Taking the bus? Barriers and facilitators for adolescent use of public buses to school

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ABSTRACT

Transport to school can contribute significantly to adolescents' physical activity but in New Zealand – as in many other countries around the world – many adolescents are driven to school. Public transport offers an opportunity to integrate incidental active transport into school commutes. In this paper, we bring together multiple sources of data into a multi-method study to elucidate the barriers to and facilitators of public transport use by adolescents for school travel in Dunedin, New Zealand, a city with low rates of public transport use. The data include a public bus survey from Otago School Students Lifestyle Survey (OSSLS, 1391 adolescents); the Built Environment Active Transport to School (BEATS) Study parental survey (350 parents), focus groups (54 adolescents, 25 parents, 12 teachers) and semi-structured interviews (12 principals); interviews with three policy-makers from local/regional/national agencies; and analysis of 10 relevant local/regional/national strategies/transport plans. The findings show how distance to school, cost, parental trip chaining, built environment features, the weather, convenience, and safety perceptions are major barriers to using public transport to school. Moreover, current transport planning documents do not favour public health. A number of recommendations that could increase public transport use are made including: raising parking prices to discourage parents driving and trip-chaining; improving bus infrastructure and services; providing subsidies; and changing perceptions of public transport use and users. These actions, however, require collaboration between government authorities across the local, regional and national scale.

1. Introduction

Travel can provide access to employment and education, as well as opportunities for physical activity and social engagement (Mindell et al., 2011). How people travel affects both their own health and that of others (Cohen et al., 2014). Many factors affect travel mode choice, including perceptions of transport modes (e.g. perceptions of public transport in car-dominated societies (Murray et al., 2010)); political frameworks and environment; funding regimes; and the built and natural environment. New Zealand's transport system is characterised by high private vehicle ownership and use (Hopkins et al., 2015); limited availability and utilisation of public transport; and low rates of active transport (Shaw and Russell, 2016). At the same time, New Zealand had the third highest adult obesity prevalence among OECD countries in 2017, while 36% of 10–14 year olds were overweight or obese in 2016/2017 (Ministry of Health, 2017). Physical activity levels in New

Zealand children and adolescents are inadequate (Smith et al., 2018a,b) with just under 40% of those aged 8–18 years meeting minimum physical activity guidelines ($\geq$ 60 minutes of moderate to vigorous physical activity (MVPA) every day) (Kek et al., 2019; Smith et al., 2018a). Given reported reductions in physical activity (Aubert et al., 2018) and rises in obesity at all ages in most high income countries, the opportunity to use active travel (primarily walking and/or cycling) to incorporate physical activity into everyday life is particularly important.

The use of public transport is often associated with 'active travel', with opportunities for increased physical activity to and from bus, tram and train stations (Bartels et al., 2016; Besser and Dannenberg, 2005; Durand et al., 2016; Jones et al., 2012; Lachapelle and Pinto, 2016; Rissel et al., 2012). Public transport, which has a range of potential benefits for the health of the planet and of people, offers the opportunity to access educational, health and social sites while still incorporating a degree of physical activity and independence.

This is important, because rates of active travel to school have fallen in New Zealand over the past several decades (Ministry of Transport, 2015), similar to many high- (Gray et al., 2014) and middle-income countries (de Sá et al., 2015). In 2010–2014, only 3% of New Zealand adolescents regularly cycled and 27% walked to school (Ministry of Transport, 2015). This is mirrored by New Zealand adolescents' ongoing preference for car-based travel (Hopkins et al., 2019) and substantially less independent mobility for schoolchildren compared with earlier generations (Bhosale et al., 2017; Ergler, 2020; Porskamp et al., 2019). Barriers to active travel to school by New Zealand adolescents include home-to-school distance, time constraints, after-school activities, lack of social support, the convenience of being driven to school, the weather, environmental factors such as lack of cycle parking or cycle paths, lack of interest, and both adolescents' and parents' concerns regarding traffic safety and absence of school zoning (Hopkins and Mandic, 2017; Ikeda et al., 2018; Kearns et al., 2012; Mandic et al., 2015a,b, 2017, 2020).

Little is known about the factors which enable and constrain the use of public buses for school travel, unlike the myriad of studies of walking or door-to-door school buses (Hinckon, 2016; Howley, 2001; Park and Kim, 2010; Wilson et al., 2010) or public bus use in general (Barker et al., 2019; Broome et al., 2010; Moore, 2012; Simons et al., 2013). Distance is important, as is the bus service and quality including frequency, journey time and connections (Wilson et al., 2010; Hinckson, 2016; Broome et al., 2010). Safety associated with crowdedness and lack of seatbelts contribute to the negative perception of bus use (Hinckson, 2016). Nonetheless, adolescents reported enjoying the time to socialise on buses (Hinckson, 2016; Jones et al., 2012; Green et al., 2014), but bullying and the costs of buses were seen as barriers (Barker et al., 2019; Broome et al., 2010; Hinckson, 2016). In contrast, free public bus schemes can be physically and socially enriching experiences for young people (Goodman et al., 2014; Jones et al., 2012).

The research presented in this paper therefore aimed first to elucidate the specific barriers to and facilitators of public transport use by adolescents for school travel in a city with low rates of public transport use for this purpose. These data were complemented by analysis of relevant national, regional and local transport policy documents and interviews with policy-makers, to help identify potential strategies to increase public bus use.

2. Methods

2.1. Context

The city of Dunedin (population c.130,000) is located on the east coast of the South Island of Aotearoa New Zealand. Dunedin is a coastal city with a territorial land area of 3,314.8 km^2 and city-proper of 255 km^2. Built on the mouth of a 20 km long natural harbour, Dunedin has a relatively flat central business district (CBD), and hilly surrounding suburbs. Much residential housing is situated on the hills, requiring navigating often multiple hills and large distances to travel to school and work. Dunedin's transport system is therefore highly dependent on private car transport. A bus network provides Dunedin's public transport system; this was used for only 1% of all trips in 2012–2014 (Early et al., 2015). It has been reported that the bus network does not meet the expectations of users due to its low frequency and route system (Early et al., 2015). Regarding using the bus network for school travel, fewer than half of Dunedin's adolescents enrol in the closest school (Mandic et al., 2018), resulting in an increasing distance to school, reduced rates of active transport to/from school, and increased reliance on motorised transport, mainly by private vehicles (Mandic et al., 2017; Keall et al., 2020).

2.2. Data sources

This paper reports on multiple data sources (Fig. 1) which engaged with a variety of stakeholders on the question of public bus use by secondary school students. The specific research questions and the data sources used to address these are provided in Table 1. Each of the data sources and relevant research methods are described briefly below and summarised in Table 2.

2.2.1. Otago School Students Lifestyle Survey data

The Otago School Students Lifestyle Survey (OSSLS), conducted in the Otago region of New Zealand in 2009, included adolescents from ten of twelve Dunedin secondary schools (Mandic et al., 2012). All participants signed consent prior to participation. For students under the age of 16 years, parents had the option to sign parental opt-out forms if they did not want their child to participate. The questionnaire package included questions on demographics, school travel, lifestyle habits and sport participation (Mandic et al., 2012) as well as public bus service (including open-ended comments) and youth space preferences. The questions relating to demographics, travel to school and public bus use in Dunedin were analysed using descriptive statistics. Findings (including comments from open-ended questions about the public bus service in Dunedin) were summarised and presented as a technical report for the Dunedin City Council (DCC) and the Otago Regional Council (ORC) (Mandic and Skidmore, 2010). Original research data from that study were analysed for this paper.

2.2.2. Built Environment and Active Transport to School (BEATS) study

All 12 Dunedin secondary schools participated in the BEATS Study, which was conducted in Dunedin, New Zealand 2013–2017 (Mandic et al., 2016). The overall study included surveys of secondary school students and their parents, focus groups with students, parents and teachers and 12 semi-structured interviews with school principals (Fig. 1, Table 2) as well as assessment of the built environment characteristics of the home and school neighbourhoods. Participants signed written consent prior to participation. For students under the age of 16, parents signed either opt-in or opt-out consent, based on the school's preference.

Data from the bus to school section of the BEATS Parental Survey completed by 350 parents (one parent per household) were used to analyse parents' perspectives on Dunedin adolescents' use of public buses to school (Table 1). BEATS focus groups and interviews were designed and conducted by DH with another research staff member present. Discussions covered a wide range of topics including but not limited to the norms, experiences and perceptions of different transport modes such as public transport (Mandic et al., 2016; Sandretto et al., 2020). All sessions were recorded and subsequently transcribed. LC (see CRediT statement) developed a coding framework and coded all transcripts of the interviews with adolescents, parents, teachers and principals, with a particular focus on participants' perspectives on facilitators and barriers to bus transport to school. The initial codes were regularly discussed and checked by CE and then developed into themes (Braun and Clarke, 2006). The qualitative interviews along with the open-ended comments in the adolescents' bus survey provided insights into the complexities of why using a bus to school seems to be less appealing than other modes of transport for many people. An overview of the themes and sub-themes developed is provided in Table 3. Four main themes were created: 1. transport mode; 2. perceptions, knowledge and experience; 3. climate and weather; and 4. school travel responsibilities.

2.2.3. Policy analysis

Three national, three regional and four local/city level policy documents published between 2003 and September 2017 (Table 4) were chosen to gain insights into the land transport hierarchy of New Zealand and how public transport is planned for different levels. These ten documents were selected based on their relevance to transport to school both in the national and local context and ranged from legally binding documents to strategic documents and plans. All documents were publicly available, downloaded from the official government
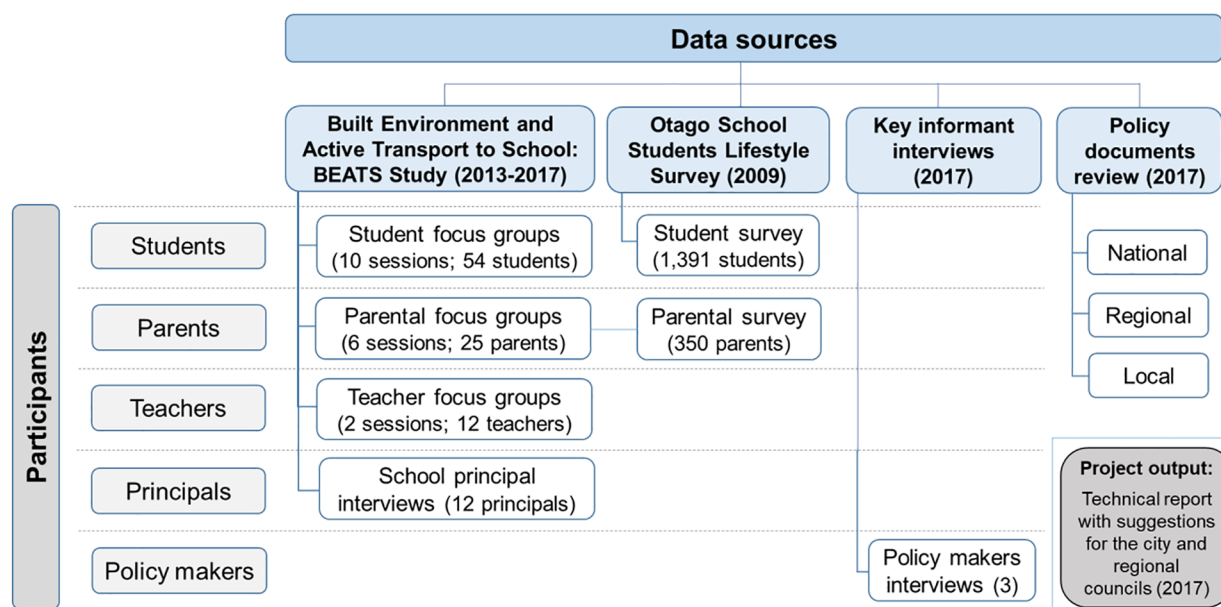
Fig. 1. Data sources, participants and a project output.

websites and then coded thematically and assessed as to whether they: discussed transport to school; considered public health from a transport perspective; approached public health from a physical activity point of view; and/or placed any emphasis on transport diversity. The policy analysis informed the development of the interview schedule with policy-makers to gain, for example, a better understanding of existing and planned integration initiatives and roadblocks for a move towards a more intgrated, multi-modal transport system (section 2.2.4).

2.2.4. Policy-maker interviews

Interviews were undertaken with three policy-makers working in Dunedin, to provide further insight on public transport issues raised by the adolescents, parents, teachers and principals and on policy issues that emerged as a result of the policy analysis such as planned and desirable initiative for enticing public transport in light of known usage barriers. Interviews were conducted with one person from each of the New Zealand Transport Agency (NZTA), ORC, and DCC. These three agencies - directly and indirectly - shape and implement policy directives into the Dunedin transport system and thus can provide institutional insights. Individuals were selected based on their knowledge and involvement in shaping and oversights of Dunedin's transport system at the local, regional and national level. Participants were invited by email and they signed written consent prior to participation. These interviews, designed and conducted by LC (see CRediT statement), focused on barriers and enablers for adolescents using public transport to school; issues for developing an effective public transport policy to school; the role of policy for increasing public transport use; and general issues of the current transport system. The interviews were digitally recorded, transcribed, coded and analysed thematically by LC with input from CE. Three themes were developed from interviews with policy-makers relating to: barriers and enablers for using public transport; issues of the current transport system and for developing an effective transport policy; and the role of policy for increasing public transport use (Table 5).

2.3. A multi-method approach

This paper brings the four methods and datasets described above into conversation using a multi-method approach. Multi-method approaches differ from mixed methods, as they may not be designed with multiple methods in mind, and thus the 'mixing' of the different data

sets is not pre-planned, but rather occurs after all of the data sets have been independently collected and analysed. This approach overcomes the inherent weaknesses and limitations from the different methods independently, and deliberately combines a diversity of methods within one investigation (Brewer and Hunter, 1989). Yet like some forms of mixed methods, the different methods are *"practiced in parallel… [weaving] together diverse research techniques to fill gaps, add context, envision multiple truths, play different sources of data off each other, and provide a sense of both the general and the particular"* (Cope and Elwood, 2009: p5). This relates to a pragmatist philosophical stance which focuses on 'what works' for a particular topic, question or concern (Rossman and Wilson, 1985). In the present investigation, our use of multiple methods allowed us to engage with wider sets of actor groups, perspectives and understandings around bus use in the case study city, Dunedin. None of the methods or data sets, and thus no participant groups, were prioritised, but all were viewed as equally important for helping us to understand bus use. In doing so we shed light on the diversity and complexity of needs and experiences and thus provide richer strategies to increase public bus use than a single method or dataset is able to do. The data were collected at different times over an 8-year period (2009–2017), therefore they were collected sequentially. The different methods were brought together to help the authors understand the barriers to and facilitators of adolescent use of public buses for school transport in a comprehensive and detailed way and to formulate relevant policy suggestions and strategies.

2.4. Research ethics

Research ethics approval was obtained for each of these studies from the University of Otago Ethics Committee (reference numbers: 13/203 (BEATS); 09/128 (OSSLS); D17/299 (policy-maker interviews)).

3. Results

3.1. Survey of adolescents in Dunedin: Findings from the Otago School Students Lifestyle Survey (2009)

In 2009, 1398 students (54% boys; age: 15.1 ± 1.2 years; 79% school years 9–10, 21% school years 11–13; 76% New Zealand European) from ten Dunedin secondary schools completed Young People's Bus Survey as part of the Otago School Students Lifestyle

Table 1
Use of data sources to address specific research questions.

Research question	Data sources			
	Built Environment and Active Transport to School (BEATS) Study	Otago School Students Lifestyle Survey	Key informant interviews	Policy documents review
How much are public buses used by adolescents for travel to/from school?	✓	✓		
What are the barriers & facilitators influencing adolescents' use of public buses for school travel?	✓	✓		
What are the schools' perceptions of the barriers to & facilitators of adolescents' use of public buses for school travel?	✓			
What aspects should be considered by policy-makers when developing a public transport to school policy for adolescents?			✓	✓
What policies are likely to increase use of public buses for school travel?	✓	✓	✓	✓

Survey (OSSLS). Overall, 61% of Dunedin secondary school students used public buses, with no significant difference between school years. In the total sample, the most common locations that students travelled to by bus were school (22%), shops in the town/city centre (29%) and other shops (16%) and recreational facilities (11%).

Among public bus users, 15% used the bus to get to school on a daily basis, 22% nearly every day, 15% once or twice per week and 49% never or hardly ever. Less than 8% of public bus users reported daily or nearly daily use of public bus to all other locations. Overall, 57% of students usually travelled on the bus with friend(s), 27% travelled alone, 7% with a sibling, 4% with a parent or other adult, and 5% with other(s). Among students who used public bus, 72% liked travelling by bus. The most frequently reported reasons why students liked travelling by bus included: getting to a desired location (89%); socialising with friends on the bus (85%); the bus being warmer and drier than walking or cycling (83%); independence (82%); taking a bus being easier than walking or cycling (75%); and no need to look for a car park (72%). Students also perceived bus drivers as friendly (52%) and buses as an environmentally friendly way to travel (60%) and safer than cycling (63%).

The most frequently reported barriers to public bus use among adolescents were cost, being driven around by parents, travelling long distances, infrequent and slow bus service, unsuitable bus timetable and lack of knowledge of the bus timetable (Table 6). Compared with bus users, a greater proportion of students who were not using public bus reported barriers associated with the public bus cost, waiting or getting to the bus stop, lack of company for riding on the bus and lack of knowledge of the bus timetable (Table 6). Non-bus users also reported higher rates of being driven around by parents and of car ownership and were less concerned with the bus frequency and timetables compared with bus users.

3.2. Survey of parents of adolescents in Dunedin: Findings from the BEATS Parental Survey (2014–2017)

Parents (n = 350; parent age 47.5 ± 5.2 years; 77% females) of secondary school students (student age 14.9 ± 1.6 years; 52% girls) from all 12 Dunedin secondary schools completed the BEATS Parental Survey (Mandic et al., 2020b). Overall, 72% of students used motorised transport to school, 22% used active transport and 6% used mixed modes. Nine percent of parents reported that their adolescent children travel to school using public bus. The average distance to school was 7.2 ± 8.4 km (median: 4.4 km; IQR: 2.4 km to 9.5 km), with no significant difference between parents whose adolescents travelled to school by bus and those whose adolescents who did not. Overall, 24% of parents reported having both public and school bus service available near their home, 46% had public bus only, 21% had school bus only, 7% had no public or school bus service and 1% were unsure.

The most frequently reported parental barriers to public bus use were adolescents' extracurricular activities; perceived convenience of car trip chaining; and the cost of public buses (Table 7.). Perceptions of convenience of car trip chaining and living too close to school or too far from a bus stop were significantly different between parents whose adolescents travelled to school by public bus compared with their counterparts who did not.

3.3. Findings from focus groups, interviews and open-ended survey questions

The qualitative insights from parents and adolescents showed the importance of private motorised transport, particularly as this related to perceived convenience, and cost. Convenient travel was interpreted as "*quick*" and/or "*easy*" transport options, which in turn makes public transport a less appealing transport mode. For example, one adolescent stated that *"I like to be able to be flexible with my travelling times because there is too much pressure to catch the bus at the right time when I can just*

Table 2
Summary of data sources and research methods.

Data	Study (Year(s))	Participants	Recruitment	Data collection details	References
Student survey	OSSLS (2019)	1398 adolescents from 10 school	Through school	30–40 min online survey Completed at school, during school time, supervised by researchers	(Mandic et al., 2012)
Parental survey	BEATS (2014–2015)	350 parents from 12 school	Through workplaces, social media, and at sporting events	20–25 min online or paper survey Completed in spare time	Mandic et al., (2020)
Student focus groups	BEATS (2014–2015)	54 adolescents from 10 schools	Through school	45–60 min per session 10 sessions (1 per school) Conducted at schools at lunch time or immediately after school	(Hopkins et al., 2019; Hopkins and Mandic, 2017)
Parental focus group	BEATS (2014–2015)	24 parents	Through workplaces, social media, and at sporting events	45–60 min per session 6 sessions Conducted after work hours	(Hopkins and Mandic, 2017)
Teachers' focus group	BEATS (2013–2014)	12 teachers from 2 schools	Through school	45–60 min per session 2 sessions (1 per school)	(Mandic et al., 2016)
Principal's interview	BEATS (2014–2015)	12 school principals from 12 schools	Through school	45–60 min per session 1 semi-structured interview (1 per school) Conducted at school during school time	(Mandic et al., 2016; Sandretto et al., 2020)
Policy analysis	N/A (2017)	10 documents	Websites	Key word search in local, regional and national government websites	N/A
Key informant interviews	N/A (2017)	3 policy-makers	Through professional contacts	30 min per session 1 session per person	N/A

BEATS: Built Environment and Active Transport to School Study; OSSLS: Otago School Students Lifestyle Survey.

Table 3
Analysis of qualitative data from focus groups, principal interviews and open-ended survey questions.

Theme	Sub-theme (no. of references)
Mode of transport	Travel habits (72) • Convenience and trip chaining (29) • Good parenting, decision making and allowances (34) • Societal changes (4) • Responsibilities for transport (5) • Distance (13)
Perceptions, knowledge and experiences	Costs (59) • Reliability and service offered (88) • Being late by taking the bus (33) • Frequency of services (19) • Unreliable service (19) • Route (17) Negative experiences and perceptions of using the bus (152) • Bus drivers and treatment of passengers (36) • Timing, duration and route of service (22) • Maintenance of buses (32) • Other passengers and crowdedness (24) • Stigmatisation of buses and users (29) • Attitudes and boredom (12) • Health and concerns for health and safety (26) Unawareness of bus services and handling of buses (16) Built environment (24) Environmental (Planetary health) (2)
Climate and weather	Climate and weather (47)
School travel responsibilities	(Dis)advantages of school bus services (16) School transport policies (28) School choice (22)

reflected on the perceived 'time savings' accrued from being driven to school (by parents, caregivers, friends), which were interpreted in relation to time which may be spent waiting for and travel on buses.

Dunedin adolescents habitually use private vehicles for both school and general travel purposes. This was coupled with parental practices, and perceived convenience to drop their children at school en-route to or from work, even when this means their offspring has to arrive much earlier than required. For example, a parent stated that: "*I think it's just whatever fits in with the parents, whatever makes it easier for the parents… some children that I know of are being dropped off at school at like 8:00*" *[parental focus group 4]*. Trip chaining is perceived as normal, appropriate and convenient within the busy family life. Families highlight the extra financial costs associated with bus travel when the car is taken out already: "*If you're driving into work then it will cost you more to put your kids on a bus, it's cheaper just to drop them off*" *[parental focus group 2]*. This was reiterated by students, who noted that the bus "*needs to be cheaper*" and that "*it costs way too much just for one zone*" *[bus survey]*.

While for some students their place of residence dictated their choice of transport, others revealed that they had little input in the decision making on their mobilities. For some, the distance to their school was simply "*too far*" to use public transport, with participants stating that: "*service is out of reach to some places I need to go*" *[bus survey]*. Others did not have parental permission to use public transport or sought to avoid potential disagreements with their parents or family members. Moreover, many participants feared being late for school or other activities, with the potential for negative repercussions deterring them from using the bus: "*Sometimes the buses are late and I might miss out on an important event or school*" *[bus survey]*. School principals also highlighted that their pupils either arrive early or are late as public bus schedules are not in synchronicity with the school day (see Table 3). Participation in extracurricular activities also reinforces the use of private vehicles, with students stating: "*I am so busy and I have so many activities to go to so I don't really go on the bus*" *[bus survey]*.

It was not only the unreliability of the bus schedule, but also the infrequent running times of buses that create problems for adolescents as "*[t]ime table doesn't work with what I want to do*" *[bus survey]* and there are "*[n]ot enough busses running, there are like 45 min gaps*" *[bus survey]*. The low uptake of bus use is also linked to students' lack of knowledge of how to use Dunedin buses, their unfamiliarity with the different routes, and managing the timetables. Therefore, it is not

drive myself and not have to worry" *[source: bus survey]*. In turn, this means that public bus transport becomes synonymous with a slower speed, less reliability and lower frequency than alternatives – such as the private car. Thus, perceptions of bus transport occur in direct relation to other transport modes, and are interpreted through the lens of the dominant car-based transport system. For instance, participants

Table 4
The ten policy documents analysed for this research project.

N	Policy document	Year	Reference
	National policy documents:		
#1	The Land Transport Management Act (LTMA)	2003	(Land Transport Management Act 2003, 2003)
#2	New Zealand Transport Agency's 2013 Guidelines for preparing regional public transport plans	2013	(New Zealand Transport Agency, 2013)
#3	Government Policy Statement on Land Transport 2015	2015	(New Zealand Government, 2015)
	Regional policy documents:		
#4	Otago Regional Land Transport Strategy	2011	(Otago Regional Council, 2011)
#5	Otago Regional Public Transport Plan 2014	2014	(Otago Regional Council, 2014)
#6	Otago Southland Regional Land Transport Plans 2015–2021	2015–2021	(Otago Regional Council and Environment Southland, 2015)
	Local / City level policy documents:		
#7	Dunedin City Council District Plan	2006	(Dunedin City Council, 2006)
#8	Dunedin towards 2050: Spatial plan for Dunedin	2012	(Dunedin City Council, 2012)
#9	The Dunedin City Integrated Transport Strategy	2013	(Dunedin City Council, 2013)
#10	Dunedin Second Generation Plan	2017	(Dunedin City Council, 2017)

Table 5
Qualitative analysis of the interviews with policy-makers.

Theme	Sub-theme (no. of references)
Barriers and enablers to use public transport to school	Cost of bus service (11)
	Safety (14)
	Providing for the transport disadvantaged (6)
	Travel practices (6)
	Time and convenience (6)
Issues of the current system and for developing an effective transport policy	Collaboration (15)
	Providing for the transport disadvantaged (6)
	Planning documents (6)
	Public bus compared to school bus (8)
Role of policy for increasing public transport use	Transport policies (9)
	Future planning (11)

surprising that many students voiced their concerns of selecting the right bus for their needs, or missing their required stop and consequently alighting in an unfamiliar environment. As a result, the bus was identified as a last resort – an option if all else failed. This means that students are travelling by bus at a time of stress and/or pressure, thus intensifying the experiences of uncertainty and time constraint.

Adolescents identified the bus, and those who travelled by bus, in terms of the 'loser cruiser', which may underpin a concern of using this mode, and of being associated with regular bus clients. This was articulated by a bus survey participant who said that buses *"smell, [are] filled with weirdos and strange people who can't afford a car"*. However, some students developed coping strategies to make their experience on the bus more pleasant, and quicker, for instance by taking an earlier, less crowded bus. A student focus group participant stated that *"There is a difference between catching the 7:20 bus and the 7:30 bus. The 7:20 bus will get you here about 7:30–7:35, whereas the 7:30 bus will get you here at like 8:00; because it's stopping and starting. It gets busier and it takes so long, which is why I prefer going early"* [student, focus group 8].

3.4. Policy analysis

Among the ten analysed policy documents, six explicitly discussed transport to school (#2, #4, #5, #6, #8, #9, Table 4); two considered public health from a transport perspective (#3, #8); and one approached public health from a physical activity perspective (#9) (Copland, 2017). Four documents placed an emphasis on transport diversity: providing for both young, physically active people and elderly or mobility-impaired transport-disadvantaged people (#4, #6, #8, #9). Car dependence and the ways it manifests as an issue at different scales was mentioned in several local documents but few documents explicitly discussed how car dependence can be addressed. One document (#5)

identified greater use of public transport to school by adolescents as a desirable goal. Yet public health was neither prioritised nor legislated for in transport planning in New Zealand at that time, which focused then on growth and viability. Dunedin appeared as an exception, as strategic planning documents (e.g. #9) refereed to the intersections between transport and public health.

3.5. Interviews with policy-makers in Dunedin

Three themes emerged from analysing interviews with policy-makers, relating to: barriers and enablers for using public transport; issues of the current transport system and for developing an effective transport policy; and the role of policy for increasing public transport use (Table 5).

Policy-makers noted the roles of pricing strategies and the cost of using public transport as a potential barrier to bus uptake, and this is understood in relation to – or competition with - other modes such as private car. As the capital and annual fixed costs of car ownership are often not directly considered by private vehicle drivers on a day-to-day basis, the cost of bus transport needs to compete with the daily marginal costs of driving, such as parking and petrol. A DCC participant reflected upon this, noting how *"It's actually very expensive to own a car, but people don't perceive it to be that way. You've got to keep it on the road, and gas, and tyres and all that sort of thing"*.

The pricing structure of bus transport was also seen in relation to wider transport policies. For instance, in Queenstown, a town in the Otago region, New Zealand, for which the ORC also plays a role in transport planning, parking revenue directly supports subsidising the bus system, thus allowing lower prices for the public bus compared with other places in the country, such as Dunedin. An ORC participant noted that *"if we did something similar with the Dunedin City Council and their parking revenue, we could introduce more competitive fares"*, both suggesting a possibility for reducing the cost of bus transport, but also understanding the connections between private and public transport at the policy level. A change in policy through *"…car-parking charges or road pricing might get the parents to change their behaviour"* [DCC respondent].

The public buses are often used by students to travel to school, yet these operate separately – with different management and pricing structures – from school buses. While traditionally students used dedicated school buses, participants noted how changes in the national policy was increasing the number of students using public buses, which means that *"[transport to school is] becoming more a part of our remit as a council"* (ORC respondent) and thus, *"[the ORC] have made a decision in their Regional Public Transport Plan that there isn't really a need to fund separate school services for kids, they can use the new (public) network"*. This raises questions about the suitability of their network for school transport, the public/student mix, but also funding the public network

Table 6
Barriers to public bus use in Dunedin as reported by secondary school students.

	Total sample n = 1391 (% agree)	Bus users (n = 850) (% agree)	Not bus users (n = 541) (% agree)	p-value
Cost				
It's cheaper to travel by car with friends or family	57%	54%	61%	0.015
I often don't have enough money for the bus fare	32%	35%	28%	0.006
I'm not able to pay the fare by mobile phone	21%	21%	21%	0.888
Choice of travel				
My parents always take me where I want to go	49%	42%	60%	< 0.001
Because I have a long way to go, I'd rather go by car	47%	43%	53%	0.001
I'd rather walk or bike the whole way	33%	27%	44%	< 0.001
I don't have anyone to go with and don't want to travel alone	26%	22%	34%	< 0.001
I have my own car and don't need to go by bus	21%	17%	27%	< 0.001
The bus trip				
The bus service is too slow	44%	42%	46%	0.226
I am scared the bus will be delayed and I'll be late for school/ the event I'm going to	28%	29%	27%	0.301
Frequency of buses				
There aren't enough bus services at weekends	44%	51%	33%	< 0.001
There aren't enough services at the times I want to travel	43%	48%	36%	< 0.001
The timetable does not suit school/event start of finish times	35%	37%	31%	0.013
I would have to change buses to get to the places I want to go	31%	33%	28%	0.063
Bus stops				
I don't like waiting at the bus stop, it's cold and wet	35%	35%	36%	0.532
It's too far or too difficult to walk to the bus stop from my home	20%	19%	22%	0.166
I don't like waiting at the bus stop, it's scary	15%	13%	19%	0.003
I have to cross a busy street to get to the bus stop	9%	7%	12%	0.002
Using the bus timetable				
I don't know the bus timetable for the places I want to visit	41%	36%	48%	< 0.001
I don't know the bus times for the area I live in	35%	27%	49%	< 0.001
I can't understand the bus timetable	20%	15%	27%	< 0.001
My parents haven't explained to me how to use the bus timetable	13%	9%	19%	< 0.001

Source: Otago School Students Lifestyle Survey 2009.
Notes: The response options were 'yes' and 'no', with 'yes' responses being reported as '% agree'.
The five most common 'other' responses included unfriendly bus drivers, distrust of other passengers and fears for safety, fears of getting on the wrong bus or off at the wrong stop, and receiving no help from bus drivers, parents that do not trust the service, or other people, and would not let their children use it, and dislike of sitting next to unfriendly unfamiliar people.

and the complex entanglement of and less than streamlined involvement of different agencies in providing bus services. One participant argued:

"I think one of the areas you would conjure with is the division of responsibility between the Ministry of Education providing buses to school, and the public bus system (run by the ORC) to support kids to school, there is sort of two views aren't there? I.e. we don't want children polluting our normal [public] buses, but equally, I personally think that they could be a very useful sort of revenue to support the public bus service" [DCC respondent]

It was clear that Dunedin policy-makers thought that health is about

healthcare and treating illness, rather than about maintaining good mental and physical health. The decisions made by the local and regional councils do not relate to public health objectives but are focused on accessibility and safety, with one participant noting *that "I think traditionally public health hasn't had a lot of influence on decision-making. … most of my professional career we've been very focused on doing no harm, so safety's been really important, so that's driven down kids walking and cycling to school"* [DCC respondent]. At the regional scale this point was also made, with a participant noting how:

"[the link between physical activity and public transport is] not [emphasised in the Otago Regional Public Transport Plan], I mean I don't really know how we would incorporate it, because the plan is

Table 7
Barriers to public bus use in Dunedin as reported by parents of secondary school students.

	Total sample of parents (% agree)	Parents of adolescents travelling to school by bus (n = 32) (% agree)	Parents of adolescents not travelling to school by bus (n = 318) (% agree)	p-value
My child has other activities before or after school	65%	59%	66%	0.450
I am already taking the car out, so it is more convenient to drive my child	59%	25%	62%	< 0.001
The bus is too expensive	45%	50%	45%	0.562
The bus trip takes too long	28%	19%	29%	0.235
The buses do not have bike racks for use free of charge	26%	25%	27%	0.855
We live too close to school	19%	0%	22%	0.004
The bus stop is too far from home	15%	3%	17%	0.043
I am concerned that my child could be bullied on the bus	7%	3%	8%	0.355
I believe it is unsafe for my child to walk to the bus stop	8%	3%	9%	0.265
I believe it is unsafe for my child to wait at the bus stop	6%	0%	7%	0.124

Source: BEATS Parental Survey 2014–2017.
Note: Responses were collected using a 4-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. Data for '% agree' represents the sum of 'strongly agree' into 'agree' responses.

sort of a 'cover all' type policy, and yeah we just have a lot of elderly and disabled, so it's like trying to provide for two polar opposites" [ORC respondent]

Changes to young people's behaviours and practices, particularly at the intersection of technological innovation were identified as potential opportunities for incentivising bus travel. For instance, a participant from the NZTA noted: *"You don't want kids waiting for ages for a bus at a bus stop because there's a perceived danger that people have. So, with technology, it can be 'just in time' type stuff, so that kids can get to the stop, the services are there and they can see where the bus is."* This can mean that the perceived safety of bus transport increases. As well as safety benefits, real-time information on smart devices was thought to make bus transport more appealing by offering accurate information on-the-go, an NZTA participant *argued "anything on a smartphone is definitely more attractive to teenagers"* [ORC Respondent]. Such real-time information could reduce uncertainty; reduce waiting times by facilitating users' appropriate arrival times at the bus stop; make bus use easier; and be an efficient method for easy payment.

Such technologies also have the potential to offer better integration between modes, so that bus transport is no longer seen in isolation from other modes, such as active modes (walking, cycling) but also connectivity between types of public transport, taxi-hubs and more. An NZTA participant noted how *"a key role for us is working towards really good integrated transport solutions as part of a whole system. So we are much more into the system thinking now… you can't just think of it as once they [students] are on the bus they are done with […] So we've got to look at opportunities for people to maybe get off the bus and jump on the bike to get home, and then you know, it's just making the whole thing more convenient and just giving more opportunities and choice really".*

4. Discussion

4.1. Barriers to school travel by public bus

Most adolescents in Dunedin did not travel to school by bus. This trend differs from cities such as Vienna where most high school students travel by bus. However this is not to suggest that the bus is the preferred mode, as more than 80% of those Viennese bus users reported a preference for a different transport mode (Stark et al., 2019). Fig. 2 summarises the major barriers to Dunedin adolescents using public bus transport to school: distance from home to school, cost, parental trip chaining, built environment features, the weather, the convenience of car-based travel, the public bus services, including their infrastructure and information, and safety concerns. Although a study of Hong Kong adolescents found that perceived distance to public transport stops was a significant factor influencing active travel in boys (Barnett et al., 2019), distance to the bus stop was relevant in our study only when there was no service that came to that locale. In line with studies elsewhere (Berggren et al., 2019), waiting times and unpredictability of service were also significant factors in determining positive perceptions and use of public transport to school. Nevertheless, it is important to note that Fan and colleagues highlighted how transit users generally overestimate the time spent waiting but the presence of amenities, including benches and shelters, ameliorated this (Fan et al., 2016). This suggests that perceived wait times may be exaggerated, and highlights the important role infrastructure plays in overcoming these barriers.

The norm of families dropping off and picking up their children by private car is consistent with the preference for car-based travel among Dunedin adolescents (Hopkins et al., 2019). This leads to two important policy considerations. First, inflexibility of workplace has meant a home office option is rare; inflexibility of working hours precludes different start times that would allow different transport options, such as the bus, for both adolescents and their parents. Recent experiences of home-working during the COVID-19 pandemic may, however, change attitudes to home-working as a feasible option for office-based workers on some, if not all, workdays or more flexible start and end times that suit families' needs better.

Skarin and colleagues pointed out the multiple ways in which household members affect each other's travel and recommended focussing on household context, not just individual travel behaviours (Skarin et al., 2017), and this is important here too. One fundamental issue is that of choice of school, which is both influenced by household resources and affects travel distances required and modes used (Jarvis and Alvanides, 2008; Mandic et al., 2017b; Sandretto et al., 2020).

Secondly, the idea that good parents show their care for their offspring through chauffeuring them around needs to be altered and socially sanctioned. This is particularly important given that parents play a critical role in decision-making about adolescents' mode of travel to school (Mandic et al., 2020b). Instead, the benefits of using public transport for adolescents' independence and health (Goodman et al., 2014) needs to be emphasised and be positioned at the centre of discussion, along with emphasising to adolescents the environmental impacts of their travel mode, as has been explored in Denmark (Møller et al., 2018).
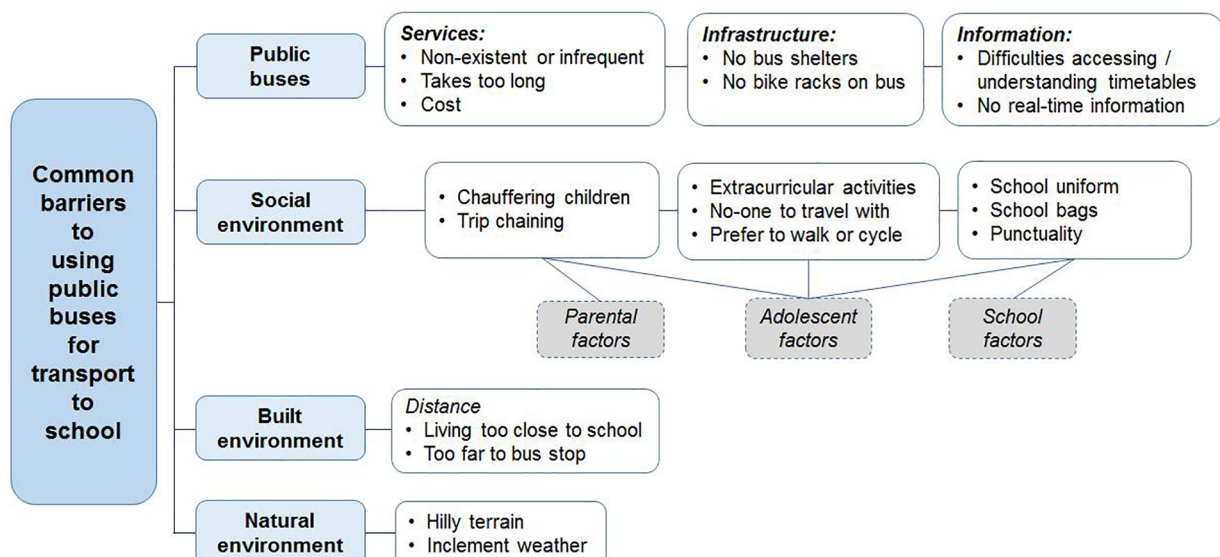

Fig. 2. Common barriers to using public buses for transport to school.

One encouraging aspect was the willingness of all 12 school principals for their school and themselves to be included in this research. This is important, given findings in Canada that lack of involvement of principals (and parents and students) was a key barrier to implementing a school travel plan effectively (Mammen et al., 2015). Thus, it becomes clear that a multi-actor and multi-institution (including government agencies) response to shift attitudes and increase the adoption of active and public transport modes is required, which takes into account the relations between actors and institutions.

From the findings of this research, a number of policy recommendations emerged (Copland, 2017; Copland et al., 2017) to encourage Dunedin adolescents' use of public buses for school travel. Policy recommendations for both city and regional councils focused on financial aspects, weather, safety and user needs. Additional city- and region-specific recommendations were also outlined in the report prepared for the city and regional councils (Copland et al., 2017). It is clear from the research that there is potential for cities to learn from one another. Literature on urban policy mobilities (e.g. McCann, 2011) has often focused on large cities, and between countries. However, our data suggest there may be much for small cities to learn from one another within one country.

4.2. Changes to policies over time

Analysis of the policy documents revealed that economic growth and efficiency but not public health were the key considerations in transport policy in the period to 2017. The exceptions were the strategic planning documents for Dunedin, in which the effects of transport choice on the public's health was mentioned. There were also conflicting aims regarding public health. After this policy analysis was conducted, a change of government and of national priorities for transport in New Zealand occurred, with different outcomes prioritised, including inclusive access, healthy and safe people, and environmental sustainability (New Zealand Ministry of Transport, 2019).

The Land Transport Management Act (New Zealand Government, 2003) mandated regional government to plan for 'transport-disadvantaged' people; which in Dunedin results in bus stops being a maximum of 400 m apart (in areas with bus routes). While this is beneficial in reducing inequalities in access, it minimises the amount of physical activity adolescents would obtain from walking or cycling to and from bus stops to levels unlikely to contribute to their health (Duncan et al., 2016). Nonetheless, the free bus travel scheme for young people in London has encouraged greater use of bus transport for short trips without significant impact on adolescents' overall active travel (Green et al., 2014), even when bus stops are in close proximity.

Policy-makers felt that enticing adolescents to use public transport for school travel is challenging in a society with an embedded car culture. However, interviews with policy-makers suggested a slow but positive change, with new investment in Dunedin's public bus network and real-time information technology, at bus stops or using apps, to increase the user-friendliness of public transport and address some of the barriers mentioned by students, parents and school principals. Cats and Loutos found that although apps underestimate waiting times, they were much more accurate than timetables (Cats and Loutos, 2016). Alternative ways of funding public transport were also being explored by policy-makers such as a flat rate for young people. In London, the provision of free bus travel to adolescents had increased bus use and decreased travel poverty (Jones et al., 2012).

The findings from our study were used to develop a set of recommendations to inform policy-makers (Copland et al., 2017). Policy documents published in the past two years have shown some shift. The updated Otago Regional Transport Plan (2018), for the first-time, links public health concerns and transport. The 2017 NZTA update of guidance on preparing regional transport policies focuses on public transport (New Zealand Transport Agency, 2017). The 2018 version of the Government Statement on Land Transport recommends the importance of mode shift from private vehicle travel, particularly in urban areas, and commits to increasing funding for walking, cycling, public transport and road policing (New Zealand Government, 2018). The strategic direction includes commitments to 'mode-neutrality' (i.e. considering all modes), reversing the previous assumptions favouring private cars, and to reducing greenhouse gas and adverse effects on the local environment and public health. The updated Otago and Southland Regional Land Transport Plan (Otago Regional Council and Environment Southland Regional Council, 2018) has a focus on economic growth but also commits to improving both public transport and safe walking and cycling linkages (including creating a network of cycle trails in southern New Zealand), as well as actions to reduce serious road travel injuries and deaths. In addition, recent policy recommendations for increasing active transport in New Zealand also recommend improving public transport (Mandic et al., 2019, 2020a). Since transport contributes about 40% of New Zealand's carbon emissions (Statistics New Zealand, 2019), the government will need to develop a strategy with clear goals related to modal shift to achieve the goals set in the recently approved Carbon Zero Act (New Zealand Government, 2019).

4.3. Strengths and limitations of the studies

Strengths of this study include the multiple sets of data in one city. The use of a comprehensive set of both qualitative and quantitative data provides insights on perspectives of potential public bus use from adolescents, parents, secondary school teachers, principals and policy-makers and allows integration of those insights for a specific geographic context.

Limitations include analysis of data gathered in only one city, which limits generalisability of findings to other cities in New Zealand or internationally. However, that applies to many other studies of travel. Importantly, our findings are very similar to those of studies elsewhere. Also, we used data collected over an 8-year period. However, the rates of adolescents using bus to school in Dunedin remained unchanged between 2009 (22%; presented in the study) and 2014/2015 (21%) (Mandic et al., 2015a,b).

5. Conclusions

Major barriers to Dunedin adolescents using public bus transport to school included distance from home to school, cost, parental trip chaining, built environment features, the weather, the convenience of car-based travel, and safety concerns. If the goal is to increase public transport use for adolescents' school-related travel, effective policies could include: increasing parking prices to discourage driving and trip-chaining for parents; improving bus infrastructure and subsidies; and by changing bus/bus users' perceptions (Copland, 2017; Copland et al., 2017). These initiatives will require collaboration between different government authorities. A policy for public bus use by secondary school students should be developed to address parental, adolescents' and schools' concerns and encourage collaborations between government authorities and schools.

6. Data statement

All policy documents reviewed for this study are publicly available. Survey, focus groups and interview data used in data analysis for this project will not be shared due to sensitivity of the collected data as well as participants having been given assurances that the collected data will not be shared.

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