country of origin. This reinforcing cycle is illustrated in Figure 7-6.

[32] These trends are indicative only and do not reflect quantitative measures. The figure highlights trends at a household level, not at an individual level.

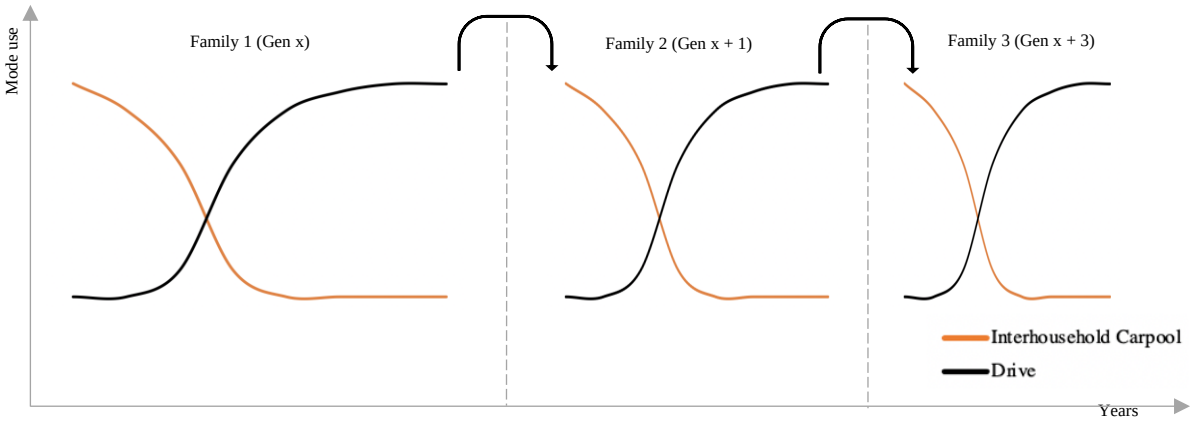


Figure 7-6 The cyclical process of evolution of mode use - adapted from Figure 7-5[33]

Note that these evolution cycles become more compressed as the years pass. Immigrants today seem to find it easier to adapt to car-dependent travel than those who arrived decades ago, and as a result generally tend to assimilate quicker. Women take less time to obtain a driver's license today than they did in the past, while households are also quicker to purchase their first vehicle. Although there are several plausible explanations for this, from the interviews it appears that South Asian immigrants today have a greater chance of making friends and community contacts due to the growing South Asian population. They make contacts faster, especially in the advent of technology and social media over the last two decades. These days it is becoming increasingly likely to have a friend or at least a contact in Australia *before* they arrive in Australia.

> *"[My friend] introduced me to one of her friends in Australia, Melbourne. I never saw them before but once I migrated here, they helped me lots. We stayed at their house five days."*
>
> HH-5, F, IN

This allows for car-dependency even before owning a car at a household level (in a manner similar to women depending on the rest of the family to use a car as outlined in Section 7.4.2). More importantly, on a macroscopic level, this means that reliance on cars actually initiates before owning a car thanks to every increasing community-network. The importance of this social network has been emphasised upon in research overseas as well (Blumenberg and Smart 2010, Blumenberg and Smart 2014).

[33] These trends are indicative only and do not reflect quantitative measures. The figure highlights broader trends at a household level, not at an individual level.

7.6 Attitudes and their evolution over time

Throughout our interviews, we noted some attitudes toward cars and public transport that were fairly common across different families. We also noted that similar to how mode use evolved over time (in Section 7.5), we believe there is also an evolution of perceptions and attitudes towards travel modes.

7.6.1 "Cars are affordable, public transport is expensive and unsafe"

Buying a car in Australia was considered 'cheap' according to the participants of this study. Participants did not face major economic hurdles to purchasing a car and considered car prices to be quite affordable compared to their countries of origin.

> *"Yeah, compared to [Sri Lanka and South Asian countries], they don't have much taxes on the car [in Australia]."*
>
> HH-6, M, SL

Maintenance and servicing of cars are also supposedly cheaper in Australia compared to South Asian perspectives. Some participants discussed how the poor road conditions in South Asia mean that cars have to be maintained properly and more frequently; Australia, on the other hand, has 'excellent roads', which lead to less wear and tear on the vehicle (HH-1, M, IN). The operational running costs, primarily fuel, are also believed to be lower in Australia by South Asian participants. While fuel prices are comparable, the travel times are comparatively lower in Australia despite longer travel distances. This is due to a lack of congestion on Australian roads when compared to South Asian roads (HH-2, M, BD).

Many of the running costs of cars - such as depreciation, parking fees, tolls, cleaning, tyres and other spare parts, servicing, accidents and infringements – were not considered when participants discussed the expense of cars. This is consistent with research that suggests that travel motivations are primarily affected by *perceptions* of costs and benefits, which do not necessarily reflect actual costs and benefits (Gatersleben 2014).

Overall, car ownership and cost perceptions that South Asians hold were in comparison to the conditions in South Asia. Combined with the higher earning potential in Australia (compared to South Asia), this means that cars were considered cheap and more affordable – especially compared to public transport.

In contrast, public transport was considered 'expensive' by many participants. Families usually made social, recreational or shopping trips together, and multiple people each paying for public transport for one trip can be considerably expensive. For the longer travel times, including long waits for trips within suburbs, there is no reason why these participants would 'pay more' for public transport, rather than driving together.

> *"I think public transport is going to be higher than to keep a car. If I use public transport all over the month, the money that I am going to pay for me, my wife and my kid, I think, it's going to be more costly than getting a car"*
>
> HH-6, M, SL

The only real exceptions to this belief are long-distance trips, particularly trips to the city centre. However, these public transport trips account for perhaps one round trip a day (e.g. for work), perhaps occasionally two. But going shopping, catching up with friends or families form the bulk of their weekly trips and they are made by car.

There were also concerns about safety on public transport. A male participant said that he felt public transport in Sri Lanka was safer because of the higher number of people who use those services later at night, and the presence of personnel throughout the day there.

> *"The public transport in Sri Lanka is great because there were buses all over the time, even in the evening, night-time as well. I would say safer [in Sri Lanka compared to Australia] even in the night-time because there were people around even till like 8-9 [P.M.]."*
>
> HH-6, M, SL

Another family raised concerns about encounters they had with drunk and unruly passengers, a sight they were unfamiliar with in Pakistan.

> *" . . . sometimes when we use the public transport in Australia, we come across a lot of drunk people catching public transport."*
>
> HH-11, M, PK

While not all participants explicitly discussed the 'unsafe' nature of using public transport, most participants did state that cars are a 'safer' mode of travel (compared to their country of origin) due to the compliant drivers, disciplined yet clear rules, and good conditions of the road.

Other concerns surrounding public transport included connectivity, travel times and interchanges (especially in suburban areas) and late-night service availability. Benefits related to environment or productivity were not raised by any of the participants

However, overall attitudes toward public transport, as with other modes of travel, change over their time in Australia. First impressions of public transport were generally positive but dropped off over time. This phenomenon, which we refer to as the 'honeymoon period,' will be discussed next.

7.6.2 The "honeymoon" period – initial euphoria of travel modes in Australia

In the realm of technology, a 'honeymoon period' is an informal term that refers to the initial euphoria of using a new device or a service, and typically can last for about four months before it wears off (Sparkes 2013). It is also a term often used in politics, referring to a period of heightened popularity that a new government or occupant of a post enjoys (McAllister 2003), or even casually when one starts a new job or starts at a new workplace (Adonis 2017). In the realm of transport planning and urban planning, this term is not commonly used (if at all). However, for the South Asian immigrants, there is no better description of their first impressions of Victoria's public transport and road conditions.

While discussing their initial impressions of infrastructure and services after arriving in Australia, participants reactions were quite positive. Public transport information was easily accessible through technology, services were 'always on time' (according to participants), services were clean and secure, and patronage was low – all big positives from their perspective.

This effect also extended to other modes of travel in Australia, such as driving, walking and cycling. Well-built infrastructure and drivers adhering to road rules was all impressive to the participants. This combined with the fact that their dream of car ownership can now finally be realised due to a perceived lack of economic barriers while in Australia meant that their views on car ownership in Australia initially are very positive.

The standard of walking and cycling facilities in Victoria was also higher compared to South Asian cities, with participants quite impressed with cycling lanes, pedestrian crossings and obedience to law of active travellers in the country.

> *" . . . prefer walking or cycling [in Australia] because you get footpaths and streets and everything. It's really hard back home because traffic, no footpaths and no proper roads."*
>
> HH-7, F, IN

It is important to understand, however, that these participants, when saying something is *good in Australia*, is almost exclusively in comparison to South Asian cities during this honeymoon period. Driving is easy compared to the conditions in South Asia; walking is safer than in South Asia; public transport is cleaner and less crowded.

However, this honeymoon period usually lasts for a limited period of time. Over time, they tend to make fewer comparisons between Australian and South Asian transport systems and instead compare driving, public transport or walking *within Australia.* This also tends to occur after they purchase their own car and are more able to compare the different modes. When this occurs, their attitudes change. These shifts are illustrated in Figure 7-7.

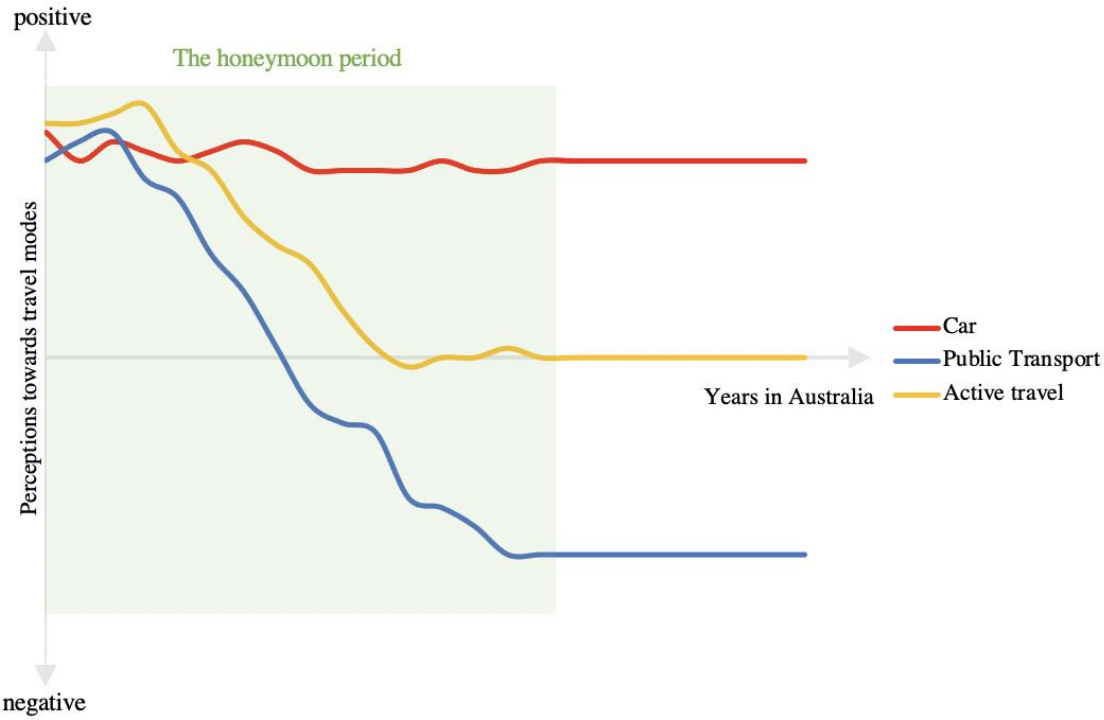


Figure 7-7 Mapping the evolution of travel mode perceptions for South Asian immigrants[34]

Public transport sees the largest change in attitudes, where positive perceptions turn negative overtime. Over time, rather than the comparisons being public transport in Victoria versus public transport in South Asia (which generally makes public transport in Australia look good at first), it evolves to public transport in Victoria versus using a car in Victoria. Cars have a lot of benefits compared to public transport which participants were happy to discuss; however, the benefits of public transport compared to cars were often overlooked. No value was placed on environmental benefits, health benefits, productivity benefits, or even cost savings.

> *"No I didn't see anything [speaking about environmental benefits of using public transport]"*
>
> HH-10, F, IN

Only two female participants discussed *having not to drive* as a benefit of using public transport. As a result, a heads-up comparison with car travel simply sheds poor light on public transport services in Victoria.

The same occurs for active travel – the initially positive view of active travel infrastructure (compared to South Asian standards) evolve where they view active travel as time consuming and impractical, for example it's too hard to carry groceries home (HH-12, F). However, their views towards active travel never quite become negative, rather they are more neutral. This is likely a result of active travel simply not being a practical choice for day-to-day trips such as work or shopping for most of these participants.

[34] These trends are indicative only and do not reflect quantitative measures.

For cars, the perceptions still remain positive, but the underlying reasons change – while initially it was because of excellent roads and ownership possibilities in Australia, over time it changes to benefits compared to public transport such as comfort, convenience, cost etc. At first, it was the realisation of fulfilling a plan to buy a car:

> *"It depends on the ability because who have their ability, they always stick to their own vehicle. People who can't buy, they have to have share the commercial or other private vehicles. Based on the you know, socioeconomic position, my family, you know at that time, we normally used the local transport. But we had a plan I would buy my own vehicle"*
>
> HH-2, M, BD

However, once ownership dreams are realised and people start becoming dependant on cars, it is it is very difficult to move away from cars, simply due to the convenience, comfort and time-saving benefits. It also becomes increasingly difficult to appreciate any potential benefits of public transport. In a way, the reasons why cars are revered by long-term residing residents are precisely the same reasons why public transport is simply looked down upon.

7.6.3 Attitude-behaviour interactions

The findings from these interviews suggest that attitudes and behaviour are interacting over time. The Theory of Planned Behaviour was presented earlier in Chapter 3: Research Approach (Figure 3-2). While the Theory of Planned Behaviour typically illustrates the relationship between attitudes, social norms, perceived behavioural control and behaviour as static, our findings suggest that these interactions are dynamic, at least among South Asian immigrants.

Not only do attitudes influence behaviour, but behaviour also influences attitudes as well. There is a wide range of research that supports this reciprocal relationship. For example, research has highlighted how attitudes towards travel change following residential relocation, the latter of which is actually influenced by attitudes in the first place (De Vos, Ettema et al. 2018). There is even evidence that behaviour has a much larger influence on attitudes than the other way around (Kroesen, Handy et al. 2017). Our findings in this chapter support both sets of findings.

For the participants of this study, it appeared that their beliefs and perceptions towards travel modes *in Australia* were at first greatly influenced by their beliefs and perceptions towards modes and activity *in South Asia*. Upon exposure to travel modes in Australia however, it seemed that those new experiences, or behaviour, caused a change in their attitudes. This in turned influenced behaviour again, and the process continued. This assimilation continues and the process ultimately terminates when there is a high level of car dependency.

This dynamic interaction is illustrated in Figure 7-8. Based on the interviews, it would be fair to assume that all three constructs of perceptions (attitude toward the behaviour, subjective norm and perceived behavioural control) played a role in travel choices in South Asia before arriving to Australia. Upon arriving in Australia, it becomes apparent that social norms no longer play a key role in guiding travel behaviour *in Australia*. Over time, as the participants became more comfortable with using any given mode (bar cycling as no participants knew how to cycle, or had any intention to learn), attitudes towards the travel mode plays the most crucial role. These attitudes end up becoming very pro-car and anti-transit

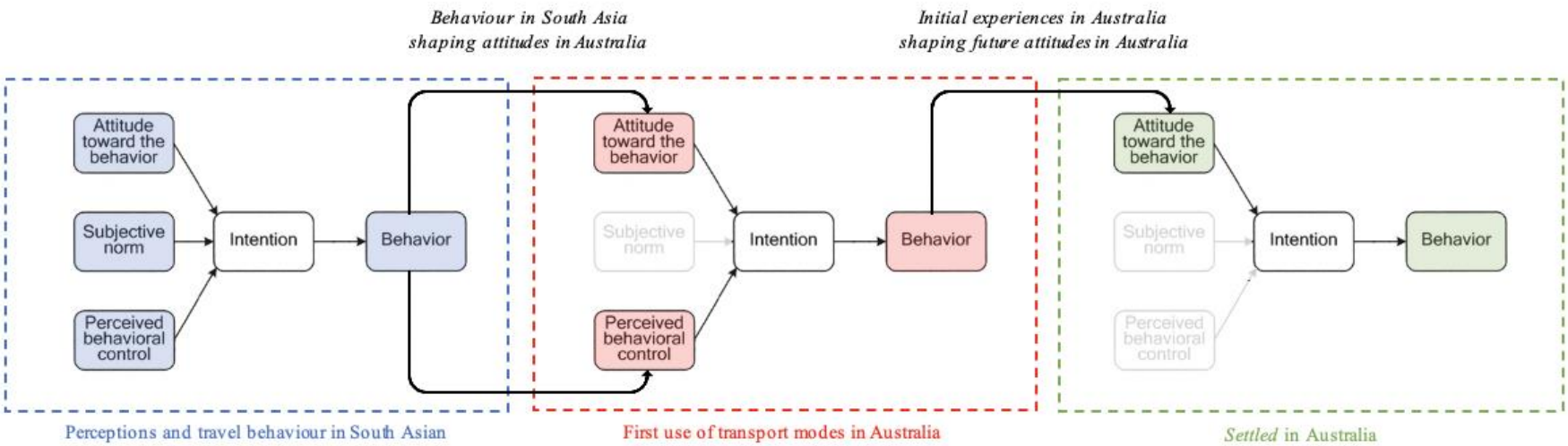


Figure 7-8 Evolution of attitudes and behaviour, and the dynamic interaction between the two. Diagram (Ajzen 2012) retrieved and modified.

7.7 Key findings from Chapter 7

Table 7-2 below summarises the key findings of this chapter, and how they relate to the research questions this task intended to address. These were outlined earlier in Figure 7-2.

Table 7-2 Chapter 7: Research questions and findings

Research question	Key findings from Chapter 7
RQ 2.1: What role do attitudinal factors play?	Cars were viewed very positively with regards to comfort, convenience and travel times. This played a key role in all participants having a stronger preference for cars in comparison to other modes of travel, which in turn translates to higher car use. In contrast participants had relatively negative perceptions towards public transport, which turn in turn, discourages public transport use.
RQ 2.2: How important are past travel habits in present day mode use?	Upbringing has a relatively weak role in shaping the preferences for these participants. Perhaps that is because many of the participants have been residing in Australia for decades, whereas this is a relatively stronger component for more recently arrived immigrants. However, generally they conform with South Asian social stigmas regarding active travel and public transport.
RQ 2.3: How does gender influence travel behaviour?	Women in this study were less likely to drive and more likely to rely on carpooling for longer-distance travel. They generally worked fewer hours and were more active in household responsibilities. Men are more likely to travel longer distances, are more likely to drive, and generally worked (and earned) more.
RQ 3.1: How does mode use change over time?	The families in our study generally arrived in Australia with the intention of car ownership and car dependency. Prior to car ownership, there were heightened levels of carpooling and public transport use. However, car acquisition resulted in drastically increased car use which also saw the fall of public transport and carpooling trips. Furthermore, this car use also facilitates carpooling and car dependency among the next wave of families, and this cycle repeats.
RQ 3.2: How do attitudes towards travel modes change over time?	Initial attitudes towards all modes are generally positive. This is primarily because these comparisons are often made with South Asian infrastructure, which, according to respondents, are of a lower standard than in Victoria. However, this 'honeymoon period' of positive feelings does not last. Over time, attitudes towards cars still remain positive, towards public transport becomes negative, and towards active travel remain large neutral (as it is a mode rarely used).

In the next (and last) chapter of this thesis, we synthesize the findings in this chapter, the previous chapters and our literature review to outline the research contributions of this thesis. We will also explore how the findings of this thesis addressed the research questions outlined at the start of the thesis, and what future researchers might consider if they wish to build upon the work presented in this thesis. Lastly, we will discuss policy suggestions addressed to policymakers and transport-planners, highlighting what they can take from the work discussed in this thesis.

PART 3
Synthesis and conclusions

8 Discussion and conclusions

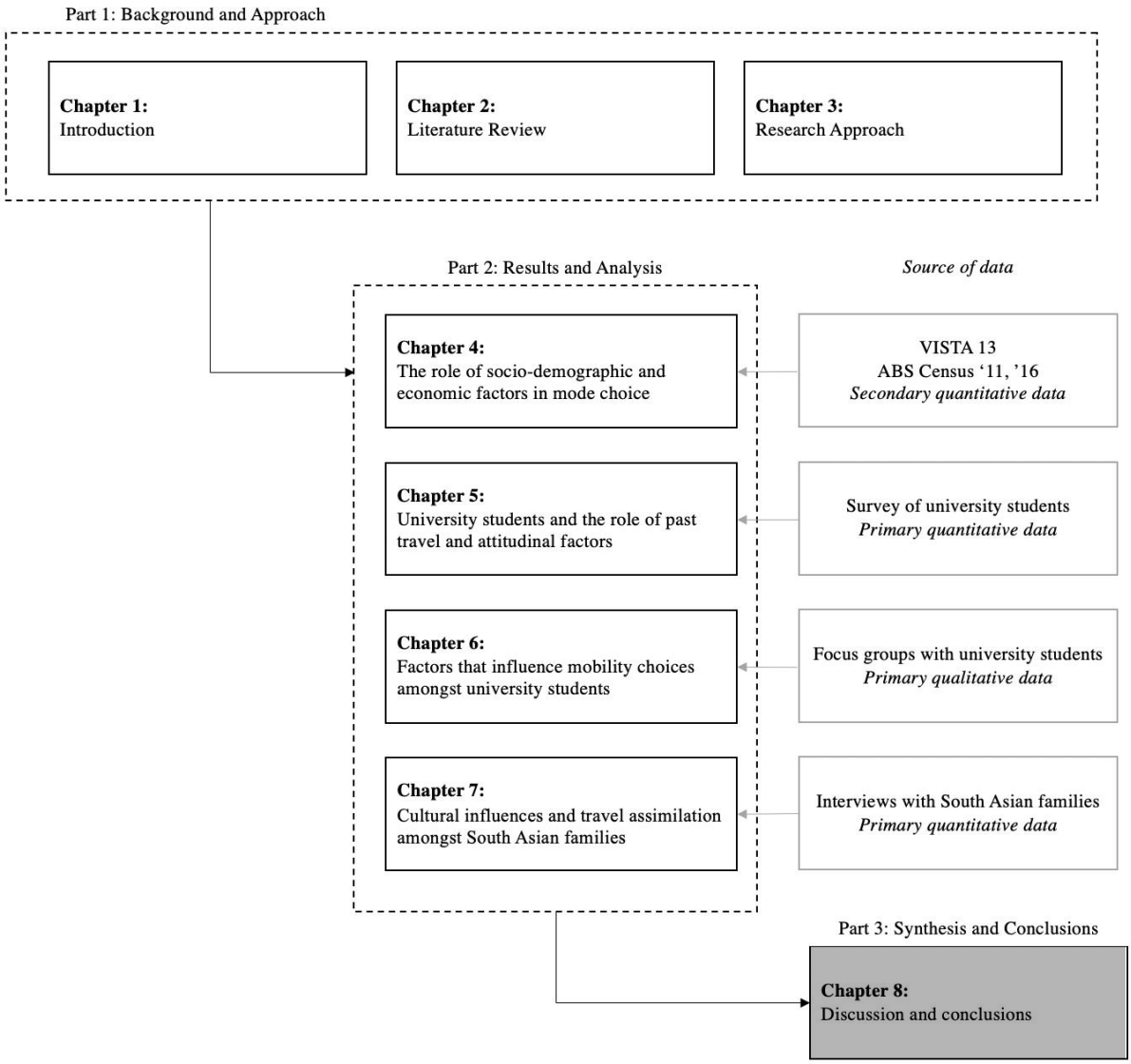


Figure 8-1 Position of Chapter 8 in thesis structure

8.1 Introduction

This thesis has addressed significant research gaps while providing valuable insights into travel behaviour in the context of South Asian immigrants in Australia. To summarise, we started with an extensive literature review (Chapter 2, Task 1), follow by four analytical chapters (Chapters 4-7, Tasks 2 to 5). In the last chapter (and task) of this thesis, we synthesise the key findings of the entire thesis in the context of our research questions to highlight new insights.

The research questions (as first presented in Chapter 3: Research Approach) are listed below:

- Research Objective 1: Identify key travel behavioural differences between South Asians in Australia and native-born Australians
    - RQ 1.1: How does short-term travel behaviour differ?
    - RQ 1.2: How do long-term mobility choices differ?
- Research Objective 2: Understand the factors which affect travel behaviour of South Asians and Australians
    - RQ 2.1: What role do attitudes play in shaping travel behaviour?
    - RQ 2.2: How important are past travel habits in present day mode use?
    - RQ 2.3: How does gender influence travel behaviour?
- Research Objective 3: Understand how South Asian immigrants' travel behaviour evolves during their time in Australia
    - RQ 3.1: How does mode use change over time?
    - RQ 3.2: How do attitudes towards travel modes change over time?

In this thesis these research questions were addressed using a variety of methods across several chapters. The next three sections of this chapter bring together the findings from Chapters 4 to 7 in order to address the research questions holistically. This is followed by a discussion of the limitations of our findings. The thesis concludes by identifying avenues of new research and policy considerations.

8.2 Research Objective 1: Identify key travel behavioural differences between South Asians in Australia and native-born Australians

The first research objective of this thesis was to identify the travel behaviour of South Asian immigrants in Australia and explore whether it differed from native-born Australians. We primarily addressed this objective in Chapters 4 and 5 with some insights from Chapter 6. The key findings by chapter are summarised in Table 8-1.

8.2.1 Research Question 1.1: How does short-term travel behaviour differ?

Based on the literature, we initially expected vastly different travel mode choices between South Asian immigrants and native-born Australians. While we did find some differences, they weren't as extreme as the literature perhaps initially suggested. Generally speaking, car-dependency was high while public transport and active travel were low for both groups.

However, demographics played an important role; while income levels were similar, South Asians lived in larger households and owned fewer cars than their native-born counterparts. There was a high level of carpooling amongst South Asians, especially amongst recent arrivals. Despite lower levels of car ownership, car use levels were relatively high amongst South Asians, as supported in both quantitative studies (Chapters 4 and 5) – however, there were fewer "car as driver" trips and more "car as passenger" trips amongst South Asians than Australians. Segregating the trips by gender, in both cohorts, women were less likely to drive than men, although the gap was much larger for South Asians. In fact, gender played an important role across all modes of travel amongst South Asians, which wasn't the case for Australians. For example, amongst South Asians women were more likely to rely on active travel and carpooling compared to men; this was not found within the Australian cohort.

This is consistent with many studies of immigrant travel. For example, the carpooling characteristics are very similar to research findings of low-income Latino immigrants in San Francisco (Barajas, Chatman et al. 2016). This was not necessarily expected because South Asian immigrants in Australia do not face the same economic barriers that Latino immigrants in America may potentially face. In our studies, South Asians tended to prefer carpooling over public transport, similar to previous findings from America (Blumenberg and Smart 2010). Given that South Asian immigrants to Australia do not face economic barriers to driving, this led to us exploring the potential role of soft factors such as past travel habits, perceptions and culture that might better explain these differences (further outlined in Section 8.3 of this chapter).

8.2.2 Research Question 1.2: How do long-term mobility choices differ?

Long-term mobility choices, such as car ownership and home location, differed significantly between South Asians and Australians. From Chapter 4, we established that overall, South Asians tend to live in larger households compared to native-born Australians. Upon further research, it was apparent that South Asians preferred to live near friends, family members or fellow community members. This often means they live in neighbourhoods with many other South Asians, which are often quite far away from the Melbourne city centre, and where availability of consistent and reliable public transport services is a bigger concern.

At a household level however, South Asians owned fewer cars than Australians despite eventually similar levels of car-based travel. Even South Asian university students were less likely to own a car and more likely to carpool compared to Australian students.

Chapters 5 and 6 identified a range of differences between Asian international and Australian students in their long-term mobility choices. International students were more financially dependent on their families, particularly for education-related expenses. They are also less likely to have access to a car, and more likely to live closer to university. This is quite different to native-born Australians, who were more likely to live with family and rely on them for accommodation.

There was also evidence that South Asian students were planning for a car-dependent lifestyle in the future. In the student survey of Chapter 5, most South Asians planned to 'settle' in Australia upon completion of their education (Chapter 5, Table 5-2). They also clearly outlined their intentions to purchase a car in Australia sometime in the future: 25% already had a car and about 50% of the students wanted to purchase a car in the future. These findings were mirrored in the focus groups of Chapter 6, where everyone wanted to remain in Australia upon the completion of their studies and everyone either possessed a car or intended to possess one in the future in Australia. Although the focus groups are not a representative sample, these initial findings were confirmed by interviews with longer-term residents in Chapter 7.

These findings are broadly consistent with prior research, and highlight behavioural traits amongst immigrants that facilitate the formation of ethnic enclaves, as found in previous research (Blumenberg and Smart 2010, Liu and Painter 2012, Chatman 2014). Although there is some evidence of concentrations of South Asians (shown in Chapter 4, Section 4.3.1), we didn't quite find neighbourhoods that were predominantly South Asian. However, the locations where South Asians settle are likely to have an important impact on the range of travel choices available to them.

Table 8-1 Summary of findings - Research Objective 1

Chapter	Research Questions	
	RQ 1.1: How does short-term travel behaviour differ?	RQ 1.2: How do long-term mobility choices differ?

Chapter 4 *Task 2: Secondary data analysis*	• Car use levels high amongst South Asians, but lower than Australians
	  ○ Includes lower driving and higher carpooling
	  ○ Driving trips higher amongst South Asian males compared to South Asian females
	  ○ High levels of carpooling amongst South Asian females
	• Public transport usage is higher amongst South Asians
	  ○ Especially for work-based trips
	• Active travel rarely used by South Asians or Australians
		• South Asians tend to live in larger households compared to Australians
		  ○ Vehicle ownership at household level is lower
		• Some evidence of the existence of ethnic enclaves amongst South Asian immigrants

Chapter 5 *Task 3: Survey of international students*	• Higher active travel amongst international students
	  ○ Especially higher amongst recent arrivals
	• Lower driving and car-based trips on average amongst international students
	  ○ Very low amongst recent arrivals, higher amongst longer residing international students
	• Public transport uses higher for international students
		• International students more likely to live near university compared to native-born students
		• Less likely to own a car (or have access to one)
		• Very few international students would like to leave Australia upon completion of their studies

Chapter 6 *Task 4: Focus group of South Asian students*	Not addressed in this chapter	• South Asians tend to live near university, or friends and community members. • South Asians international students less likely to own a car, but all stated intentions to purchase one in the future.

8.3 Research Objective 2: Understand the factors which affect travel behaviour of South Asians and Australians

The second research objective of this thesis was to explore the role of three key non-economic factors, attitudes, past travel habits and gender, in explaining travel behaviour amongst South Asians and Australians. We addressed this objective across all four analytical chapters (Chapters 4 to 7). The key findings are summarised in Table 8-2.

8.3.1 Research Question 2.1: What role do attitudes play in shaping travel behaviour?

Our literature review suggested that if economic factors were not the key factors explaining differences in travel behaviour, then attitudes are likely to play an important role. Indeed, many psychosocial factors that we hypothesized would be important in South Asian immigrants' travel behaviour in Australia (based on the literature review) were found to be influential.

In Chapter 5 for example, Asian students generally have strong pro-car views, while their views on active travel and public transport are generally negative. Australian students, on the other hand, don't have such strong views towards cars, and are more tolerant towards alternative modes of travel. More importantly, attitudes were significant in predicting mode use for all students even after controlling for socio-demographic and economic variables such as car access or work status. This suggests attitudes are an important predictor of travel behaviour amongst university students. This is consistent with the findings from a study among young adults in India (Verma, Manoj et al. 2016).

We conducted follow-up focus group studies with university students (presented in Chapter 6) and found that many of the travel decisions made by students are influenced by the negative perceptions of public transport. This suggests that the pro-car views found in Chapter 5 were a reflection of anti-transit views that were uncovered to a deeper extent in Chapter 6. In particular, South Asian international students don't see many of the advantages to using public transport as native-born students may do (such as environmental benefits or productivity on-the-go). As a result, South Asian students are often reliant on cars (drive, carpool, carsharing, even taxis), while Australian students are much more open to using various modes (including multi-modal travel) that suit their travel needs.

This pro-car vs anti-transit dilemma was further explored in interviews with South Asian families (Chapter 7). In these interviews, cars were considered convenient and public transport had a host of negatives attached to it. These attitudes changed depending on how long families had been in Australia, but this aspect will be discussed in Section 8.7.3 below.

There is one component of attitudes that did not play the significant role that we expected it would. Previous literature suggests that the car plays an important role in social status among South Asians in their home countries (Raza 2016) and amongst ethnic or immigrant communities in other countries (Handy, Blumenberg et al. 2008). In the survey of university students, we did find that South Asians were more likely than Australians to believe that owning a car meant someone was successful in life; however, the average rating of this question among South Asians was 'neither agree nor disagree'. In our focus groups in Chapter 6, we found that for South Asian and Australian students alike, cars are simply the more convenient, comfortable, and in most instances, quicker mode of travel. In the interviews with families, they acknowledged social status values of cars back in South Asia, but they were said to play little to no role in present-day travel behaviour in Australia.

8.3.2 Research Question 2.2: How important are past travel habits in present day mode use?

Past travel behaviour has been found to predict present travel behaviour in previous research (Ouellette and Wood 1998, Ajzen 2002, Muromachi 2017). However, the impact of past travel habits of immigrants prior to their arrival to a new country has rarely been explored in previous research. When people immigrate from a place with a very different transport system, their past habits may not impact their behaviour in a new country.

In our survey analyses from Chapter 5, we found that despite the supposedly stark differences between the transport systems in South Asia and Australia, the past travel habits of university students from Asian countries and Australia were similar in many ways. On average, both groups were quite car-dependent, with relatively lower use of public transport and active travel. Growing up in a household with cars was found to have a profound effect on university students' present travel mode use. For Australian students, past travel habits were a significant predictor of present mode use for all of the modes we studied. For Asian students however, only past active travel was found to be significant; past car use did not predict present car use. This is significant as it is one of the first pieces of evidence that immigrants may bring over *some* of their past travel habits to Australia despite the vastly difference transport systems.

In our follow-up focus group discussions presented in Chapter 6, past travel habits had little to moderate impact on present-day travel habits amongst South Asian students, confirming our findings from Chapter 5. South Asian students' overall lack of exposure to traditional public transport modes (bus, train, trams) in Asia and reliance on door-to-door services such as chauffeured-driven cars, rickshaws and taxis meant public transport in Australia did not adequately meet their expectations. Active travel was also a rarity amongst these students at present, especially for non-university trips, as they didn't often engage in this mode back in South Asia. In contrast, for Australian students, travel independence (especially during high school) greatly shaped the fact that they are more comfortable choosing any given mode.

In our final study with South Asian families (Chapter 7), we found upbringing to be a relatively weak component on shaping preferences for these participants. This is perhaps because many of the participants have been residing in Australia for decades, whereas this could be a relatively stronger component for more recently arrived immigrants (such as the international students in Chapter 6). While South Asian families generally acknowledged certain social stigmas around the use of public transport, they also claimed to be somewhat unaffected by such perceptions. Instead, their experiences in Australia helped shape their perceptions, which eventually leading to pro-car views.

8.3.3 Research Question 2.3: How does gender influence travel behaviour?

Chapters 4 and 7 helped explored this question in greater detail. In the secondary data analysis (presented in Chapter 4), we explored *if* gender influences travel behaviour and found some key differences between the genders. For example, South Asian women have lower licensing rates than their male counterparts (which was not the case amongst native-born Australians). Women from South Asia also relied more heavily on carpooling (trips made by car as a passenger), whereas the men made the largest proportion of their trips as a driver. While both South Asian men and women increase their car use to approach the levels of native-born Australians, women generally took longer to assimilate compared to men. A logistic regression analysis showed that even when sociodemographic and economic factors are accounted for, South Asian women were *still* less likely to drive, and more likely to make active travel, public transport and car passenger trips compared to males.

These findings were echoed in Chapter 7 amongst interviews with families. Women in that study were less likely to drive and more likely to rely on carpooling for longer-distance travel. They generally worked fewer hours compared to men and took a more active role in managing household responsibilities, caring for children and maintaining contact with fellow community members. In contrast, men were more likely to travel longer distances, more likely to drive, and generally worked (and earned) more, all while assuming fewer responsibilities around the house.

The reason for these differences was unclear, as generally the women in this study were highly educated and capable of working and driving more. Although further research is needed to confirm this, it may be underlying cultural beliefs and practices which contributed to these differences.

Table 8-2 Summary of findings - Research Objective 2

Chapter	Research Questions		
	RQ 2.1: What role do attitudes play in shaping travel behaviour?	RQ 2.2: How important are past travel habits in present day mode use?	RQ 2.3: How does gender influence travel behaviour?

Chapter 4 *Task 2: Secondary data analysis*	Not addressed in this chapter	Not addressed in this chapter	• Licensing rates similar across genders among Australians; amongst South Asians, men have higher licensing rates than women.
			  ○ Despite this, South Asian women have high car-based trips because of carpooling
			• Different trips characteristics between South Asian men and women.
			  ○ Not so much amongst Australian men/ women
			• Sociodemographic and economic conditions controlled for, women (compared to men) were still
			  ○ Less likely to drive
			  ○ More likely to use public transport
			  ○ More likely to make active travel trips

Chapter 5 *Task 3: Survey of international students*	• Attitudes have been found to be different amongst different cohorts
	  ○ Asian students are pro-car, while views on public transport and active travel are negative
	  ○ Australians have opposing views.
	• Differences also exist between recently arrived and longer residing Asian students
	• Attitudes are a significant predictor of mode use
		• Travel experiences between South Asian international students were similar
		  ○ This is despite vast sociodemographic and infrastructure differences between both regions
		• Modelling has shown
		  ○ Growing up in a household with cars plays a significant role in present-day travel behaviour
		  ○ Past travel habits significant for Australian students for any given mode
		  ○ Only significant for active travel amongst Asians
			Not addressed in this chapter

Chapter 6 *Task 4: Focus group of South Asian students*	• Cars viewed by both Asian and Australian students as the more convenient, comfortable and quicker mode of travel.
	• Travel decisions influenced by negative perceptions of public transport
	  ○ South Asians saw no benefits in public transport
	  ○ Australians complained about service reliability
		• Past habits had some impact on present-day travel habits
		• South Asians lacked exposure to traditional public transport
		  ○ Australians experienced 'real' independent travel in high school; first exposure to public transport
		• Relied on door-to-door services that do not exist in Australia
			Not addressed in this chapter

Chapter 7 *Task 5: Interviews with South Asian families*	• Social norms exist in South Asia
	  ○ Very few of the participants were affected
	• Cars viewed very positively
	  ○ Leads to higher car use
	• Public transport viewed poorly
	  ○ No benefits of public transport
	  ○ Reflected in low public transport trips
	• Attitudes evolve over time
	  ○ All modes viewed positively upon arrival
	  ○ Only views towards cars remained positive later
		• Past travel habits not so important amongst families
		  ○ Potentially due to most participants having resided in Australia for so long
		• Generally conforms to South Asian travel patterns
			• Women less likely to drive, more likely to carpool
			• Women worked less, travelled less for work
			  ○ Men on the other hand were more likely to travel longer distances and more likely to drive
			• Women had more household responsibilities
			• Reasons unknown, perhaps cultural values

8.4 Research Objective 3: Understand how South Asian immigrants' travel behaviour evolves during their time in Australia

The third and final research objective of this thesis was to understand how South Asian immigrants' travel behaviour evolved over the duration of their time in Australia. We addressed this objective using three research questions across Chapters 4 through 7. The key findings are summarised in Table 8-3.

8.4.1 Research Question 3.1: How does mode use change over time?

Chapters 4, 5 and 7 helped contribute to answering this research question.

In the secondary data analyses (Chapter 4), particularly the ABS Census analysis, there was clear evidence of travel behaviour assimilation. The commute mode of longer-residing South Asian immigrants more closely resembles native-born Australians' travel patterns (plotted in Chapter 4, Figure 4-12). However, even after 15 years of living in Australia, the mode choice for work trips for South Asians still don't fully match the mode choice among native-born Australians: car use is still lower and public transport use is higher among South Asians.

We found similar results in Chapter 5 among university students. Recently arrived students are more likely to use active travel and less likely to drive compared to their counterparts who have been residing in Australia for a longer duration. The overall result is an increase in car-dependency amongst Asian (and South Asian) students as duration of stay increases, eventually reaching similar if not higher levels when compared to Australian university students.

The interviews among families in Chapter 7 provided some of the richer insights into how travel behaviour changes over time. Initially, new arrivals relied somewhat on carpooling – not only intrahousehold carpooling (within members of a household), but also interhousehold carpooling (carpooling across households). However, increased familiarity and car purchasing resulted in drastically increased car use. This saw a decrease in use of both public transport and interhousehold carpooling trips. These 'settled' households were then able to use their cars to support more recent arrivals, providing them with the initial aid of interhousehold carpooling; and then the cycle repeats.

Generally, all relevant studies identified in the literature review agreed that there is some form of assimilation with regards to decreasing public transport use and increasing car-dependency (Chapter 2). The nature of the assimilation identified in this thesis is consistent with those findings, and we observed increased car-dependency and lower public transport use over the duration of residency of the participants. However, the literature on travel assimilation of immigrants is somewhat divided when it comes to the degree and rate of assimilation, as we had previously discussed in Chapter 2, Section 2.3.4. The immigrants in our research overall assimilated quite quickly, perhaps because their use of cars began even before owning a car (as discussed above). Travelling by car actually often began before owning a car (as illustrated in Chapter 7). Female immigrants were somewhat slower to assimilate than males, although it could be a result of lower licensing rates (Chapter 4) and the fact that many of the women interviewed did not know how to drive prior to arriving in Australia (Chapter 7).

It is also important to note that with the exception of some gender-based differences in this study, many of the 'barriers' to travel highlighted in other research on immigrants did not apply to the South Asian immigrants in our research. Previous research (generally in the United States) has presented a host of reasons which may explain why immigrants feel excluded from

using a particular mode. On the top of that list would be socioeconomics and financial capability – i.e., affording a car or having enough money to use public transport. There are also language barriers for some groups (Chung, Choi et al. 2014) and for others it may a steep learning curve before they are familiar with driving and/or using public transport (Chatman and Klein 2013). However, in this study, barring females lacking the experience of driving in South Asia in general (based on evidence from Chapters 6 and 7), the participants didn't discuss any such barriers. While strictly-enforced road rules can be discouraging and making driving difficult for immigrants (Chung, Choi et al. 2014), our participants suggested otherwise and stated that such rules made driving easier in Australia compared to their home countries. The fact that the amount of driving (especially amongst females) increased in Australia, and that our participants were more comfortable driving in Australia than South Asia, is in direct contradiction to research from New Jersey, USA, where Indian immigrants (habitual drivers back home) were uncomfortable with driving in a new environment (Chatman and Klein 2013). This could be a result of younger, more skilled South Asian immigrants making their way into Australia, or it could be attributed to the fact that both South Asia and Australia drive on the left side of the road whereas in the United States people drive on the right.

8.4.2 Research Question 3.2: How do attitudes towards travel modes change over time?

The last research question of this thesis was addressed across Chapters 5 to 7.

In our survey of international students in Chapter 5, we asked a range of attitude-based questions. We found out that attitudes, similar to travel behaviour, potentially changed over time. Recently arrived Asian students had stronger pro-car views compared to Australians. Longer-residing international students were found to have views resembling those of Australian students. This suggests that attitudes may actually change over time. Similarly, their views on public transport also become more negative over time.

This was explored further in Chapter 6 during our focus groups with university students to further unpack this finding. The South Asian participants in this study came from privileged backgrounds by South Asian economic standards, meaning they don't particularly care about social status and emotional attachments to cars even in their countries of origin. But the realisation of greater freedom associated with car ownership and use meant that they (and their families) prefer car use and aspire to car ownership in Australia. This transformation is also driven by inadequacies of public transport especially in suburban Melbourne, including longer travel times and service unreliability. To some extent, frustrations towards public transport build up over time, even amongst native-born Australians.

This finding was further reinforced in Chapter 7. Initial attitudes towards all modes are generally positive. Yet this 'honeymoon period' of positive feelings, as coined in Chapter 7, does not last. This is primarily because these initial attitudes are based on comparisons against South Asian infrastructure, which, according to respondents, is of a lower standard compared to Australia. This has been extensively addressed in South Asian literature, with frequent references to congested roads and unsafe public transport (Pucher, Korattyswaropam et al. 2005, Mahmud and Rabbani 2012). However, over time, the importance of transit service frequency and reliability supersedes Australia's 'superior' transit infrastructure, and this is where South Asian public transport with frequent and door-to-door services are considered better. Over time, attitudes towards cars still remain positive, whereas attitudes towards public transport become negative and attitudes towards active travel remain large neutral (as it is a mode rarely used).

At the time of this research, we were unable to find any literature that explored whether the attitudes of immigrants changed over time. While most research explored the evolution of mode use, the evolution was attributed to sociodemographic changes such as income or car ownership. However, our research indicates that it is possible that attitudes actually change which influences, and may even accelerate, this evolution.

Table 8-3 Summary of findings - Research Objective 3

	Research Questions	
Chapter	RQ 3.1: How does mode use change over time?	RQ 3.2: How do attitudes towards travel modes change over time?

Chapter 4 *Task 2: Secondary data analysis*	• Evidence of increasing car-dependency amongst South Asian immigrants in Australia.
	  o Longer-residing South Asian immigrants' travel habits resemble native-borns' travel patterns more than recently arrived immigrants.
	• After 15 years of living in Australia, the mode choice for work trips for South Asians still doesn't match native-borns`1.
	  o Car use is still lower, while public transport use is higher.
		Not addressed in this chapter

Chapter 5 *Task 3: Survey of international students*	• Recently arrived students travel differently to longer-residing students.
	  o More likely to use active travel, less likely to drive than Australian students
	• Higher car-dependency amongst Asian (and South Asian) students as duration of stay increases
	  o Eventually reaches similar mode-use levels to Australian students
		• Attitudes towards travel modes are different between newer arrivals and longer residing Asian students
		  o Recently arrived Asian students had stronger pro-car views (compared to Australians)
		  o Australian and longer-residing Asian students were more similar in attitudes
		  o Longer-residing Asian students have negative public transport views

Chapter 6 *Task 4: Focus group of South Asians students*	Not addressed in this chapter	• South Asian students unaffected by social status upon arrival • Attitudes towards cars become positive over time o Realisation of greater convenience • Public transport views become negative over time

Chapter 7 *Task 5: Interviews with South Asian families*	• High reliance on carpooling and public transport upon arrival
	• Car acquisition leads to increased car-based trips
	  o Lower public transport use, lower carpooling across households
	• Car acquisition for one family helps a newly arrived family carpool
	  o Repeating cycle that speeds up the assimilation process as more immigrants arrive
		• 'Honeymoon period' upon arrival when attitudes towards all modes are positive
		• Attitudes evolve over the duration of their stay
		  o Attitudes towards cars still remain positive
		  o Attitudes towards active travel remain neutral (rarely used mode)
		  o Attitudes towards public transport become negative due to poor travel experience and positives of car use.

8.5 Research limitations

The tasks undertaken in this thesis had several limitations, as outlined in this section. They revolve around survey/ questionnaire design, analysis and contextual limitations.

8.5.1 The definition of 'South Asians' and 'Australians'

This thesis focussed on South Asian immigrants; this very focus, however, has some limitations.

Unlike much of the research from the United States, we did not use 'ethnicity' to define South Asians in this thesis. For this thesis, we defined 'South Asian immigrants' using the variable country of birth, comparing them to Australian-born citizens. As such, 'South Asian' and 'Australian' participants were defined by them being born in South Asian and Australia respectively. This definition was chosen because the Australian census asks for country of birth and bases statistics on immigration using this variable.

However, theoretically, using this definition means a 'South Asian' might be someone born to an Australian couple in South Asia. While this is quite rare, it is still a possibility. Furthermore, an 'Australian' in this study might be a second-generation[35] South Asian immigrant who strongly identifies as South Asian. This approach means that our findings are mostly limited to first generation South Asia immigrants, and does not provide a full picture of the broader South Asian community. Indeed, our only (limited) insights on second-generation immigrants (in Chapter 7) were provided by immigrant parents reflecting on their children's attitudes. Talking directly to second-generation immigrants may have yielded different results. As the South Asian population in Australia grows, there will be more second-generation immigrants, necessitating further research.

Furthermore, when discussing cultural aspects in this thesis (such as the role of gender or the social status of cars), it is difficult to assess a particular nationality as one homogenous group. Not all South Asians are the same – someone from a large city (such as Delhi which has a working metro system) would not have the same perceptions as someone from smaller, rural cities such as Chandpur (Bangladesh) or Ratnapura (Sri Lanka). This has been highlighted in a study in China where aspirations of car ownership were greater amongst university students in a *smaller* city compared to those in a *larger* city (Zhu, Zhu et al. 2012).

Similarly, comparing South Asians to 'Australians' as a whole overlooks the great diversity within the Australian-born population. Some 21% of Australians have at least one parent born overseas (Australian Bureau of Statistics (ABS) 2017); they may identify strongly with the culture of their parent(s).

Perhaps accounting for ethnicity or country of birth of parents, or even immigrant status, would have led to a more accurate representative of the ethnicity in focus. For example, the National Household Travel Survey (NHTS) in the United States collects immigrant status. In Australia, the New South Wales Household Travel Survey (NSW HTS) asks country of birth as well as a few qualitative questions such as reasons for driving or using public transport to work. These approaches could guide other travel surveys into the future.

[35] Second-generation refers to person born in Australia with at least one parent born overseas.

8.5.2 Issues with measuring 'assimilation'

Studying travel behaviour assimilation is difficult when we do not have access to longitudinal data following the same cohort over time. Instead, we relied on triangulating findings across several pieces of analysis and the existing literature to infer our conclusions.

The fundamental concern with our approach is that our data were collected in a definite point in time. This approach was similar to many past studies of travel assimilation of immigrants; for example, Tal and Handy based their conclusions about assimilation on the year of arrival of immigrants, rather than survey the same immigrants over multiple years (Tal and Handy 2010).

The quantitative analyses in Chapters 4 and 5 used a similar approach. Chapter 4 compared the journey to work for South Asians based on year of arrival. Similarly, the survey distributed to students in Chapter 5 compared the attitudes and behaviours of international students who had recently arrived vs. students who had lived in Australia for several years. Although we infer that these differences represent 'change over time', it could be that different cohorts of South Asian arrivals have fundamentally different attitudes and behaviours that will not change. There are some external factors that could, hypothetically, contribute to this alternative explanation. This includes changes to the transport systems in South Asia and Australia over time; for example, improvements in transit in South Asia could increase the expectations of more recent arrivals. In addition, Australia keep increasing skill and education requirements for immigrants (especially in recent years), so more recent arrivals are likely to differ somewhat from past arrivals.

Triangulating these quantitative findings with the two qualitative studies, however, suggest that assimilation is indeed occurring among South Asians in Australia. Respondents were able to reflect on their own behaviour and attitudes soon after arrival and compare them to their attitudes and behaviour today. However, because these studies relied on participants' recall, there is always the possibility that they are not accurately recalling their past behaviour and attitudes.

Furthermore, although the two qualitative studies looked at different life stages (students vs. families), we cannot conclusively link the findings from the two studies. We do not know if a South Asian's travel behaviour as a student evolves to what we found in the family interviews, as most of the families arrived as skilled migrants and not students. Students who are able to settle in Australia may face a different set of life stage changes which in turn will influence their longer-term travel behaviour in Australia.

An alternative, albeit a more costly research approach with regards to finances and time, would be to collect data from the same group of participants across multiple years and see whether these changes actually occur over time. This will be discussed more in Section 8.6.3.

8.5.3 Limitations around questionnaire design and recruitment

The quantitative analyses used for in this thesis included univariate, bivariate and multivariate methods. However, because the data were cross-sectional, causality could only be inferred and not explicitly established. As a result, causalities were inferred based on literature and previous research. While a vast array of research was explored to make informed deductions on causalities, it is still based on assumptions that cannot be conclusively established.

The questionnaire used in Chapter 5 was intentionally designed to manage respondent burden and that limited how many questions could be asked. The concise survey captured key information, but based on feedback on the survey, many students felt even that 10-minute

survey was ‘too long’. In that concise survey format, mode use could not be captured using a traditional travel diary, and the scope of questions was necessarily limited. A traditional travel diary would have facilitated the collection of a more accurate and detailed travel patterns instead of relying on participants stating their “general” travel choices. It also meant that the survey did not capture some variables that may have improved model fit. Particularly for active travel, questions around possession of a bicycle or the quality of active travel infrastructure could have improved the modelling. However, the time and financial limitations of the PhD candidature meant that more sophisticated data collection methods were not utilised.

Furthermore, many of the attitudinal questions (particularly for the analysis presented in Chapter 5), were collected on a Likert scale. By definition, this assumes that the strength of an attitude is linear (i.e., the difference between agree and neutral is similar to the difference between neutral and disagree). In reality, however, attitude scales can be non-linear, and this is something that was not tested in our analysis. Furthermore, the validity of some responses may be questionable due to social desirability, e.g., participants may not be fully open about some of the attitudinal questions in the survey – this is very similar to some of the limitations highlighted in qualitative research.

The purposive sampling methodology utilised during recruitment also meant that the sample was non-random, and results are likely to be biased (Etikan, Musa et al. 2016). Again, this is less of problem with qualitative research where the aim was to uncover themes and factors that influenced travel behaviour. For the survey amongst students however, this can be an issue. But nevertheless, it is important that this is acknowledged so that future researchers building on our work can be cautious about the transferability of our findings (discussed in more depth in Section 8.5.4).

The number of respondents for the university questionnaire was relatively modest; in particular it was difficult to recruit greater numbers of South Asian students which is why we chose to conduct some analyses on the broader Asian student population (in Chapter 5). While there are many similarities between South Asian students and Asian students more broadly (noting that the former is actually a subpopulation of the latter), it doesn’t change the fact that we had to deviate from our initial plans to accommodate for the lack of data. The accuracy of the regression models’ predictions would have also improved if we were working with a larger dataset.

The primary research tasks were undertaken in metropolitan Melbourne, and most of the participants lived in the suburbs. While the suburban setting is fairly typical of where the majority of Australia’s population lives, a similar study undertaken in a more inner-city area, where sustainable transport options are more readily available, could have yielded different results. Potentially, we could have seen increased use of public transport and active travel, and less use of cars.

Lastly, the global pandemic and COVID-19 outbreak in Melbourne where the researchers were located also affected data collection (notably the family interviews in Chapter 7). After stay-at-home orders were imposed in Melbourne in March of 2020, interviews had to be conducted online (via Zoom) or over the phone. Based on our experience with interviews prior to that, it is apparent that participants were more comfortable sharing their personal stories in face-to-face settings. In conversations over the phone, particular emotions and reactions could not be noted which we feel was an important component of not only data collection but also in adjusting questions to increase comfort and engagement of the participants. Some of the responses were also potentially biased due to work-from-home arrangements and stay-at-home government orders. The lack of travel meant that participants had to recollect their “usual” travel behaviour prior to the pandemic in many instances.

8.5.4 Transferability of findings across Australia and globally

Immigrants are diverse with regards to past habits, cultural influences and economic and demographic conditions. This thesis had to balance between breadth (all immigrants) and depth (specific subgroups of South Asian immigrants). However, this does raise the question of how transferrable the results are to other immigrant groups in Australia and the validity of our findings in other countries.

In Chapter 2, we discussed in-depth how Australia's immigrants were primarily composed of skilled immigrants and international students. This is quite different to research on immigrants' travel behaviour elsewhere, where is there is greater existing research on immigrants with lower income. As such, our research on 'skilled immigrants' as presented in this thesis adds valuable depth to existing research on immigrant travel behaviour research. The research context also captured participants residing in low-density areas who are more likely to be dependent on cars, including recently arrived immigrants. This is quite different to research in other international contexts where immigrants, particularly recently arrived ones, are more likely to live in dense, inner-city neighbourhoods (Handy, Blumenberg et al. 2008).

The research on international students presented in this thesis is quite significant globally. Although the research presented in this thesis was undertaken in Australia, the findings are likely to be relevant to other countries as well. International student numbers are increasing in many countries around the world (Verbik and Lasanowski 2007), as are immigrants from Asian countries to countries such as New Zealand (Tuli 2014), Canada (Asia Pacific Foundation of Canada 2018) and the United States (Smith 2018). More immigrants today are arriving as students first, compared to years ago (Birrell 2019). This is most apparent in Task 5 (Chapter 7); all immigrants who arrived pre-2000 arrived as skilled immigrants, while after that, there were more international students. This is also consistent research that illustrated the growing importance (and numbers) of this relatively new, 'two-step' migration process (Hawthorne 2010).

Our research somewhat encompasses the demographic of international students going to many countries, not just Australia. International tuition fees are quite high in countries such as the United States, Canada or United Kingdom, and many international students are from Asian countries such as China or India. International students are also less likely to reside with family, and for many students, it is their first foray into independent living. As such, it is likely that our findings will hold some validity if similar studies were repeated in those countries under similar context settings.

8.6 Avenues for future research

Many of the limitations identified in the previous section can be overcome through future research. The avenues for future research are outlined in this section.

8.6.1 Exploring other immigrant populations and subpopulations

Australia is very multicultural with different immigrants making up the population, all of whom have had different experiences, have different views on transportation in Australia and are likely to behave or react to policies differently. While our research focussed on South Asians, this should be followed up by more research on other immigrant subpopulations as well. Immigrants from other Asian countries such as Vietnam or Malaysia also form large parts of the Australia immigrant population. Chinese immigrants in particular play a crucial role in the Australian economy and are an increasing presence in many other countries such as the United States or Canada. Even in the United States, which has primarily focussed research on Latino immigrants, researchers have acknowledged that the travel behaviour of Asian immigrants is likely to differ (Hu 2017).

As a result of the financial and time constraints applying to this study, it was necessary to focus the research on particular South Asian immigrant subpopulations – namely, international students and families. However, there are many immigrant groups in Australia; exploring them can give transport planners and policymakers greater insight into the people who they are trying to serve. While skilled immigrants and international students form a large proportion of immigrants arriving, around one-third of all permanent immigrants arrive on family or humanitarian visas (Phillips and Simon-Davies 2017). These sub-populations of immigrants may have different attitudes or travel behaviours and are worthy of future study.

One of the limitations addressed earlier is that we could not directly link our research on international students to our study of immigrant families. It is difficult to know how many international students eventually settle in Australia, and as of yet (at the time this thesis is written) we do not know how their travel behaviour might change as they transition into working and family life. Research could also explore whether recently arrived immigrants and international students share similar perceptions and past habits, and what these mean for their present-day travel habits.

Finally, as raised in Section 8.5.1, a growing proportion of Australians are second-generation immigrants. Further research could explore whether ethnicity and cultural identification plays a role in the travel behaviour of 'native-born' Australians who identify with a particular ethnic group.

8.6.2 Alternative urban settings

We conducted this research in mostly suburban settings. Similarly, most of our immigrant families were homeowners and all of them were car owners. While this is largely representative of the Australian population, there are many immigrant groups in Australia who settle closer to city centres. Furthermore, many Australian universities and technical colleges that attract international students are located closer to city centres. The findings from this thesis may have been different if they were conducted in inner-city areas, or if it included more families who were renting or did not own a car. Future research could address this limitation by expanding the survey to a wider range of locations, including recruiting more participants in inner-city

areas. In addition, research could also explore immigrants moving to and settling in regional areas of Australia. These are areas with low population density, where public transport services and active travel infrastructure are even more limited. Regional migration is something of increasing importance (especially in recent years), and is something we will discuss from a policy perspective later in the Chapter (in Section 8.7.2).

8.6.3 Better understanding of causality and assimilation

As identified in Section 8.5.2, the present thesis cannot conclusively establish whether behaviour and attitudes change over time, only hypothesize. Longitudinal studies exploring the lives and choices of participants across several years could be a way forward. This would, however, be a large-scale study, which would require further justification to invest such time and finances in. Perhaps exploring comparable transitions amongst immigrants in other countries, particular those from developing countries moving to a developed country, would be ideal. In the absence of bespoke surveys, some longitudinal travel surveys do exist (such as the Netherlands Mobility Panel); future researchers could examine different surveys to determine whether immigration status is collected and whether sample sizes are large enough to allow reasonable analyses.

Related to the issue of assimilation over time is the issue of establishing causality. The regression models used in this thesis assumed that 'soft factors' were influencing travel behaviour. However, we did not have sufficient data to understand causality, i.e. whether attitudes or past travel habits influenced travel habits. Indeed, our qualitative studies (particularly interviews with families in Chapter 7) suggested that causality likely works in both directions. Not only do such soft factors influence travel behaviour, but their travel behaviour in Australia appeared to change their attitudes over time in a bidirectional relationship (see Figure 7-8 in Chapter 7). For immigrants, especially recently arrived ones who are likely to be exploring their best travel options from financial and comfort standpoints, it is important to understand when attitudes start to change so that policy interventions can stagnate the process, prolonging 'sustainable' travel as long as possible (see Section 8.7.1 for further discussion).

8.6.4 'Soft factors' in need of further research

In this thesis, the importance of soft factors was acknowledged, and the role of some such soft factors were explored. Primarily, this was limited to variables such as gender, past travel habits and perceptions.

We conjectured the bidirectional relationship between attitudes and travel behaviour, and the how both of these two variables "evolve" over time for immigrants. While we found some pieces into the possible changing of perceptions, this is something that requires more research. Particularly for immigrants who perhaps arrive from different cultures with different travel practices (as many South Asians were in our studies).

The role of gender also needs to be explored further. A lot has remained unknown, particularly how household roles evolve through migration from South Asia to Australia, and how this translates to travel behaviour. The importance of social status, or lack of, was found through qualitative efforts and could perhaps be tested in larger studies. More importantly, something which was overlooked for the scope of this thesis is how social status, past travel habits and other soft factors might differ depending on an immigrant's background. There are a few of the soft factor-related issues future researchers should consider.

8.7 Policy recommendations

This thesis finds that for South Asian immigrants, many forces combine to push them into car dependency. In Australia, the stream of immigrants arriving (highly educated, in financially strong positions) mean that immigrants are younger and quicker to adapt to the car-dependant culture of Australia. This, combined with rapid population growth, means that there is increasing strain on transport infrastructure and a pressing need to encourage more sustainable transport among the entire population.

The policy recommendations in this section focus on how to encourage South Asian immigrants to adopt and maintain more sustainable travel behaviour. It focusses on three avenues for change:

- Prolonging immigrants' initial travel behaviour in Australia (i.e. slowing down the assimilation process)
- Changing policy to encourage immigrants to settle in places with better public transport options
- Encouraging alternative modes of travel (or discouraging car use)

These do not necessarily have to be immigrant-specific. In fact, we would argue that taking these into consideration would greatly enhance the policy-planning processes in Australia.

Lastly, we highlight the need for policy-planners to support such research. This will help and encourage academics to undertake such research in the first place and will also help policymakers make informed decisions tailored to people's needs.

8.7.1 Slowing assimilation

One possible policy is to slow the transition from South Asian immigrants' initial 'sustainable' forms of travel to car-dependency. It's not so much that they assimilate to car-dependency that is the concern (it would occur inevitably), but rather why it occurs so quickly that poses questions of the actual usability of non-car modes of travel.

Firstly, our participants saw no real benefit in using public transport and disregarded common 'benefits' such as cost, productivity and environmental impacts. Environmental problem awareness, for example, has been found to be quite effective in increasing people's willingness to reduce car use (Steg, Vlek et al. 1995). This is particularly important for immigrants who may have arrived from countries whose transport policies did not place great emphasis on people's environmental awareness (Hasnat, Kabir et al. 2019). Most of the South Asian countries where participants in this study arrived from rate low on the Environmental Performance Index (EPI), especially compared to Australia (Wendling, Emerson et al. 2018). Environmental messages from the government could raise environmental awareness amongst everyone, immigrants included.

If environmental benefits do not resonate with South Asian immigrants, then a second opportunity is incentivising modes that do not require car ownership. Carpooling was found to be a big part of the South Asian travel culture in Australia; commercial carsharing businesses could perhaps postpone the need for individual car ownership upon arrival. State or local council agencies could work to further roll-out effective and affordable carsharing programs, especially serving suburban areas. Cheaper or even free travel on public transport for university students could help them be familiarised with the system, and take cost concerns out of the equation. This could be for a fixed period around the time of their arrival at the start of semester

(for international students, as an example). For new immigrant families, family passes may be an effective solution to allow them to experience public transport as a family (rather than having to purchase multiple tickets). This could enable them to avoid having to rely on carpooling with community members to get to places. Finally, most participants in this thesis had little or no experience with riding a bicycle. Programs that teach immigrants to ride a bicycle, for example, have proven to be effective in the Netherlands (van der Kloof, Bastiaanssen et al. 2014) and Finland (Leppänen 2017). Such programs, even temporarily, could help immigrants familiarise themselves with sustainable modes of travel.

Finally, making changes to the driver licensing requirements could slow the transition, and in the process, disincentivise car dependence among recent immigrants. In Victoria, immigrants can drive using their overseas license even though the Victorian licensing system is one of the strictest in the world (for example it requires 120 hours of supervised driving while on a learner's permit). Immigrants and international students can practically start driving at the time of arrival because six months is provided to allow the "conversion" to domestic licenses. Furthermore, if they are at least 21 years old and have had an overseas license for at least three years, immigrants can bypass the graduate licensing system entirely and apply for a full license. Perhaps a more stringent licensing system for immigrants would not only improve road safety in the short-term, but also provide the crucial time and opportunity for immigrants to try out other modes of travel.

8.7.2 Reconsider the definition of the 'regional migration' pathway

Perhaps the biggest challenge to slowing assimilation is that South Asian immigrants tend to live in suburban areas where car dependency is high. In recent years this settlement pattern has been encouraged through the 'regional migration' pathway – an incentive to encourage newer immigrants to live in regional areas and the smaller cities of Australia. For example, international students studying in regional Victoria are eligible for extended graduate visas and more 'points' on their skilled immigration assessment (Australian Government Department of Home Affairs (DHA) 2020).

The program was implemented to boost population and job growth in regional areas and smaller cities. From an economic perspective, this may be logical. But from a transport and urban planning perspective, it further deteriorates the already-existing problem of gradual car dependency. Furthermore, within Melbourne the definition of 'regional' used by the Victorian State Government is different to the definition set by Department of Home Affairs for migration purposes, as illustrated in Figure 8-2 with the dark blue areas in that map showing outer metropolitan areas which are classified as 'regional' in the context of migration policy.

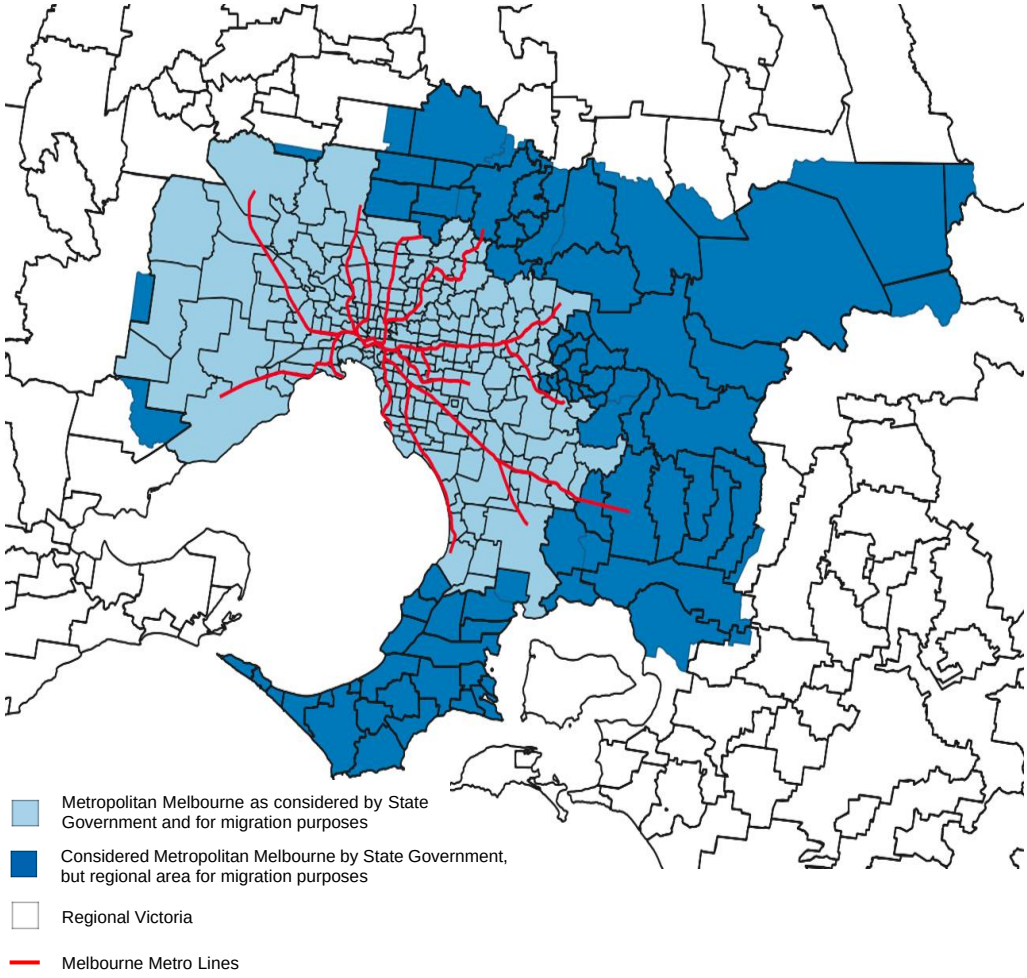


Figure 8-2 Map of Victoria highlighting Metropolitan Melbourne and Regional Victoria

The dark blue regions in this figure are all heavily car dependent with little or no train service and limited bus services. Many South Asian immigrants already live in those areas, as previously presented in Chapter 3 (see Figure 3-5). Between the existing immigrant communities and this immigration incentive, South Asians are essentially encouraged to live further away from better public transport facilities, which, over time, translates to higher car use. The findings from this thesis suggest that outer suburban areas should not be included in the regional migration scheme.

It is well-established in literature that density allows for designing more sustainable cities (Fatone, Conticelli et al. 2012) and helps facilitate better public transportation (Bertaud 2004). As such, immigrants should be encouraged to live closer to the city or where there is better public transportation. Failing that, governments should consider improving the public transport networks where recent immigrants tend to settle. If recent immigrants find that public transport can meet more of their travel needs, they are more likely to slow their assimilation toward car dependence.

8.7.3 Encourage the shift to alternative modes of travel

Many of the shortcomings of public transport identified in this thesis (frequency, reliability, etc) are problems for anyone living in Melbourne's suburbs, not just immigrants. However, some of the negative perspectives were somewhat unique to South Asian immigrants in Australia. These perceptions could be addressed in a targeted manner to increase the chances that they will use public transport.

It should be noted, however, that South Asian immigrants in Victoria are somewhat unique when comparing to immigrants elsewhere, particularly in the United States (where most of the secondary research we explored came from). While cities like Sydney or Melbourne may not have the best public transport systems in the world, Australian public transport services are considered better than most systems in the United States (Levinson 2018). Furthermore, immigrants coming to Australia generally have better socioeconomic profiles than immigrants in many other countries, meaning they are able to choose where they live and how they travel – not all immigrants elsewhere, especially recently arrived ones, have that luxury due to financial restraints. As such, the potential interventions discussed in this section may not be applicable (or appropriate) in many other economies.

8.7.3.1 The low cost of car dependency

In our two qualitative studies (Chapters 6 and 7), participants considered public transport to be an 'expensive' mode of travel. They also discussed a great deal about how cars were 'cheaper' in Australia than in their home countries. Our research has indicated that the purchase price for cars in Australia is indeed cheaper than in South Asia. Take for example a Toyota Corolla – very popular car sold globally: in Australia they start from about AUD 23,000. In India, the same car starts from about INR 1,500,000 (AUD 30,000) and in Sri Lanka, the price starts from about LKR 7,000,000 (AUD 55,000)[36]. This, compared with the higher average incomes in Australia, means that cars are much more affordable in Australia than they are in South Asia. In contrast, Australian public transport systems are some of the most expensive in the world, with Sydney and Melbourne being in the top 10 most expensive cities[37] for public transport (Reid, Nicol et al. 2019). And for participants who can rely on carpooling like many of our international students and recent immigrants, the cost of public transport may act as a deterrent to using the mode.

On the other hand, participants did not discuss or consider the expenses related to car-ownership and use: vehicle value depreciation, parking fees, tolls, cleaning, tyres and other spare parts, servicing, accidents and infringements. However, travel motivations and behaviours are primarily affected by *perceptions* of costs and benefits which do not necessarily reflect actual costs and benefits (Gatersleben 2014). For immigrants arriving from a different infrastructure setting, acknowledging actual costs can be even more difficult, primarily because comparisons are often made with their homeland standards in the near future.

Transport agencies could run awareness campaigns to highlight the true cost of car use compared to public transport, both financially and environmentally, much as they currently do to communicate road safety messages. Furthermore, state governments could follow the lead of places such as Singapore or Hong Kong and increase the *actual* cost of motoring, while simultaneously investing heavily in public transport and active transport (James and Piotr

[36] Prices approximated from multiple car-selling websites
[37] Measured using monthly ticket price

2003). While such measures are likely to be politically unpopular in Australia, there are growing calls for reform in road use charging which may open up opportunities.

> *"There needs to be a change to the way Victorians use the transport system if we want to reduce congestion and get the most out of our big infrastructure projects. A change to transport pricing will motivate and incentivise people to make that change."*
>
> Quote obtained (Infrastructure Victoria 2020)

8.7.3.2 Expensive public transport that leaves a lot to be desired

South Asian public transport systems, as is, have their flaws, but according to our participants, there are positives as well which matter to participants. Our research has indicated that public transport in Victoria does not meet the expectations of users. Perhaps even more important than the perceived high cost is the infrequent services and lack of connectivity, especially in suburban areas of Melbourne. Furthermore, recent (and rapid) developments mean that the standards of public transportation in South Asia is catching up to, or even better in some cities, than Melbourne's.

> *"Like if I compare it to our [Melbourne] metro [at present], it [Delhi Metro] is much cleaner. You can't have food in the metro, a proper security check is done before you enter in the station . . ."*
>
> Quote obtained from Task 5 (interviews with South Asian households).

There are many more projects that are underway in South Asia such as the Metro Mass Rapid Transit System (MRT) in Dhaka, Bangladesh (Mamun 2020) or the Lahore Metro in Pakistan, (Asad 2020), both of which are the first metro systems in those countries. Recent plans in South Asia to upgrade public transport infrastructure also address some of the deficiencies that these immigrants experienced in South Asia (based on our literature review), such as safety and overcrowding (Saxena 2019). This is testament to the rapid economic development experienced by each of the South Asian economies. It also potentially means that the 'honeymoon period' we discussed in Chapter 7 may not even exist amongst future immigrants as they would be arriving from cities with potentially better and newer public transport systems.

There are plans for projects in Melbourne that would seemingly tackle some of such shortcomings. For example, the Metro Tunnel, expected to complete in 2025, is Melbourne's "biggest rail project since the 1970s" (Victoria's Big Build 2020). This combined with the planned Suburban Rail Loop (to be completed in 2050) is expected to ease some of the concerns of public transport services and capacity. The Suburban Rail Loop in particular is expected to address suburban-level public transport connectivity concerns. However, the loop does not actually cover the suburbs where South Asians currently tend to live, which are even further away from the Melbourne CBD. And as Melbourne grows geographically and regional migration becomes more prominent, it potentially means that their car dependency is still likely to continue. And this is only part of the concerns that current government strategies are unable to address.

Another issue comes from the very nature of public transport in Australia compared to South Asia. Traditional public transport modes in South Asian (e.g. bus, train, tram) are combined with a vast array of door-to-door services such as rickshaws and other paratransit modes, which can mean that using public transport is actually more convenient in South Asia than Australia. Some modes of 'public transport' in South Asia are akin to taxi-based travel services in

Australia, only cheaper and quicker. Tackling this problem is challenging and requires more research and development. Even if you could increase the frequency of transit services, the concern from an infrastructure standpoint is last-mile connectivity (especially in the suburbs). While we certainly don't foresee the introduction of rickshaws and similar door-to-door services on Melbournian streets anytime soon, increasing density, facilitating active travel or use of electric shared micro-mobility modes may help to overcome the challenge of last mile connectivity. Examples include e-scooters or Segways, which are in fact illegal to ride in Victoria (at the time of writing this thesis). Alternatively, planners could also study flex-route transit services. Research from Canada has highlighted the potential of demand-responsive transit services in low-performing fixed route services in suburban areas (Alshalalfah and Shalaby 2012).

'Cheap' cars, 'expensive' public transportation, low urban density, high incomes – all these factors combine to align people towards car-based travel in Melbourne, and that is a recipe for anything but sustainable travel. For the South Asian immigrants in our studies who grew up in societies with more expensive cars, cheaper and better-connected public transport, high population and urban density, and lower incomes and standard of living, it is not surprising that they so quickly start depending on cars. Immigrants came to Australia to have a better life, and if a car facilitates easy and "cheaper" mobility, what's stopping them from relying on it? Furthermore, they want to live near their friends and contacts, which are already further away from the CBD (i.e. less density and less transit infrastructure), and this, in turn, is not helped by the regional migration incentives. What are we doing to help or even encourage them to travel sustainably? This is a question policy-planners must address quickly.

8.7.4 Further investment in exploring immigrant travel behaviour

The underrepresentation of immigrants on travel surveys and research is not a problem exclusive to Australia, but also in other parts of the world (Tal and Handy 2010). We submit that there needs to be change at a government level to (a) recognise the importance of immigrants beyond blanket "multiculturism", skill and wealth and (b) understand their travel needs and support them appropriately. International students in particular need to be recognized for the value they bring beyond tuition fees and skills – many, if not most, are part of the future generation of Australian residents.

In Australia however, studying ethnicity can be a sensitive issue. In Australia, most travel surveys don't ask a respondent's ethnic background (or country of birth), either to avoid intrusiveness (Department of Transport and Main Roads Queensland, personal communication, May 2017) or to eliminate the possible element of political incorrectness (Monash University Campus Access and Transport, personal communication, June 2018). We understand that space on surveys always comes at a premium, but if the importance of such questions were acknowledged at a government level, perhaps survey designers would be more comfortable placing such questions on their survey.

Research on immigrants' travel patterns in Australia are not only limited, but also quite new, suggesting that this issue has only been acknowledged in recent times. Most of the Australian research on this topic is in its infancy, and often explored the issue at a high level (Klocker, Toole et al. 2015, Yoo, Diamond et al. 2015, Kerr, Klocker et al. 2016). On the other hand, many pieces of research have emerged from the United States that were actually funded by or supported by local governments and/or state agencies (Blumenberg 2009, Barajas, Chatman et al. 2016, Smart and Klein 2017). To quote Tal and Handy (2010), immigrants could be the

‘agents of change’ that help to facilitate a transition to a more sustainable transport system. Yet at present, nothing at a policy levels seems to incorporate this principal.

Instead of relying on common practices, embracing the unique population and cultural mix and innovative solutions may be a better fit. But this requires more research and engagement by governments in these areas. State and local authorities could be doing more to ensure that researchers are being motivated and supported to do so.

8.8 Concluding remarks

Immigrants have played a vital role in the growth of the Australian economy. Beyond simply contributing to population growth, they help promote multiculturalism and diversity in the population, bring their skills to the job market, enrich the education sector and enhance Australia as a country and an economy (Encina and Santalucia 2013, Wright, Clibborn et al. 2016). Australia's immigration system ensures skilled immigrants and international students, or those with sufficient wealth, make the transition to live in Australia. In return, Australia provides a high standard of living (United Nations Development Programme (UNDP) 2019) with some of the world's most liveable cities, excellent healthcare and education, vibrant multiculturism and excellent social security (Dixon 2000). And while there is a lot that immigrants get to learn from living in Australia, there is perhaps a lot we may be able to learn from them when designing our infrastructure and transport systems.

In order to successfully help transition our society to a more sustainable one, transport planners and policymakers need to be more aware of people's needs and wants and make decisions to suit specific demographics, including immigrants. A 'one-size-fits-all' approach may not be the most fruitful, and while common practices elsewhere (such as some of the ideas generated in other countries as discussed in Section 8.7.1) are a good place to start, more investment into understanding Australians and immigrants alike could help us make the transition to sustainable travel more quickly and effectively. Conducting research on particular subpopulations to better identify and solve a problem should not be considered taboo, especially if the purpose is to improve society as a whole.

This thesis has uncovered some important parameters that help explain travel behaviour differences between native-born Australians and South Asian immigrants. Through exploring parameters such as attitudes, past travel habits and some insights into gender, we have established that traditional parameters recorded on travel surveys may not capture the full picture of the entire, diverse population who transport planners are trying to serve. These are parameters which not only influence travel behaviour of immigrants, but rather the general population. We have also explored assimilation, and the underlying reasons behind that assimilation, albeit qualitatively, which has uncovered some key decision-making dynamics amongst immigrants that, amongst other findings in this thesis, should be explored further.

Shying away from accepting the need for further research is short-sighted. A better understanding of immigrants, or any subpopulation for that matter, would better help serve their needs. Such research would help transport planners to, as Rajé put it, "deploy limited financial resources to meet real local needs" (Rajé 2007). In the realm of transport planning, research on cultural subgroups (such as immigrants) is simply an alternative way of better understanding the problems and coming up with solutions. The solutions do not need be tailored to only help immigrants travel – rather we are learning ways in which we can help the broader population. Why do immigrants travel sustainably at first? What prompts them to change? Why do they end up in high car dependency? We have given one set of answers based on our research – more research will help better guide planning and policy decisions into the future not only for immigrants, but for all Australians.

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Appendices

Appendix A – Task 3 survey

This survey that was compiled and distributed to fulfill Task 3 has been imported from Qualtrics and has not been modified with in any way of form, bar making the font size proportionally smaller to fit within fewer pages. The survey starts from the next page.

Travel Behaviour of South Asian international students

Survey Flow

Standard: Explanatory Statement (2 Questions)
Standard: University Student (1 Question)
Block: Country of Birth/ Student Status (6 Questions)
Standard: Demographics (3 Questions)
Standard: Infrastructure perceptions in Victoria (1 Question)
Standard: Household/ Family Questions (8 Questions)
Standard: Past Travel Habits (4 Questions)
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Page Break

Start of Block: Explanatory Statement

Q1.1
Survey: Understanding travel behaviour and mode choices of international students in Australia
You are invited to take part in this study. You have been chosen as you are currently enrolled in tertiary education and are above the age of 18. Please read this Explanatory Statement in full before deciding whether or not to participate in this research.
What does the research involve? The overall aim of this study is to see whether people's travel habits are influenced by their country of birth. This research involves participants completing surveys and possibly follow-up questionnaires and interviews, subject to consent and selection. By undertaking the survey, you are agreeing to participate in this study. You can stop participating in this study any time you wish. Because the project involves anonymous responses, you cannot retrieve and withdraw data once submitted.
We do not anticipate any risks to you in undertaking this research. Completing this survey should only take about 10 minutes of your time. When you complete the survey, you can enter a prize draw for a **$100 Coles Group and Myer Gift Card**. We will also ask if you are willing to be contacted for a follow-up interview. You do not need to agree to a follow-up interview to enter the prize draw.
Confidentiality and data storage. Identifying information will only be collected for the prize draw or to contact you for follow-up research if you agree. Data will be stored securely, and results will only be presented in de-identified form. Identifying information will be erased after the interview and prize draw.
Results. Results will be published in the form of a research paper and thesis. If you wish to have a summary of the results, contact Rahman Shafi at rahman.shafi@monash.edu or Dr. Alexa Delbosc at alexa.delbosc@monash.edu.
Complaints. Should you have any concerns or complaints about the conduct of the project, you are welcome to contact the Monash University Human Research Ethics committee.
Executive Officer
Monash University Human Research Ethics Committee (MUHREC)
Research Office, Room 111, Chancellery Building D, 26 Sports Walk,
Clayton Campus, Monash University VIC 3800
Tel: +61 3 9905 2052
Email: muhrec@monash.edu
Fax: +61 3 9905 3831
Project # 11737
Thank you,
Dr Alexa Delbosc

Q1.2 I am aged 18 or over, and I wish to continue this survey.

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Q1.2 = 2

End of Block: Explanatory Statement

Start of Block: University Student

Q35 Are you a current university student?

- ○ Yes (28)
- ○ No (29)

Skip To: End of Survey If Q35 = 29

End of Block: University Student

Start of Block: Country of Birth/ Student Status

Q2.1 Are you a current Monash University student?

- ○ Yes (1)
- ○ No (2)

Skip To: Q36 If Q2.1 = 2

Q2.2 Which Monash University campus (or campuses) do you attend? (Select all that apply)

- ☐ Clayton (1)
- ☐ Caulfield (2)
- ☐ Peninsula (3)
- ☐ Parkville (4)
- ☐ Other (5) _____

Skip To: Q2.3 If Condition: Which Monash University cam... Is Greater Than 0. Skip To: Which level of qualification are you ....

Q36 What is the postcode of where your institution is located?

_____

Q2.3 Which level of qualification are you currently enrolled in?

▼ Foundation Year or Diploma (1) ... Doctor of Philosophy (4)

Q2.4 In which country were you born?

▼ Afghanistan (1) ... Zimbabwe (1357)

Skip To: End of Block If Q2.4 = 9

Q2.5 How many years have you lived in Australia?

▼ Less than 1 (1) ... More than 5 (6)

End of Block: Country of Birth/ Student Status

Start of Block: Demographics

Q3.1 To which gender identity do you most identify?

▼ Male (1) ... Other/Prefer not to say (3)

Q3.2 In which year were you born?

▼ 2017 (1) ... 1979 or earlier (39)

Q3.3 Where were your parents born?

	Australia (1)	Overseas (2)
Father (1)	○	○
Mother (2)	○	○

End of Block: Demographics

Start of Block: Infrastructure perceptions in Victoria

Q4.1 Please indicate the extent to which you agree with the following statements.

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
I feel Victorian roads are generally safe for driving (1)	○	○	○	○	○
I feel safe on public transport in Victoria (2)	○	○	○	○	○
I feel it is safe to walk around where I live (3)	○	○	○	○	○
I feel cycling is safe around where I live (4)	○	○	○	○	○
I like living in busy, populated inner-city areas (5)	○	○	○	○	○

End of Block: Infrastructure perceptions in Victoria

Start of Block: Household/ Family Questions

Q5.1 How many people (including yourself) live in your household?

▼ 1 (yourself) (1) ... 5 and above (5)

Q5.2 Which of the following best describes your household?

▼ I live alone in on-campus accommodation (1) ... Other (6)

Q5.3 Do you have children of your own?

- Yes (1)
- No (2)

Q5.4 Do your parents pay for any of the following?

	All of it (1)	Most of it (2)	Some of it (3)	None of it (4)
Housing (1)				
Food and utilities (2)				
Education (3)				

Q5.5 Did you grow up in a household with cars?

- Yes (1)
- No (2)

Q5.6 At present, do you own or have access to a car you can drive?

- Yes (1)
- No – but previously used to (2)
- No – never had (3)

Q5.7 Do you have a valid driving license?

- Yes, an Australian probationary or full license (1)
- Yes, a full license issued overseas (2)
- Yes, a learner's permit (3)
- No (4)

Q5.8 Do you think you will do any of the following?

	Already Completed (1)	Before completing my studies (2)	After my studies (3)	Don't know **or** I haven't thought of it (5)	Never (6)
Buy a car (1)	○	○	○	○	○
Buy a house (2)	○	○	○	○	○
Settle in Australia (3)	○	○	○	○	○
Settle overseas (4)	○	○	○	○	○

End of Block: Household/ Family Questions

Start of Block: Past Travel Habits

Q6.1 During **secondary school/ high school**, how much **did you drive or were you driven** to the following places?

	Always (1)	Most of the time (2)	About half the time (3)	Sometimes (4)	Never (5)
To school (1)	○	○	○	○	○
Recreational activities (sports, movies, out with friends) (2)	○	○	○	○	○
Activities with family (shopping, dinners) (3)	○	○	○	○	○

Q6.2 During **secondary school/ high school**, how much did you travel by public transport to the following places?

	Always (1)	Most of the time (2)	About half the time (3)	Sometimes (4)	Never (5)
To school (1)	○	○	○	○	○
Recreational activities (sports, movies, out with friends) (2)	○	○	○	○	○
Activities with family (shopping, dinners) (3)	○	○	○	○	○

Q6.3 During **secondary school/ high school**, how much did you travel by walking to the following places?

	Always (1)	Most of the time (2)	About half the time (3)	Sometimes (4)	Never (5)
To school (1)	○	○	○	○	○
Recreational activities (sports, movies, out with friends) (2)	○	○	○	○	○
Activities with family (shopping, dinners) (3)	○	○	○	○	○

Q37 During secondary school/ high school, how much did you travel **by cycling** to the following places?

	Always (1)	Most of the time (2)	About half the time (3)	Sometimes (4)	Never (5)
To school (1)	○	○	○	○	○
Recreational activities (sports, movies, out with friends) (2)	○	○	○	○	○
Activities with family (shopping, dinners) (3)	○	○	○	○	○

End of Block: Past Travel Habits

Start of Block: Present Travel Habits

Q7.1 **At present**, How frequently **do you drive** to the following places?

	Always (1)	Most of the time (2)	About half the time (3)	Sometimes (4)	Never (5)
University (1)	○	○	○	○	○
Other activities such as work, recreation, family activities (2)	○	○	○	○	○

Q7.2 At present, how frequently **do you take public transport** to the following places?

	Always (1)	Most of the time (2)	About half the time (3)	Sometimes (4)	Never (5)
University (1)	○	○	○	○	○
Other activities such as work, recreation, family activities (2)	○	○	○	○	○

Q7.3 **At present**, how frequently **do you walk** to the following places?

	Always (1)	Most of the time (2)	About half the time (3)	Sometimes (4)	Never (5)
University (1)	○	○	○	○	○
Other activities such as work, recreation, family activities (2)	○	○	○	○	○

Q7.4 At present, how frequently do you cycle to the following places?

	Always (1)	Most of the time (2)	About half the time (3)	Sometimes (4)	Never (5)
University (1)	○	○	○	○	○
Other activities such as work, recreation, family activites (2)	○	○	○	○	○

Q7.5 At **present**, which modes do you **primarily** use for the following trip purposes?

	Public Transport (1)	Driven by someone (2)	Drive (3)	Walking (4)	Bicycling (5)	Other (6)	I don't have to travel for this purpose (7)
Education (1)	○	○	○	○	○	○	○
Work (2)	○	○	○	○	○	○	○
Recreational activities (visiting friends, shopping, sports) (3)	○	○	○	○	○	○	○
Other purposes (4)	○	○	○	○	○	○	○

End of Block: Present Travel Habits

Start of Block: Mode Perceptions

Q8.1 To what extent do you agree with the following statements related to travel by car?

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
Travelling by car is more comfortable than other travel modes (1)	○	○	○	○	○
A car is faster than other modes of travel (2)	○	○	○	○	○
Owning a car means someone is successful in life (3)	○	○	○	○	○
A car opens up more work opportunities (4)	○	○	○	○	○
Car ownership is a symbol of wealth (5)	○	○	○	○	○
Owning a car allows you to secure high-paying jobs (6)	○	○	○	○	○
People who own a car have a better quality of life (7)	○	○	○	○	○

Q8.2 To what extent do you agree with the following statements related to travel by alternatives to the car?

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)
Public transport is cost-effective (1)	○	○	○	○	○
Public transport means I can be more productive while travelling (2)	○	○	○	○	○
I enjoy walking to places (3)	○	○	○	○	○
I enjoy riding a bike (4)	○	○	○	○	○
Taking public transport means you aren't successful in life (5)	○	○	○	○	○

Q8.3 To what extent do you agree with the following statements about the views of your friends and family?

	Strongly agree (1)	Somewhat agree (2)	Neither agree nor disagree (3)	Somewhat disagree (4)	Strongly disagree (5)	Not Applicable (6)
My friends think having a car in important (6)	○	○	○	○	○	○
My friends think public transport is uncool (7)	○	○	○	○	○	○
My family thinks public transport is unsafe (8)	○	○	○	○	○	○
My family thinks I should avoid walking to places (9)	○	○	○	○	○	○
My family thinks I should avoid cycling to places (10)	○	○	○	○	○	○
My family thinks I should drive to places (11)	○	○	○	○	○	○

End of Block: Mode Perceptions

Start of Block: Comments/Suggestion

Q9.1 If you want to share anything else not in the survey, or if you have any additional comments or suggestions related to the survey, please feel free to write them here.

_____

End of Block: Comments/Suggestion

Start of Block: Prize Draw Details

Q10.1 Do agree to provide your contact details for the following purposes?

	Yes (1)	No (2)
To enter the prize draw (1)	○	○
To be contacted for participation in future research on this topic (2)	○	○

Skip To: End of Survey If Q10.1 [1] (Count) =

End of Block: Prize Draw Details

Start of Block: Personal Information

Q11.1 What is your name?

_____

Q11.2 Please provide us with the best way to contact you (phone or e-mail).

_____

End of Block: Personal Information

Appendix B1 – Task 4 discussion guide

Discussion Guide (Sample only – modified in-between sessions)

Task 4: Data collection for Chapter 6
Factors that influence mobility choices amongst university students

Overall themes of this discussion

- We have already observed that the travel habits of international students change the longer they live in Australia, especially in the case of car dependency. Probing themes including
    - How do they define "settled"?
    - What variables alter in this time period?
    - Plans for the future?
    - Revisiting the role of attitudes, social norms and behavioural control
        - Perceptions of transport infrastructure in Australia vs South Asian

Introduction

- Explanation of how the discussion will operate
- Names and brief introductions
    - Course
    - Years lived in Australia (for international students)

Socio-demographic and socio-economic parameters

- How many of you have a full driver's license?
- How many of you own a car?
- How many of you are completely financially independent?
- What travel mode to you currently use at present?
- How far do you live away from university/ work etc.?
    - Does your work influence your choice in having a car?

Attitudinal/ Perception questions

- Defining settled
    - How do you define the term “settled”?
    - Would you define yourselves as “settled”?
        - Ask importance of . . . (to be settled)
            - Car ownership
            - Household ownership
            - Family Children
    - Does being/not being settled influence your travel choices?
        - Are there financial barriers to choosing a particular mode?

Change in travel behaviour over the years

<Targeting international students>

- Tell me about your day-to-day travel habits when you first came to Australia
- How does your travel behaviour differ today?
- Are you planning to live/work in Australia after your studies?
    - Do you think about future actions for present day mode choice?

<Going back to rest of the group>

- Do your future plans influence your present-day mode choice?
- Do you think public transport in Victoria is getting better/worse every day?

Social Norms

- How important of a role does family play in your travel choices?
    - Targeting those who families does not the transport options near your home
- How were the transport options when growing up?

<Target those who have a car>

- What is the main reason behind you using a car?

Conclusion

- Is there anything else anyone would like to add before we wrap up this discussion?
- Thank you and session closed

Appendix B2 – Task 5 interview guide

Interview Guide (Sample only – modified in-between sessions)

Task 5: Data collection for Chapter 7
Cultural influences and travel assimilation amongst South Asian families

Overall research themes

This study aims to understand factors which influence mobility choices amongst South Asian families (father/ mother/ both born in South Asia) and native-born (father/ mother/ both born in Australia) families.

Briefing and participant introductions

- Do you have any questions?
    - Explanatory statement understood?
    - Has consent form been signed? – You understand that this conversation will be audio-recorded for further analysis
    - Want to hear from both participants
- Names and brief introductions
    - Pseudo-names can be used for flow of conversation
    - Household composition
        - Birth of "father", "mother", "children" –families of their own?
        - Second-generation immigrants

Past travel habits and mobility choices

- Choosing Australia and why
- Country of birth
- Driver's license
    - Years living in Australia before obtaining driver's license
    - What age did you obtain license, and how long have you been driving?
    - Driving back in **(country of birth)**
- Travel options back home before coming to Australia
    - What transport modes were available?
    - Any social perceptions you want to share?
- First arriving to Australia
    - Anything you found different in terms of the road, public transport?
    - Options at first
        - Cars, friends with cars
        - Residential choice at first
            - How did you choose your home?
    - Difficulties
        - Adapting to a new system, making friends, culture?

Present-day mobility choices

- Residential location at present:
    - Type of residence (house, apartment etc.) – owned/ rented
    - Location
        - Choosing this location
        - Occupation, and distance from work
            - Network of friends/ relatives?
    - Members of households (family composition)
            - Do you have children? What are their travel needs?
    - Can you walk or cycle to any places of interest (such as a grocery store etc.)?
        - Is that important to you?
- Car ownership
    - Cars in the household
    - Use of cars (who uses which car, role-defined?) - gender
    - Motivator in purchasing car
        - Necessity, social/ peer pressure, comfort
- Car use at present
    - Familiarity/ comfortable with road rules?
    - Ownership costs (compared to public transport or active travel)
- Public transport options near house
    - Bus/ train/ tram
    - Connectivity: how did it influence household location?
    - Any problems using public transport?
    - Are all members equally comfortable using public transport near home?
- Barriers from using different modes
    - Do you have any reservations towards any particular travel mode?
    - Social exclusion?

Evolution of travel habits and the future

- How have your travel habits changed now?
    - Increased familiarity with the system
    - **(if moved houses)** motivation behind changing location
    - How does "I want to travel . . . ." compare to "I am travelling . . ."
- Intention(s) to move to a new house, buy car etc.
- What would motivate you to travel using public transport and active travel?

Concluding remarks

- Anything else that influences your travel behavior?
- Anything else/ comments you would like to add/ make before wrap-up?

Thank you (session closed)

Appendix C – Extended analysis using logistic regression models

The calculations in this appendix have been referred to in Chapter 5 in order to make particular statements of findings. The results presented here are of an alternative set of regression models we ran where we not only compared South Asians and Australians, but also other immigrant groups such as those who arrived from England or New Zealand, China or Mainland Southeast Asia[38].

For this particular analysis only, we analysed 274 South Asian respondents (and trips), and 3,731 trips by Australians (and trips). For comparative purposes, using the same process, we analysed 285 trips by immigrants from England or New Zealand, 227 trips by Mainland Southeast Asian immigrants (comprises of the countries of Cambodia, Laos, Malaysia, Myanmar, Thailand and Vietnam). Lastly, 153 trips by Chinese immigrants were also analysed. A full breakdown of demographics of participants used in this model in presented in Table C-1. The mode 'car as driver' was set to zero as it was selected as the base case for all three modes. Because the table generated from SPSS is very large, only the key parameters have been presented for the final models.

[38] comprises of the countries of Cambodia, Laos, Malaysia, Myanmar, Thailand and Vietnam

Table C-1 Dataset breakdown of trips by various demographic variables (separated by each country of birth)

Variables	Variable categories	South Asians		Australians		English or New Zealanders		Mainland Southeast Asians		Chinese		Combined *(not modelled)*	
		N	%	N	%	N	%	N	%	N	%	N	%
Age		*On a scale*											
Mode	Car as driver	161	*58.8*	2337	*62.6*	183	*64.2*	141	*62.1*	84	*54.9*	2906	*62.2*
	Car as passenger	37	*13.5*	486	*13.0*	29	*10.2*	45	*19.8*	21	*13.7*	618	*13.2*
	Public Transport	45	*16.4*	385	*10.3*	27	*9.5*	19	*8.4*	32	*20.9*	508	*10.9*
	Active Travel	31	*11.3*	523	*14.0*	46	*16.1*	22	*9.7*	16	*10.5*	638	*13.7*
Gender	Male	152	*55.5*	1773	*47.5*	147	*51.6*	105	*46.3*	75	*49.0*	2252	*48.2*
	Female	122	*44.5*	1958	*52.5*	138	*48.4*	122	*53.7*	78	*51.0*	2418	*51.8*
License Status	Learner's or No License	46	*16.8*	310	*8.3*	18	*6.3*	22	*9.7*	22	*14.4*	418	*9.0*
	Probationary or Full License	228	*83.2*	3421	*91.7*	267	*93.7*	205	*90.3*	131	*85.6*	4252	*91.0*
Main Activity	Other	40	*14.6*	507	*13.6*	38	*13.3*	51	*22.5*	13	*8.5*	649	*13.9*
	Full-time or Part-time Education	14	*5.1*	216	*5.8*	7	*2.5*	11	*4.8*	17	*11.1*	265	*5.7*
	PT/Cas Work	65	*23.7*	988	*26.5*	65	*22.8*	46	*20.3*	33	*21.6*	1197	*25.6*
	FT Work	155	*56.6*	2020	*54.1*	175	*61.4*	119	*52.4*	90	*58.8*	2559	*54.8*
Household Income ($/wk)	Low (0-1100)	44	*16.1*	546	*14.6*	44	*15.4*	51	*22.5*	41	*26.8*	726	*15.5*
	Medium (1101-2250)	147	*53.6*	1358	*36.4*	98	*34.4*	106	*46.7*	65	*42.5*	1774	*38.0*
	High (2251-7500)	83	*30.3*	1827	*49.0*	143	*50.2*	70	*30.8*	47	*30.7*	2170	*46.5*
Household Location	Inner Melbourne	34	*12.4*	959	*25.7*	82	*28.8*	42	*18.5*	21	*13.7*	1138	*24.4*
	Middle Melbourne	96	*35.0*	1001	*26.8*	63	*22.1*	128	*56.4*	105	*68.6*	1393	*29.8*
	Outer Melbourne	144	*52.6*	1771	*47.5*	140	*49.1*	57	*25.1*	27	*17.6*	2139	*45.8*
Number of people in household	1	8	*2.9*	366	*9.8*	18	*6.3*	15	*6.6*	13	*8.5*	420	*9.0*
	2	55	*20.1*	1081	*29.0*	84	*29.5*	33	*14.5*	40	*26.1*	1293	*27.7*
	3	79	*28.8*	755	*20.2*	72	*25.3*	55	*24.2*	39	*25.5*	1000	*21.4*
	4	107	*39.1*	1006	*27.0*	76	*26.7*	89	*39.2*	37	*24.2*	1315	*28.2*
	5+	25	*9.1*	523	*14.0*	35	*12.3*	35	*15.4*	24	*15.7*	642	*13.7*
Vehicles in household	0	13	*4.7*	90	*2.4*	17	*6.0*	7	*3.1*	11	*7.2*	138	*3.0*
	1	98	*35.8*	877	*23.5*	57	*20.0*	65	*28.6*	51	*33.3*	1148	*24.6*
	2	121	*44.2*	1720	*46.1*	145	*50.9*	122	*53.7*	75	*49.0*	2183	*46.7*
	3+	42	*15.3*	1044	*28.0*	66	*23.2*	33	*14.5*	16	*10.5*	1201	*25.7*
Trip Purpose	Social, Recreation, Shopping	88	*32.1*	1585	*42.5*	118	*41.4*	76	*33.5*	52	*34.0*	1919	*41.1*
	Education	5	*1.8*	106	*2.8*	3	*1.1*	6	*2.6*	6	*3.9*	126	*2.7*
	Work, Business	130	*47.4*	1541	*41.3*	127	*44.6*	94	*41.4*	66	*43.1*	1958	*41.9*
	Others	51	*18.6*	499	*13.4*	37	*13.0*	51	*22.5*	29	*19.0*	667	*14.3*
Weekday	No	83	*30.3*	838	*22.5*	56	*19.6*	54	*23.8*	37	*24.2*	1068	*22.9*
	Yes	191	*69.7*	2893	*77.5*	229	*80.4*	173	*76.2*	116	*75.8*	3602	*77.1*
Home area population density (pp/km^2)	4001+	9	*3.3*	263	*7.0*	33	*11.6*	9	*4.0*	3	*2.0*	317	*6.8*
	2001-4000	94	*34.3*	1607	*43.1*	84	*29.5*	136	*59.9*	101	*66.0*	2022	*43.3*
	0 - 2000	171	*62.4*	1861	*49.9*	168	*58.9*	82	*36.1*	49	*32.0*	2331	*49.9*
	Total	274	*100.0*	3731	*100.0*	285	*100.0*	227	*100.0*	153	*100.0*	4670	*100.0*

South Asians generally travelled less than Australians in terms of distance, as Table C-2 below highlights. In terms of travel times, South Asians travelled the longest in terms of journey times compared to all bar Chinese respondents. South Asians also made more stops that

Table C-2 Distance travelled, time travelled and number of stops for trips (separated by country of birth)

		Compared to Australia			
Country of Birth	Australia	South Asia	Eng/ NZ	Southeast Asia	China
Distance Travelled (km)	38.94	31.14**	39.22	27.75**	30.83*
Time Travelled (mins)	26.82	27.51	26.25	26.58	33.13**
Number of stops	1.27	1.43*	1.25	1.22	1.51**

t-tests used to compare means

* = p<0.01 ** = p<0.05

The final models had statistically significant large chi-squared statistics, indicating that the parameters chosen for this model have a substantial impact on predicting mode choice. This is presented in Table C-3. The Cox and Snell R^2 values ranged between 0.34 and 0.65, while the Nagelkerke R^2 values ranged 0.39 and 0.72, as highlighted in C-5. They are similar, and while not the best fit, are reasonable for this purpose. It should be noted that a lot of parameters have not been considered in this model.

Table C-3 Model fitting information for all models (by country of birth)

Country of Birth	Model	Model Fitting Criteria	Likelihood Ratio Tests		
		Likelihood	Chi-Square	df	Sig.
South Asians	Intercept Only	617.067			
	Final	355.792	261.275	69	0.000
Australians	Intercept Only	7861.617			
	Final	6312.822	1548.794	69	0.000
English/ New Zealanders	Intercept Only	588.347			
	Final	406.813	181.534	69	0.000
Mainland Southeast Asians	Intercept Only	476.883			
	Final	307.942	168.941	69	0.000
Chinese	Intercept Only	356.537			
	Final	196.780	159.757	69	0.000

Table C-4 Goodness of fit for all models (by country of birth)

Country of Birth	Model	Chi-square	df	Sig.
South Asians	Pearson	559.821	747	1.000
	Deviance	355.792	747	1.000
Australians	Pearson	10636.713	10530	0.230
	Deviance	6211.125	10530	1.000
English/ New Zealanders	Pearson	767.841	777	0.586
	Deviance	405.426	777	1.000
Mainland Southeast Asians	Pearson	3301.315	609	0.000
	Deviance	307.942	609	1.000
Chinese	Pearson	350.314	384	0.890
	Deviance	196.780	384	1.000

Table C-5 Pseudo R-square values for all models (by country of birth)

Country of Birth	South Asians	Australians	English/ New Zealanders	Mainland Southeast Asians	Chinese
Cox and Snell	0.61	0.34	0.47	0.52	0.65
Nagelkerke	0.69	0.39	0.54	0.60	0.72
McFadden	0.42	0.19	0.31	0.35	0.45

All the parameters chosen for this model are statistically significant predictors to mode choice. Due to using the same set of predictors for every demographic, not all variables were significant for every country of birth. For example, *age* was only a significant variable for native-born Australians, as was the *number of people in household.* Gender was significant for all regions bar English/ New Zealanders, while main activity was significant for South Asians and Chinese. The detailed table is presented in Table C-6.

Table C-6 Likelihood ratio tests - Significance of predictors/ parameters in multinomial logistic regression model (separated by country of birth)

Country of Birth	Effect	Model Fitting Criteria	Likelihood Ratio Tests		
		-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig. < 0.05 is Green
South Asians	Intercept	355.792[a]	0.000	0	
	Age	357.706	1.914	3	0.591
	Gender	386.335	30.542	3	0.000
	License Status	375.081	19.289	3	0.000
	Main Activity	377.943	22.150	9	0.008
	Household Income	365.214	9.422	6	0.151
	Household Location	364.356	8.563	6	0.200
	Number of people in household	375.593	19.801	12	0.071
	Vehicles in household	392.689	36.897	9	0.000
	Trip Purpose	387.934	32.142	9	0.000
	Weekday	364.189	8.396	3	0.038
	Population Density	362.860	7.068	6	0.315
Australians	Intercept	6312.822[a]	0.000	0	
	Age	6324.272	11.450	3	0.010
	Gender	6352.926	40.104	3	0.000
	License Status	6660.801	347.979	3	0.000
	Main Activity	6329.254	16.432	9	0.058
	Household Income	6334.104	21.281	6	0.002
	Household Location	6350.353	37.530	6	0.000
	Number of people in household	6356.312	43.490	12	0.000
	Vehicles in household	6433.784	120.962	9	0.000
	Trip Purpose	6581.676	268.853	9	0.000
	Weekday	6413.802	100.979	3	0.000
	Population Density	6324.253	11.431	6	0.076
English/ New Zealanders	Intercept	406.813[a]	0.000	0	
	Age	408.605	1.793	3	0.617
	Gender	416.036	9.223	3	0.026
	License Status	431.647	24.834	3	0.000
	Main Activity	414.773	7.960	9	0.538
	Household Income	414.851	8.038	6	0.235
	Household Location	420.174	13.361	6	0.038
	Number of people in household	419.014	12.201	12	0.430
	Vehicles in household	434.133	27.321	9	0.001
	Trip Purpose	427.036	20.223	9	0.017
	Weekday	410.151	3.338	3	0.342
	Population Density	417.472	10.660	6	0.099
Mainland Southeast Asians	Intercept	307.942[a]	0.000	0	
	Age	310.092	2.150	3	0.542
	Gender	322.087	14.146	3	0.003
	License Status	327.375	19.434	3	0.000
	Main Activity	316.604	8.663	9	0.469
	Household Income	322.820	14.878	6	0.021
	Household Location	317.693	9.752	6	0.135
	Number of people in household	320.761	12.819	12	0.382
	Vehicles in household	328.439	20.497	9	0.015
	Trip Purpose	321.865	13.924	9	0.125
	Weekday	319.932	11.991	3	0.007
	Population Density	314.281	6.339	6	0.386
Chinese	Intercept	196.780[a]	0.000	0	
	Age	212.842	16.062	3	0.001
	Gender	203.728	6.949	3	0.074
	License Status	234.609	37.830	3	0.000
	Main Activity	214.526	17.746	9	0.038
	Household Income	206.657	9.878	6	0.130
	Household Location	208.568	11.788	6	0.067
	Number of people in household	218.912	22.132	12	0.036
	Vehicles in household	213.106	16.326	9	0.060
	Trip Purpose	231.039	34.259	9	0.000
	Weekday	206.174	9.394	3	0.024
	Population Density	211.050	14.271	6	0.027

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

a. This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

The final model(s) are relative to the mode car as a driver, and have in presented in Table C-7, Table C-8 and Table C-9. Each table represents the modes *car as passenger, public transport* and *active travel*, respectively.

Looking across the tables, most of the independent variables are acting in the predicted direction based on previous research. For example, having a full or probationary license[39] mean that one is over less likely to be driven in a car or choosing public transport, and less likely to use active travel when compared to driving. Being in full-time work decreases the odds of getting a ride from someone or using active travel. One is more likely to use if living in inner Melbourne. If the trip is on a weekend, it is less likely that the trip will be made public transport, and more likely as a car passenger. If a household has no vehicles, it increases one's chances of using transit or active travel considerably. However, there are broader generalisations, that may or may not hold across all immigrants (at least as per the analysis presented here).

However, the key focus of this thesis is on South Asians. Our findings show that South Asians are the *only immigrant group* where travel habits are significantly influenced by gender. Even when controlling for all other factors (income, household, age etc.), South Asian females are 10x more likely as South Asian males to be driven on any given trip, as presented in Table C-7. South Asian females are also 7x more likely to use public transport (Table C-8) and 5 times more likely to use active travel (Table C-9) than South Asian males. This highlights the strong possibility of cultural influences and /or past travel habits. It should also be noted that the sample size for Australian respondents was much larger than any of the other cohorts, so in-depth conclusions couldn't be made (statistical significance for many established parameters could not be established).

[39] Independent driving without probation

Table C-7 Multinomial Logistic Regression – Car as passenger (relative to car as a driver)

	Variables	Variable categories	South Asians		Australians		English / New Zealanders		Mainland Southeast Asians		Chinese	
			Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)	Sig.
Car as passenger	Intercept		-	0.687	-	0.000	-	0.01	-	0.543	-	0.143
	Age		0.977	0.324	0.991	0.055	0.990	0.63	0.989	0.616	0.916	0.073
	Gender	Male	0.109	0.000	0.482	0.000	1.011	0.98	0.126	0.001	0.195	0.026
		Female	-	-	-	-	-	-	-	-	-	-
	License Status	Learner's or No License	6.430	0.025	65.572	0.000	19 E20	0.99	50.613	0.002	9.9 E3	0.000
		Probationary or Full License	-	-	-	-	-	-	-	-	-	-
	Main Activity	Other	5.683	0.020	1.448	0.036	2.596	0.18	1.117	0.877	0.018	0.026
		FT/PT Education	2.393	0.446	1.318	0.333	0.000	0.99	0.667	0.778	0.082	0.198
		PT/Casual Work	0.667	0.533	1.101	0.501	0.817	0.76	1.464	0.532	0.249	0.183
		FT Work	-	-	-	-	-	-	-	-	-	-
	Household Income ($/wk)	Low (0-1100)	0.170	0.053	0.522	0.001	0.945	0.94	0.195	0.024	9.584	0.074
		Medium (1101-2250)	0.445	0.136	0.614	0.000	2.861	0.05	0.404	0.096	1.043	0.966
		High (2251+)	-	-	-	-	-	-	-	-	-	-
	Household Location	Inner Melbourne	3.052	0.340	1.076	0.707	0.618	0.59	0.684	0.686	0.154	0.239
		Middle Melbourne	1.424	0.528	0.856	0.330	1.573	0.50	0.948	0.930	0.457	0.453
		Outer Melbourne	-	-	-	-	-	-	-	-	-	-
	Household Size	1	0.000	0.998	0.262	0.000	0.000	1.00	0.000	0.996	0.000	0.997
		2	1.617	0.503	1.402	0.032	1.799	0.41	1.610	0.513	1.542	0.692
		3	1.045	0.943	0.928	0.647	1.322	0.68	0.891	0.855	0.402	0.359
		5+	2.493	0.259	0.843	0.344	1.657	0.53	2.367	0.212	0.374	0.557
		4	-	-	-	-	-	-	-	-	-	-
	Vehicles in Household	0	1.107	1.000	4.934	0.006	1.2 E8	0.99	1.1 E15	0.996	0.000	0.997
		1	0.730	0.598	1.630	0.003	1.382	0.60	1.888	0.308	0.317	0.302
		3+	0.274	0.109	1.014	0.917	1.109	0.87	0.972	0.969	0.104	0.163
		2	-	-	-	-	-	-	-	-	-	-
	Trip Purpose	Others	0.161	0.074	0.917	0.671	0.822	0.83	0.661	0.533	0.101	0.171
		Social, Recreation, Shopping	1.647	0.415	2.311	0.000	1.959	0.23	1.736	0.395	3.184	0.158
		Education	1.273	0.919	5.174	0.000	2.8 E7	0.99	0.467	0.759	0.000	0.997
		Work, Business	-	-	-	-	-	-	-	-	-	-
	Weekday	No	2.060	0.209	2.989	0.000	2.489	0.10	4.348	0.007	13.308	0.012
		Yes	-	-	-	-	-	-	-	-	-	-
	Home area population density (pp/km2)	4001+	0.000	0.998	0.751	0.355	15.371	0.01	0.453	0.701	14.426	0.268
		2001-4000	0.415	0.157	0.921	0.585	1.518	0.54	1.593	0.408	0.302	0.166
		0-2000	-	-	-	-	-	-	-	-	-	-

Table C-8 Multinomial Logistic Regression – Public Transport (relative to car as a driver)

	Variables	Variable categories	South Asians		Australians		English / New Zealanders		Mainland Southeast Asians		Chinese	
Public Transport	Intercept		-	0.353	-	0.000	-	0.33	-	0.292	-	0.277
	Age		1.001	0.954	0.986	0.010	1.000	1.00	1.043	0.251	0.910	0.021
	Gender	Male	0.146	0.001	0.948	0.690	0.194	0.00	0.764	0.713	0.576	0.390
		Female	-	-	-	-	-	-	-	-	-	-
	License Status	Learner's or No License	18.818	0.001	61.079	0.000	5.3 E20	0.99	49.495	0.008	1.0 E3	0.000
		Probationary or Full License	-	-	-	-	-	-	-	-	-	-
	Main Activity	Other	0.183	0.184	0.986	0.954	0.732	0.78	4.451	0.292	0.011	0.050
		FT/PT Education	0.317	0.642	1.036	0.914	0.000	0.99	35.994	0.080	0.596	0.741
		PT/Casual Work	0.499	0.269	0.878	0.456	0.581	0.43	1.771	0.546	3.432	0.192
		FT Work	-	-	-	-	-	-	-	-	-	-
	Household Income ($/wk)	Low (0-1100)	3.753	0.165	0.686	0.095	0.505	0.50	0.000	0.995	2.062	0.619
		Medium (1101-2250)	1.625	0.475	0.946	0.711	1.379	0.59	0.276	0.151	4.547	0.153
		High (2251+)	-	-	-	-	-	-	-	-	-	-
	Household Location	Inner Melbourne	5.353	0.117	2.762	0.000	8.961	0.01	2.117	0.518	1.538	0.789
		Middle Melbourne	1.206	0.789	2.081	0.000	0.832	0.84	0.195	0.089	11.270	0.030
		Outer Melbourne	-	-	-	-	-	-	-	-	-	-
	Household Size	1	0.003	0.065	0.549	0.032	0.435	0.54	0.000	0.996	18.508	0.044
		2	0.294	0.161	1.016	0.932	1.225	0.79	1.908	0.525	3.355	0.229
		3	0.758	0.669	1.206	0.333	0.469	0.31	0.257	0.240	3.420	0.247
		5+	0.538	0.500	0.993	0.974	0.544	0.62	2.679	0.333	10.770	0.068
		4	-	-	-	-	-	-	-	-	-	-
	Vehicles in Household	0	1.6 E10	0.995	48.675	0.000	5.5 E8	0.99	1.7 E15	0.996	0.211	0.400
		1	1.000	0.009	2.666	0.000	0.935	0.93	8.216	0.017	2.088	0.456
		3+	0.856	0.873	0.653	0.021	0.531	0.44	0.634	0.685	1.385	0.801
		2	-	-	-	-	-	-	-	-	-	-
	Trip Purpose	Others	0.147	0.029	0.132	0.000	0.000	0.99	0.064	0.056	0.013	0.007
		Social, Recreation, Shopping	0.059	0.025	0.252	0.000	0.270	0.05	0.215	0.188	0.727	0.700
		Education	2.745	0.682	6.096	0.000	3.4 E7	0.99	0.291	0.610	0.074	0.189
		Work, Business	-	-	-	-	-	-	-	-	-	-
	Weekday	No	0.189	0.032	0.552	0.007	0.858	0.87	0.171	0.227	0.278	0.336
		Yes	-	-	-	-	-	-	-	-	-	-
	Home area population density (pp/km2)	4001+	0.389	0.596	1.225	0.480	1.529	0.69	0.000	-	29.647	0.157
		2001-4000	1.731	0.389	1.133	0.479	0.787	0.75	0.338	0.213	2.925	0.210
		0-2000	-	-	-	-	-	-	-	-	-	-

Table C-9 Multinomial Logistic Regression – Active Travel (relative to car as a driver)

	Variables	Variable categories	South Asians		Australians		English / New Zealanders		Mainland Southeast Asians		Chinese	
Active Travel	Intercept		-	0.012	-	0.000	-	0.02	-	0.069	-	0.008
	Age		1.015	0.524	1.003	0.489	1.022	0.30	1.013	0.591	1.102	0.047
	Gender	Male	0.200	0.004	1.041	0.708	0.694	0.43	0.792	0.671	0.280	0.094
		Female	-	-	-	-	-	-	-	-	-	-
	License Status	Learner's or No License	16.366	0.001	25.414	0.000	6.5 E20	0.99	6.654	0.172	3.1 E2	0.007
		Probationary or Full License	-	-	-	-	-	-	-	-	-	-
	Main Activity	Other	4.422	0.036	1.626	0.003	1.193	0.81	0.806	0.807	0.000	0.010
		FT/PT Education	4.539	0.197	1.887	0.021	0.000	0.99	7.604	0.111	0.186	0.382
		PT/Casual Work	0.418	0.262	1.274	0.068	0.569	0.35	1.348	0.686	0.990	0.993
		FT Work	-	-	-	-	-	-	-	-	-	-
	Household Income ($/wk)	Low (0-1100)	0.262	0.138	0.708	0.050	0.211	0.09	0.239	0.108	5.443	0.234
		Medium (1101-2250)	0.613	0.414	0.856	0.197	1.086	0.87	0.584	0.424	1.239	0.845
		High (2251+)	-	-	-	-	-	-	-	-	-	-
	Household Location	Inner Melbourne	11.644	0.014	2.040	0.000	1.593	0.54	1.373	0.767	3.691	0.462
		Middle Melbourne	1.109	0.869	1.442	0.015	2.114	0.22	1.308	0.702	3.227	0.314
		Outer Melbourne	-	-	-	-	-	-	-	-	-	-
	Household Size	1	2.288	0.513	0.950	0.814	0.943	0.95	1.114	0.922	8.439	0.178
		2	1.221	0.806	1.137	0.393	0.811	0.73	1.976	0.404	1.127	0.928
		3	1.465	0.555	1.077	0.632	0.641	0.44	1.514	0.579	0.777	0.831
		5+	0.108	0.113	0.933	0.703	0.126	0.10	2.266	0.414	18.435	0.068
		4	-	-	-	-	-	-	-	-	-	-
	Vehicles in Household	0	1.7 E8	0.996	13.893	0.000	8.5 E8	0.99	1.997	-	0.569	0.746
		1	3.044	0.071	1.865	0.000	1.517	0.47	3.650	0.076	0.467	0.507
		3+	2.727	0.217	0.891	0.411	0.922	0.89	0.257	0.262	0.758	0.873
		2	-	-	-	-	-	-	-	-	-	-
	Trip Purpose	Others	2.117	0.328	0.375	0.000	0.252	0.15	0.365	0.262	0.627	0.748
		Social, Recreation, Shopping	4.706	0.022	1.096	0.431	0.951	0.92	2.531	0.183	14.477	0.013
		Education	0.000	-	1.603	0.310	0.091	-	5.586	0.348	39.490	0.072
		Work, Business	-	-	-	-	-	-	-	-	-	-
	Weekday	No	0.992	0.989	1.095	0.481	1.737	0.32	0.851	0.811	1.759	0.522
		Yes	-	-	-	-	-	-	-	-	-	-
	Home area population density (pp/km2)	4001+	0.076	0.159	1.821	0.009	8.416	0.02	1.339	0.841	0.000	-
		2001-4000	1.297	0.668	1.087	0.559	1.369	0.60	0.493	0.295	0.112	0.044
		0-2000	-	-	-	-	-	-	-	-	-	-