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Perceptions of cycling among high school students and their parents

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ABSTRACT

Cycling is a healthy, low-cost, and low-carbon alternative to motorized transport. As a relatively fast active mode of transport, cycling can overcome the distance barrier of walking, while also providing cardiovascular exercise and reducing demand for motor vehicle travel. The "cycling renaissance" has seen an increase in the number of cyclists in urban spaces, and there is evidence of increased investment in cycling infrastructure and cycle skills training in some places. Yet the number of high school students cycling to school is declining in many industrialized countries. Transport to school is a major contributor to daily traffic congestion, resulting in both local and global environmental concerns, and high school students have been relatively overlooked in research to date. In this paper, we present empirical material from a qualitative study of high school students and parents in Dunedin, Aotearoa New Zealand. Focus group sessions were conducted during 2014 and 2015 with students and parents separately, to explore their perceptions of modes of transport and transport to school decision making. Key findings relate to perceived safety, implicit messages, and social norms. We find that a complex range of factors contribute to perceptions of cycling safety, including features and perceptions of the built environment, traffic safety (including behaviors of other road users), previous cycling experiences (including accidents), and adolescents' cycling skills and on-road experiences. Overcoming concerns through behavioral and cultural interventions coupled with upskilling and thoughtful infrastructure may present a pathway to increasing rates of cycling.

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1. Introduction

Cycling is an important part of a low-carbon transport transition. Unlike walking which can be perceived to be slow and cumbersome (Krizek, Forsyth, & Baum, 2009), cycling offers a faster mode for negotiating the urban environment, escaping the congestion and parking stresses of private car travel, and negating the associated greenhouse gas emissions. The "cycling renaissance" has seen a resurgence of interest in cycling among particular groups in the global north[1] (Pucher, Buehler, & Seinen, 2011). Yet in terms of transport to school, with a few exceptions [e.g. Belgium (Van Dyck, De Bourdeaudhuij, Cardon, & Deforche, 2010) and Denmark (Cooper et al., 2006), the Netherlands (Dessing, de Vries, Graham, & Pierik, 2014), and Japan (Mori, Armada, & Willcox, 2012)], most industrialized countries report historically low rates of cycling to school [e.g. the United States (McDonald, 2007), Canada (Larsen et al., 2009), Spain (Chillon et al., 2009), Ireland (Nelson, Foley, O'Gorman, Moyna, & Woods, 2008), Australia (Leslie, Kremer, Toumbourou, & Williams, 2010), and New Zealand (Mandic et al., 2015a)]. The perceived danger of cycling, and the potential for collisions with motorized vehicles have been highlighted as particularly strong barriers, limiting the uptake of cycling as a mode of transport (Kerr et al., 2006; Ahlport, Linnan, Vaughn, Evenson, & Ward, 2007), also known as utility cycling (e.g. Smith, 2016). Parents have also been identified as critical "gatekeepers" to the uptake of active transport to school (Black, Collins, & Snell, 2001; Carver, Timperio, Hesketh, & Crawford, 2010; Jago & Baranowski, 2004; Kerr et al., 2006; Lorenc, Brunton, Oliver, Oliver, & Oakley, 2008) particularly as a result of parental perceptions of child safety (Murray, 2009; Woldeamanuel, 2016). Parental confidence in the child's cycle skills is another determinant of cycling to school levels for children (Trapp et al., 2011; Ducheyne, De Bourdeaudhuij, Spittaels, & Cardon, 2012) and this mediates the association between parental perceptions of safety and cycling in children (Trapp et al., 2011).

To date, most research related to active transport to school has focused on the experiences of primary and intermediate school students, often neglecting high school students. Yet the mobility experiences of this age group are likely to continue through to adulthood, thus instilling mobility expectations and aspirations that support cycling is critical. In the present study, high school students and parents of high school students are the unit of interest. This paper draws from qualitative material gathered through focus group sessions conducted in Dunedin, Aotearoa New Zealand (New Zealand hereafter), in which perceptions of transport modes were discussed. The present paper focuses in particular on high school students' and parental perceptions of cycling in general and cycling to school.

2. Literature review

Incidental exercise achieved through daily activities including active transport to school (ATS) results in a range of

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[1]The term "global north" is used to denote economically developed/industrialized countries, which includes New Zealand and Australia.

well-articulated and oft-reported benefits for health, well-being and the environment. The promotion of physical activity has traditionally centered on sport and exercise (Dobbins et al., 2009), but there is a growing recognition of the positive outcomes that result from ATS, particularly for children and adolescents. These include the development of independence and space for relaxation. Yet in recent years, active transport (e.g. cycling and walking) to school has been replaced by motorized travel.

Cycling is widely encouraged due to its positive impact on health and well-being, as well as on air pollution and road traffic congestion (Daley & Rissel, 2011). Yet there are declining rates of cycling to school across the global north (Department for Transportation, 2013; McDonald, 2007; McDonald & Aalborg, 2009; New Zealand Ministry of Transport, 2015). Barriers to cycling can include insufficient or inadequate physical cycling infrastructure (e.g. separated cycling lanes, bicycle racks), but also perceptual factors (Daley, Rissel, & Lloyd, 2007; Willis, Manaugh, & El−Geneidy, 2015; Ghekiere et al., 2016). Positive perceptions of cycling (Willis et al., 2015), perceptions of cycling as an environmentally neutral, rather than carbon-intensive transport mode, and awareness of the contribution cycling can make to daily physical activity (Daley & Rissel, 2011) have also been identified as factors that stimulate the uptake of cycling.

Nevertheless, there is considerable heterogeneity in perceptions of cycling as a transport mode. These diverse perceptions of cycling can relate to experiences of cycling, socially determined norms around cycling and perceptions of cyclists, and the compatibility of cycling with local transport infrastructure. Cycling can be undertaken as a sport, a recreational activity, or a mode of transport, and each activity is perceived differently (Horton, Rosen, & Cox, 2007). For the purpose of this paper, we are specifically referring to cycling as a mode of transport, while also acknowledging the complex intersection of cycling for transport and leisure.

The system of cycling requires specific materialities (e.g. bike, lights, helmet, and footwear) and competencies (e.g. how to cycle) but is still a transport mode of relatively low cost and complexity. Consequently, cycling has a long and interwoven history with daily-life and social activities. In the global south, bicycles have historically offered a low-cost and often culturally embedded means of transport, but this culture is becoming replaced with aspirations for motorized transport. In the global north, the necessity to transition to a more sustainable system of transportation has prioritized, and in some cases politicized, the transition toward active, low-carbon transport modes (Norcliffe, 2015).

In order to increase the rates of cycling, a wide range of interventions have been trialed across different populations (e.g. children, adults, and subsets) (see Yang, Sahlqvist, McMinn, Griffin, & Ogilvie, 2010 for a review of interventions), and specifically related to transport to school (see: Weigand, 2008). Evidence of the effectiveness of cycling intervention programs is limited (Lorenc et al., 2008). Lorenc et al. (2008) suggested that this could be because interventions often focus on built environment factors, such as bicycling lanes, and neglecting socio-cultural factors including perceptions of safety and cultures of automobility (Lorenc et al., 2008). A relationship between the construction of bicycle lanes and increased rates of cycling to school has been proposed, yet this assumption is supported by limited empirical evidence (McMillan, 2005), and the relationship between bicycle lanes and the uptake of ATS is yet to be empirically validated (Pont et al., 2009). And somewhat paradoxically, the existence of cycling infrastructure can contribute to lower rates of cycling, particularly when these cycle paths are along the routes with high traffic (Willis et al., 2015). Thus it may be through *indirect* mechanisms that changes to the built environment affect the uptake of ATS, for instance by way of increased parental perceptions of safety. Therefore, this could indicate that policies to promote cycling need not only to promote a supportive urban form and disincentivize motorised transport modes, but also need to address, and modify parental perceptions of active transport modes (McMillan, 2005).

Parental perceptions of safety have a significant role in cycling uptake among children (Ducheyne et al., 2012). Research with young teenagers (12–16 years) reported a strong correlation between parental attitude and student's mode choice (Woldeamanuel, 2016). Moreover, there is evidence to suggest that parental perceptions can also contribute to gender biases in the uptake of active transport modes. Carver et al. (2010) found that some parents discourage outdoor physical activity for girls more so than for boys. In Australia, however, Carver et al. (2008) found no significant differences between boys' and girls' self-perception of traffic safety and 'stranger danger'. In Italy, on the other hand, gender influenced children's perceptions of their own safety. For instance, girls in small cities were more likely to communicate feelings of danger compared to those from small towns (Zani et al., 2001)

The main contribution of this paper is its focus on the perceptions of cycling to school by adolescents and their parents, extending academic literatures commonly focused on primary school children (e.g. Trapp et al., 2011; Ducheyne et al., 2012). By incorporating parental perceptions we add additional, qualitative insights to the cycling to school, and active transport to school literature. A strong parental influence on transport mode choice for both children and adolescents has been reported previously (Trapp et al., 2011; Ducheyne et al., 2012; Carver, 1982). Thus by incorporating parents into this research, we are able to provide accounts of parental perceptions of safety among other issues, as potential barriers or enablers to the adolescents' uptake of active transport, and in particular, cycling to school.

3. Methods

3.1 *Qualitative focus groups*

The research reported here forms part of an interdisciplinary, multimethod study on transport to school behaviors in Dunedin high schools; the Built Environment and Active Transport to School (BEATS) study (Mandic et al., 2015b, 2016a). Focus group sessions were designed to elicit in-depth, nuanced social perceptions of cycling. Focus groups are particularly valuable to this end due to their collective context. Thus the aim of the focus group is to get the participants to interact with one another (Ritchie, Lewis, McNaughton Nicholls, & Ormston,

2014), often with very little intervention by the researcher. Focus groups differ from group interviews in that the group interactions are of specific interest and these interactions are explicitly used to generate data and new insights into a particular phenomenon (Berg and Lune, 2012), thus they are both synergistic (Stewart, Shamdasani, & Rook, 2007) and spontaneous (Ritchie et al., 2014). Focus groups can, therefore, present a more natural environment, more closely related to real life, "because participants are influencing, and influenced by others" (Krueger and Casey, 2009: p.7). Due to the highly social nature of transport and modal choice, there is a strong tradition of focus group use for transport research (e.g. Xenias & Whitmarsh, 2013), and particularly in engaging with children and adolescents (e.g. Simons et al., 2013, 2014).

3.2 *Study area*

Dunedin is a small, coastal city on the lower South Island of New Zealand. It covers an area of 3,314 km^2, and is home to approximately 130,000 people, making Dunedin New Zealand's seventh-largest city by population, and second largest by territorial land area. The Köppen climate classification identifies Dunedin's climate as "Oceanic" or "Maritime": a generally temperate climate, with mild summers and cool winters. Yet the highly varied topographical landscape of Dunedin results in a variety of "microclimates" across Dunedin suburbs. Dunedin's city center or Central Business District (CBD) is inland from the Otago Harbour. Beyond the CBD, the city is surrounded by hills and ocean. Much of Dunedin's residential housing is on the hillsides (see Figure 1 for a topographical representation). This topography places specific challenges for promoting active transport modes.

State Highway 1 (SH1), a major highway running the length of New Zealand, passes through Dunedin on two one-way streets with a 50-kilometer per hour (KPH) speed limit through the CBD, and 60 KPH outside of the CBD. SH1 is highlighted in Figure 1. These one-way streets also have some of the most developed cycling infrastructure. The map in Figure 1 shows cycle lanes with darker lines, while roads are depicted with white lines. There are more cycle lanes under development in the relative flat area of South Dunedin, as part of a proposed cycle network to connect existing cycling infrastructure and provide access to key destinations (Dunedin City Council, 2012). There is also a proposal to create separated cycle lanes in order to improve cycle safety along the SH1 (NZTA, 2016).

3.3 *Participant recruitment*

The details of recruitment for the student and parental focus groups have been described elsewhere (Mandic et al., 2016a) and are briefly summarized in the following section. A total of 6 parental and 10 student focus groups were conducted. The sample size for student and parental focus groups was determined by redundancy and saturation (Eisenhardt, 1989; Lincoln & Guba, 1985).

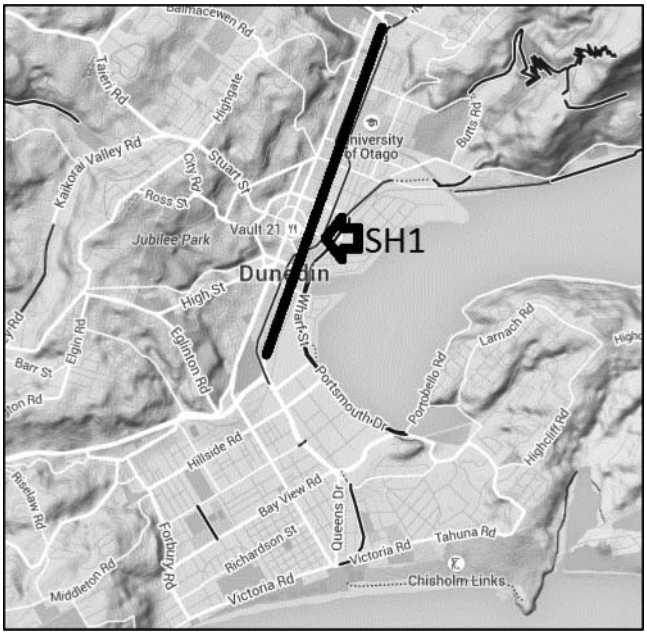

Figure 1. Map of Dunedin's City Center and Road Network. Source: Authors diagram from Google Maps). White lines indicate road network. Dark lines indicate existing cycle lanes. The bold black line highlights State Highway 1 (SH1), the one-way system which passes through Dunedin.

3.3.1 *Student focus groups*

Students were recruited for the focus groups through their high school, as part of the BEATS Study. Any student who completed the quantitative survey and anthropometry testing was eligible to participate in a focus group. Inclusion criteria ensured that participants were high school students, and enrolled in one of the 12 high schools in Dunedin. While all efforts were made to ensure a gender and age group balance in the focus groups, this was not always possible. Student focus groups were conducted at 10 schools: five co-educational schools, and five single-sex schools (three girls' schools and two boys' schools). The focus groups were conducted during lunch time or immediately after school on site at each participating school. Students were rewarded with a book voucher for their time. Student focus groups were scheduled in agreement with high school principals, and were performed between June 2014 and April 2015. A total of 10 student focus groups with 54 students were completed (Table 1).

Home address data were recorded using the online survey and used to determine New Zealand Index of Deprivation (a neighborhood area deprivation score) as a surrogate for students' socioeconomic status (Salmond, Crampton, King, & Waldegrave, 2006). The deprivation index was recoded from the original 10-point scale (1 = least deprived to 10 = most deprived) into five categories: lowest (1–2), middle-low (3–4), middle (5–6), middle-high (7–8) and highest (9–10) deprivation score. Overall neighborhood deprivation score categories for students (available for 50 (93%) students) were 28.0% lowest deprivation, 32.0% middle-low, 12.0% middle, 16.0% middle-high, and 12.0% high deprivation. Modes of travel to school were also self-reported by students in the online survey (Mandic et al., 2016a). Usual transport to school among student focus group participants (data available for 53 (98%) students) were 49.1% driven by others, 5.7% driving themselves, 5.7% school bus, 1.9% public bus,

Table 1. Student focus group details.

Focus group code	Co-educational status of the school	Number of participant	Year groups included in session	Date of focus group
SFG #01	Girls school	2	9	13/06/2014
SFG #02	Boys school	6	9,10,12	18/09/2014
SFG #03	Co-ed	11	9, 10, 11, 12,	18/09/2014
SFG #04	Girls school	5	9, 13	20/10/2014
SFG #05	Boys school	4	9	17/09/2014
SFG #06	Co-ed	3	9,11,13	28/10/2014
SFG #07	Co-ed	5	9, 13	15/09/2014
SFG #08	Co-ed	5	9, 10, 13	24/10/2014
SFG #09	Girls school	9	9	20/10/2014
SFG #10	Co-ed	4	9, 10, 13	29/04/2015

SFG, student focus group; Co-ed, co-educational (mixed-gender schools)

35.8% walking and 3.8% cycling (2 students cycled to school most/all of the time, 6 rarely, and 45 never cycled to school). Overall, 43.4% of students used motorized transport only, 30.2% used active transport, and 26.4% used a combined motorized and active transport to school.

3.3.2 *Parental focus groups*

Parents of Dunedin high school students were invited to participate in a quantitative survey and a parental focus group as part of the BEATS Study. It was not a prerequisite that the parental participant's child had participated in the student study. Parents could participate in one or both of the research activities; 96% of focus group participants also completed an online survey. Advertisements for participants were posted in school newsletters and local businesses. Focus group sessions were held in a room on the University of Otago campus. Sessions were run between 4 pm and 8 pm in the evening, and parents were rewarded with a book voucher for their time. A total of 6 parental focus groups, with 25 participants, were conducted during 2014 and 2015 (Table 2). Overall neighborhood deprivation score categories for parent participants (available for 24 (96%) parents) were 37.5% lowest deprivation, 25.0% middle-low, 16.7% middle, 16.7% middle-high, and 4.2% high deprivation. Highest education of the parent participants were 20.8% high school, 12.5% polytechnic degree, 50.0% university degree, and 16.7% postgraduate degree. Highest education of an adult in the household included 4.2% high school, 4.2% polytechnic degree, 62.5% university degree, 16.7% postgraduate degree, and 12.5% other.

3.4 *Focus group content*

Focus groups were attended by at least two of the BEATS research team, with the same lead researcher for all focus groups. The lead researcher, a trained qualitative researcher, took responsibility for running the session, providing topical questions and prompts, and ensuring all participants were able to contribute. Key themes for the student focus groups included: current travel practices, motivations for current practices, barriers to alternative practices, perceptions of transport modes, stereotypes of users of different transport modes, and influences on travel behaviors (e.g. parents, teachers, and peers). For parental focus groups, key themes included: current travel patterns and social pressures, personal transport to school experiences, perceptions of benefits of ATS, relationships between travel and independence, the built environment, and perceptions of safety.

The second researcher took detailed notes of the focus group conversations, and was invited to ask additional questions for clarification at the end of the session. Refreshments were provided for both student and parent focus groups, which helps to create a more relaxed environment and to foster a positive environment in which the participants feel free to speak at ease and without judgment. Participants were reassured that their responses would be anonymized in any subsequent reporting of the empirical material, as per the University of Otago Human Ethics Board approval.

3.5 *Analysis*

The focus groups were digitally audio-recorded and fully transcribed into text documents. These documents were then uploaded to NVivo10 qualitative analysis software. The focus group transcriptions were explored for reference to cycling. Through a process of abstraction and interpretation, the researchers attempted to categorize the empirical material looking across and within key themes. An iterative coding process was adopted which allowed the researchers to look deeper within the material for more nuanced perceptions of cycling within the sample. Each focus group was explored collectively by way of "whole group analysis"

Table 2. Parental focus group details.

Focus group code	Gender	Number of participants	Date of focus group
PFG #01	3 M + 3 F	6	06/10/2015
PFG #02	6 F	6	08/10/2015
PFG #03	2 M + 2 F	4	16/10/2014
PFG #04	4 F	4	18/09/2014
PFG #05	2 F	2	25/11/2014
PFG #06	1 M + 2 F	3	06/08/2015

PFG, parental focus group; M, male, F, female.

(Ritchie et al., 2014), after which similarities and differences between the focus group sessions were examined. Similarly, the student and parental focus groups were analyzed as two distinct bodies of information, before being drawn together to identify the cross-group patterns and trends in perceptions of cycling. This process allowed for themes to be identified in one or both groups of participants.

3.6 Limitations

This paper reports the findings of a small number of focus groups with a nonrepresentative sample specific to the city of Dunedin, New Zealand. The sample includes students from 10 of 12 Dunedin high schools in Dunedin; however, the findings are illustrative of the specific context (e.g. people, time, and place). All parental participants, and most student participants, self-selected to participate in this research. Self-selection bias can result in more open, patient and interested participants than the general sample universe (Robinson, 2014). The impact of this bias on the research findings was accounted for by the researcher. Thus while these findings provide a depth of insight into perceptions of cycling among parents and adolescents, they should not be interpreted as broadly generalizable beyond this specific sample.

4. Findings

The analysis uncovered perceptions of cycling that related to cycling in general, and cycling to school specifically. While focus group themes were concentrated on transport to school, this was interwoven with other types of everyday travel, including work (for parents) and leisure. Three key themes are used to present the findings: 1) perceived safety, 2) implicit messages, and 3) social norms. These themes are not represented as "drivers" and "barriers" to cycling, but as nuanced conceptualizations of cycling by the research participants.

4.1 Complexities of perceived safety

Safety emerged as a key feature of focus group discussions and was more clearly articulated by the parental focus group participants, than by students. The interviewers did not specifically ask about safety; however, this emerged as an important theme relating to perceptions and uptake of cycling, and perceived acceptability of cycling as a mode of transport for high school students. Narratives of safety and relative safety are therefore presented as a wider context in which transport to school decisions are made. From the interviews, we found a series of subthemes relating to safety: perceptions of safety and a "safe environment," infrastructure (e.g. cycling lanes), accidents and collisions, responsibilities for safety, and the adolescents' cycle skills.

While safety was widely identified as a concern for parental participants, it was conceptualized by some parents as a fluid term, in that it could be overcome by negotiating particular urban areas, roads and junction, and times of day. This was particularly noticeable with parents who cycled regularly and encouraged their children to cycle too.

> *Participant 1: [Safety is] in your head. It doesn't stop me. It's just a bit more selective than you would like to be or be able to be less selective of the roads… It's to not have to kind of choose certain streets or even times to get to a cycle way or get to a footpath where I can ride on or something like that it would be nice if there were a few more there.*
> *Interviewer: So what times and what areas would you avoid?*
> *Participant 2: The one-way system, I never cycle on the one-way system.*
> *Participant 3: There's still so many trucks on it ae?*
> *Participant 2: There are parked cars on one side and traffic on the other. I try to avoid streets where I am in-between parked cars and traffic.*
> *(Parental Focus Group #03)*

Dunedin's major one-way transport route through the city as a part of New Zealand Highway #1 was perceived to be a particularly dangerous "site" for cycling at most times of the day. Yet paradoxically, this road also has the most developed cycling infrastructure. In this situation, the perceived safety associated with available cycle lanes is replaced by perception of danger due to the volume and speeds of other traffic: "It's really freaky with the trucks going past you at 100 KPH… I suppose the one-ways are the things, the areas where it seems a bit dodgy at times" (Participant 4, Parental Focus Group #02). Thus cycle lanes alone do not appear to be sufficient to increase perceived safety of cycling on a particular road. The cycle lanes on Dunedin's SH1 were built in 2001 in response to a cyclist fatality following a collision with a motor vehicle in 1998 (ViaStrada, 2013). However, further fatal collisions between cyclists and motor vehicles (2005, 2011, 2012) contributed to perceptions of Dunedin's SH1 as "dangerous" and "unsafe" for cyclists.

Since the "safety" of cycling was not assured by infrastructure alone, another participant uses a route without cycle lanes when traveling through the city, especially with their high-school-aged children.

> *I have had a couple of near misses and I am quite reluctant for them [participant's children] to be on the bikes now even though I am a pretty keen cyclist myself… [We go] straight down George Street from North East Valley. Straight down George Street because you know, [my wife] works in transport, she reckons that those cycle lanes are just death traps, there has been three people killed on them over the last few years. As she said, George Street is a lot slower. There is a lot of double parking and people pulling in, so it's got some of those natural obstacles. (Participant 4, Parental Focus Group #03)*

The student focus groups also highlighted the importance of a "safe" route to school, and suggested that safety is more important than distance to school in determining the likelihood of uptake of cycling to school. For instance, a student with a short journey would not cycle if that journey was on "unsafe" roads. Thus "the types of roads that you have to bike on, that's a huge factor" (Participant 2, Student Focus Group #06).

In terms of places that are perceived to be particularly dangerous, places with a high volume of traffic were highlighted as particularly high-risk, "I think really busy places at really busy time of day [should be avoided by cyclists]" (Participant 1, Parental Focus Group #03). And there was evidence of students modifying their behavior to negotiate busy and "unsafe" roads, with one adolescent noting that he would rather negotiate the broken glass on the side roads than ride on the main road:

Participant 6: Some of the roads seem to have a bit of glass on them sometimes.
Interviewer: Glass on the pavement?
Participant 6: No, on the roads where you're riding your bike… I try and dodge it but it's not the best.
Interviewer: Are there particular roads where you find more glass than others?
Participant 6: It's sort of the off-roads rather than the main roads.
Interviewer: So do you avoid those roads?
Participant 6: I normally just go on them [the side roads] so that I don't get run over. Going on the main road, there are a lot more cars. (Student Focus Group #02)

Nevertheless, the responsibility for safety appeared to be directed to cyclists rather than other road users. For instance, a parent participant argued that "I don't think that cyclists should go where there are lots of trucks. That is just kind of asking for trouble." (Participant 1, Parental Focus Group #03). This puts responsibility for safety on the cyclist, rather than the transport system or the car driver. It therefore replicates the hegemonic discourse of a car-dominated transport system. These comments articulate the perceived necessity for cyclists to modify their behavior to ensure they avoid an unsafe situation. This includes not cycling on busy roads, not cycling at peak times, and avoiding roads where trucks might be present, even if there is cycling infrastructure on such roads.

In the absence of a bypass or alternative route, heavy goods vehicles are required to drive through Dunedin on SH1 to reach more southern parts of New Zealand. Cyclists using the cycle lanes are therefore sharing the roads with large, high-speed motorized vehicles and this was identified as a hazard. This perception related to the truck driver's ability to account for or *see* cyclists. For instance one participant stated that "I saw that thing on TV the other night about how little they [truck drivers] can see… it was scary." (Participant 1, Parental Focus Group #03). This therefore promotes a narrative around hegemonic use of the transport system, which biases toward large motorized vehicles as the dominant road users. However, while some participants perceived it to be the responsibility of the cyclist to avoid the truck driver, another participant noted that truck drivers can be more considerate to cyclists than "main street drivers." Thus, the driving competency and willingness of the vehicle driver to account for cyclists was identified as a major risk factor.

Participant 2: Truck drivers know how dangerous they are. So I find they are often more considerate… I try and avoid streets where there is a lot of traffic because the main street drivers are just driving around talking to the kids or listening to the radio and they are not conscious of how dangerous they are for cyclists. They are the people I have the most trouble with.
Interviewer: So normally there is a lot around the trucks being the scariest or the most dangerous for cyclists but it's actually just road users?
Participant 1: They [truck drivers] are the best drivers, they are good drivers. Well maybe it's more for me, I don't think we should demand space everywhere, where there is critical needs move lots of stuff and you can use trucks and you may as well put cyclists somewhere else. (Parental Focus Group #03)

This participant therefore questioned the value and positioning of the cycle lanes along the major route through Dunedin (Highway #1), an area that heavy vehicles were unable to avoid.

Student focus groups provided another example, highlighting the antisocial behaviors of some drivers, which can contribute to safety concerns. For instance, while traffic volumes were identified as a barrier to cycling, specific driver behaviors were perceived as a greater issue for students: "Sometimes you get the occasional driver that likes to get right behind you and toot [their horn] to see if you fall off" (Participant 2, Student Focus Group #02), or that " some people don't see [the cyclist] and open their door [onto them]" (Participant 11, Focus Group #03). The latter comment may indicate awareness of cyclist injuries and fatalities which in some cases have been the result of roadside parallel parking. The dependence of cyclists on the behavior of car drivers to ensure their safety was highlighted as problematic by students, "It's kind of annoying to rely on driver's to know what they're doing, because there are some really bad drivers" (Participant 2, Student Focus Group #03). They also noted that in rush-hour traffic "everyone gets really annoyed with cyclists" (Participant 6, Student Focus Group #03), which could suggest some intolerance and wider negative social perceptions relating to cycling and cyclists in Dunedin.

Yet despite concerns about the geographic positioning of existing cycle lanes along streets with high volume of traffic, safety concerns for cycling also contributed to articulated perceptions for greater need to invest in cycling infrastructure. Funding disparities between infrastructure for motorized transport versus cycling was highlighted as a source of frustration by parents. Perceptions and experiences of danger when cycling in Dunedin led some participants to emphasize the importance of fully separated cycle lanes.

They spend enough money on the highways and stuff. Last year, 30 years of biking or something, and a car just came straight through the intersection and smashed the whole back wheel up and sent me flying. Before that I had been so blasé, you know. [But now] I can feel how heavy this car was and it made me feel so vulnerable and then to think that my kids are out in that sort of traffic as well. It is just like "I don't care how much it costs or whatever just get them off the road." (Participant 4, Parental Focus Group #03)

This participant spoke of the need for fully separated cycle lanes that would protect cyclists from motorized vehicles. In contrast to the aforementioned "unsafe space" of the one-way system, the off-road cycling lanes around Dunedin's harbor were reported to be a safe and attractive place to cycle, with parents participants talking about driving to the off-road cycle paths with their children to "practice" cycling.

Many of the bike, so called bike lanes in Dunedin are actually in my opinion more dangerous than not having them. Kaikorai Valley is a good example; it used to have two lanes in each direction. Now it's got a bike lane and a car lane in each direction, but I actually think that cyclists would be better off taking up one of the car lanes, and the cars would drive round the cyclists. Whereas at the moment they are on a straight narrow bike lane maybe this wide. So any car that's going close, you're going to end up under a car in the next lane. I really wish both lanes didn't exist, I think four lanes, because then there's space for car doors to be open. (Participant 6, Parental Focus Group #01)

The parental focus groups articulated a correlation between school students being driven to school and the road traffic volumes that contribute to a perceived "unsafe" cycling environment. For instance, a parent stated that

"Every time a parent takes a teenagers or a child to school because 'there's too much traffic', it creates more, 'too much traffic' and it's possible that every time that happens it also triggers a decision for another parent to also drive their kids to school" (Participant 6, Parental Focus Group #01). This was reiterated in another focus group session, where a participant argued that "If everybody cycled instead of taking their car, then there wouldn't be all the cars on the road and it [safety] wouldn't be such an issue" (Participant 2, Parental Focus Group #03).

Parents used personal experiences of cycling risk and danger to explain their current perceptions of cycling for both themselves and their children. For instance, one participant spoke of two collisions with motor vehicles which contributed to concerns about safety of cycling, and less cycling.

> *I would love to cycle, but when I was a university student here I had two [accidents], down by the Hocken [library] with the logging truck and another one where I was knocked off by a taxi, who came through a stop sign and hit me. So I don't feel safe. I mean I'd love to bike, and the only time I've biked after that was when I was living in Andy Bay and I could use the cycle track around Portsmouth Drive, and so most of the time I was completely off the road. (Participant 5, Parental Focus Group #02)*

Another participant in the same focus group identified the same urban area of Dunedin as being dangerous, due to the large logging trucks. This participant stated that she "lost her nerve" when it comes to cycling on the road, and this is mostly due to the volume of heavy vehicles.

> *I love to cycle, however, whether I've lost my nerve or whatever I feel it to be unsafe for me now, even though there are cycle trails around the edge of the harbour. But I think that some of it I'd still need to be on the road with the logging trucks which go by the Hocken [library]. That's where I need to go and I'm just quite put off by that. (Participant 1, Parental Focus Group #02)*

Learning to ride a bike was acknowledged as an important competency for young people, "It's a massive skill increase as well for a child. It's a great confidence builder for them" (Participant 1, Parental Focus Group #01). Yet while the need for children to gain cycle skills was well-articulated, the course of action was less clear. The use of off-road cycle lanes was preferred by most parents; however, it was acknowledged that this contributed to delayed development of adequate on-road cycling skills for some children.

> *Participant 1: The older one we've still got. But the younger one, she is just not good enough, she doesn't "get" traffic either.*
> *Participant 3: It takes them a bit to get that traffic, that sense in traffic, the speed sense and all that even with walking and crossing the road.*
> *Participant 1: So maybe that is a disadvantage with separated cycle ways is that people won't learn traffic habits. The older girl did because she was out riding all the time in traffic.*
> *(Parental Focus Group #03)*

This lead some parents to delay riding a bike for their children until they felt the children were mature enough and able to negotiate the traffic, and particularly motor vehicles on the road: "My kid has actually been asking for a bike and she is not very good on a bike and only just learnt to ride it and we live on the hill. I'm just putting it off as long as I can because it's so dangerous. And when we get it we will probably just put on the car and go to that path" (Participant 2, Parental Focus Group #04).

4.2 *Implicit messages*

This theme emerged from the student focus groups, where it became clear that there is evidence of subtle and implicit messaging which may promote a particular culture around cycling for Dunedin's high school students. The way cycling is framed by schools (either explicitly or implicitly) emerged as a potential barrier to uptake of cycling to school by Dunedin high school students. This was articulated through two examples: the provision of bike racks and storage, and school rules relate to uniform requirements, particularly for female students. From the student focus groups, it became clear that there is generally low awareness of bicycle storage facilities at school. Across the schools, noncyclists were often unsure of the availability or location of bike racks for their use.

> *Participant 3: No one bikes except…*
> *Participant 2: Two or three people might bike.*
> *Participant 3: But there is no bike rack. Like there is nothing.*
> *Participant 2: Yes there is.*
> *Participant 1: There are heaps.*
> *Participant 2: Over by the… house.*
> *Participant 1: I'll show you.*
> *Participant 3: Oh, behind it? I have never been behind it.*
> *(Student Focus Group #05)*

The positioning of cycling racks at school was also identified by adolescents as either being too hidden or too exposed, and in both cases safety and security of bikes was questioned. The dialogue below provides evidence of these diverse perspectives, with one participant arguing that bike locks are sufficient to ensure the security of a bike at school.

> *Participant 3: We don't have many bikers at all really. We've got a couple our actual bike rack facilities are a bit exposed. The bike racks are pretty visible from, from the street so I think that puts a few people off. Just security issues and things.*
> *Participant 6: There are simple bike locks that will fix it.*
> *Participant 3: Oh yeah I mean but still, people are a little cautious of that.*
> *(Student Focus Group #02)*

It was also suggested that ulterior motives contributed to poor advertising of the location of the cycling facilities on the school grounds, and therefore the option of cycling to school. Student focus group participants argued that the rules relating to cycling to school were unclear, and thus only keen cyclists would cycle to school. This could be interpreted as the discouragement of cycling as a mode of transport to school.

> *Participant 4: They don't really make the rules very clear about bikes either, I don't even know if there are any bike racks around here or anything.*
> *Participant 5: Yeah there is… I don't think [the principal] would really advertise it because, I don't know, some people would say it's a bad look on the school like you being in your uniform, because we're girls, ladies who wear skirts and stuff.*
> *(Student Focus Group #04)*

Female students at both single-sex and co-ed schools frequently identified their school uniform as barrier to cycling to school. Most female school uniforms require a knee length kilt

skirt which was viewed as incompatible with riding a bicycle. To respond to this, high school students wanting to cycle would need to change into their school uniform, "I know a couple of people who bike in their sports gear and leave their uniform at school and then they get changed when they get to school" (Student Focus Group #04, Participant 4). When asked about this practice, participants suggested that only the teachers' favorite students would be allowed to change at school, and it was widely viewed as against school rules.

Interviewer: You mentioned a couple of people you know who cycle like on bikes to school in their gym clothes and leave their uniforms here. Do you think there are many students in school are aware that they are allowed to do that?
Participant 3: I'm not really sure if we're allowed to. But they're quite the teacher's pets so they're not really [allowed to]. They get away with things that they're not really supposed to do. I am not sure whether you're allowed to or not.
(Student Focus Group #04)

This resulted in cycling being perceived as a mode that "other people" do, rather than a socially acceptable mode of transport. Moreover, the incompatibility of the school uniform with cycling contributed to a perception of cycling to school as a male rather than female activity.

Participant 7: Generally it's the boys more than the girls [who cycle to school] because we [girls] can't actually ride the bikes with skirts without having to get changed before and after.
Interview: *Ok sure, are you allowed to wear other clothes if you were going to ride a bike?*
Participant 1: I don't see why not.
Participant 6: You're supposed to wear a full school uniform outside of school.
Participant 7: Which makes it practically impossible to bike because we can't actually move our legs.
Participant 9: Unless you change into a totally different outfit.
Participant 7: Then you get told off when you walk into the school and they're like you're not wearing a school uniform.
Interviewer: So you'd have to be in your school uniform or not school uniform?
Participant 2: You're not allowed in school unless you're in your school uniform.
Participant 7: You're not allowed to do partial because it makes it look bad for the school.
(Student Focus Group #03)

4.3 *Socialization, individual and group norms*

For high school students there appears to be a narrative of cycling being for "other people," and thus it was not seen to be a socially acceptable transport option for many student focus group participants. This was for a variety of reasons including the topography of Dunedin. The hilly landscape made some participants view cyclists as "sporty" people. For instance, one student stated, "I sort of think that Dunedin is almost too hilly for people to be able to cycle everywhere apart from the really hard-core cyclist so I can't really think of much else" (Participant 1, Student Focus Group #01).

There was also evidence of the common discourse around cyclist behavior, "Once we were coming along the peninsula and there were two bikes like up the middle. Not in the middle, but taking up the whole lane, and they shouldn't" (Participant 9, Student Focus Group #03). This dialogue suggests that cyclists do not abide by road rules. These group norms can perpetuate the dominance of private car travel, and reduce the likelihood of young people taking up cycling as a transport mode, particularly if they do not identify with the people they perceive to be "cyclists."

In contrast to this, cycling for recreation was viewed differently and more favorably in many contexts. These norms could be reducing the uptake of cycling as a transport mode, as one parent identified their daughter's willingness to ride a bike recreationally, but not for transport, despite family norms to the contrary. This could suggest that for some high school students, cycling is perceived to be nondesirable transport mode, and therefore not used.

Participant 3: She [participant's daughter] would not get on a bike. She would ride a bike for recreation, but for getting from A to B? She was like, "No way am I getting on the bicycle."
Interviewer: Why was that?
Participant 3: I don't know, uncool? Not the thing that she was going to be seen doing? And it was ridiculous, we all bike. It wasn't anything that she got from us practically.
(Parental Focus Group #01)

Across both sets of participants, those who regularly cycle tended to prioritize "time alone," and value this attribute of cycling. Students in particular focused on the importance of "alone time" between home and school. For these students, time to think while cycling was highly valued and therefore contributed to a prioritization of cycling as a mode of transport to school.

Interviewer: So why do you think it might be nice to have some alone time?
Participant 2: Away from your siblings.
Participant 1: It's sort of space between family and like school friends.
Participant 3: It's good to have a period of time where you can just think.
(Student Focus Group #08)

This was reiterated in another focus group, where both walking and cycling to school were identified as a time to transition between home and school.

Participant 3: It's just kind of a break from, kind of the transition between at home in the mornings things can be a little frantic organization of everything and then school and then when you actually have to start knuckle down and get working so it's quite nice kind of. There is nothing else really to do, you know what I mean? You've just got to walk.
Participant 6: Yeah, I know what you mean, I quite like my bike ride and I can figure out how I am going to do my homework.
(Student Focus Group #02)

This narrative of "alone time" was contrasted with discussions around the importance of socializing and social activities with peers. Socializing after school was identified as an important, often spontaneous activity, and for those who cycled to school, having a bike was a limitation:

Participant 3: The bikes is a bit of a pain, it would be better if I was able to walk if I was to go anywhere else because you have to chain in up somewhere handy to remember it.
Interviewer: So you might not be able to go do things after school because you have your bike?
Participant 3: Yeah it's just another factor that I have to take into account; it makes things faster but sort of yeah.

Interviewer: What sort of activities would you want to do, what sort of things do you think it might?
Participant 3: Oh just I don't know if a group of friends going into town I could head in with them or that's probably the main thing just anything outside the usual routine.
Interviewer: So riding your biking into town would just be quite frustrating for you?
Participant 3: It's a pain.
(Student Focus Group #08)

This was compounded by a desire to be social and walk with friends, whereas cycling was perceived to be a solo activity: "walking home with people and walking to school with people, that's more convenient than going on a bike" (Participant 4, Student Focus Group #08). Parents also agreed that there is a lack of flexibility to adapt to changing social environment, to accept impromptu invitations, when cycling to work.

One of the negatives [about cycling] I think is that you can cycle somewhere but if you have to come home and its inconvenient, or if you get offered a ride, or you get a quicker option home then it is inconvenient because you are bringing a bike. (Participant 2, Parental Focus Group #01)

The parental focus groups highlighted a change trend in the socialization of cycling in Dunedin. Parents participants spoke of "gangs that you would be cruising around the place with" (Participant 1, Parental Focus Group #03), and cycling was a key feature of this social time when they commuted to school as adolescents.

Participant 1: We biked; it's just what you did. Well we walked to and then you bike to cause we were on the flat in South Dunedin, just every kid did. So it wasn't really a decision it was just how things were.
Interviewer: So cycling was quite normal?
Participant 1: Absolutely yes. It was on the flat, there was bugger all traffic. Well we were on the footpath anyway and getting yelled at by old ladies to get off and stuff. But I was, that was just what everybody did… there was a lot more kids then though, people had bigger families and stuff so there was a lot more, we had a lot more neighbours who actually had kids our age.
(Parental Focus Group #03)

Thus, this socialization of cycling may have contributed to a culture of cycling that is no longer visible in Dunedin.

5. Discussion and implications

The research presented in this paper applied focus group research methods to examine high school students' and parental perceptions of cycling as a mode of transport, particularly to school. Cycling is a low-carbon, active mode, which can contribute to increased physical activity, as well as reducing the carbon intensity of the transport system. Yet the proportion of adolescents cycling to school has been declining for some time in many industrialized countries. While there has been a surge of interest in cycling as a hobby, this interest has had limited impact on cycling for transport.

The research illuminated a number of key findings:

1. Physical infrastructure (e.g. cycle lanes) does not result in perceptions of safety alone; the geographical context and user profile (e.g. types, volumes, and speeds of traffic on the road) are also important characteristics.
2. Safety is mediated by behaviors including avoidance of temporally and/or spatially "dangerous" areas, and responsibility for cyclist safety appears to be with the individual cyclist rather than the wider transport system, or other road users.
3. Perceptions of a "safe" route to school might be more important than distance to school for the adoption of cycling among high school students.
4. Social norms (e.g. "people like me don't cycle") and implicit messages (e.g. poor awareness of bike racks and school rules) might be contributing to low rates of cycling to school.
5. Cycling is increasingly viewed as an individual transport mode, which may be less attractive to some high school students but equally attractive to those desiring time alone.

Bicycle lanes were introduced on Dunedin's SH1 in response to a cyclist fatality (ViaStrada, 2013). Yet subsequent high-profile fatalities and serious injuries have called to question the success of this physical infrastructure in ensuring the safety of cyclists. Plans to further separate the cycle lanes from motorized transport have been proposed. The evidence from this research suggests that, consistent with previous research (e.g. Dill & Carr, 2003), building separated cycle lanes might increase perceptions of safety for some cyclists on these roads. This finding concurs with research, which has reported that for under-represented populations, including women and children, a high degree of separation from motorized traffic is important for increasing rates of cycling for transportation (Garrard, Rose, & Lo, 2008). Nevertheless, the qualitative findings suggest that large-scale physical infrastructure developments alone are unlikely to address safety concerns. Antisocial driver behavior, proximity to large and/or high-speed vehicles, and traffic volumes also need to be considered. In Dunedin, the existing on-road cycling lanes which have been built along Dunedin's SH1 were viewed as particularly unsafe, especially during busy times which includes travel to school times. Thus, it was argued that the configuration of cycling lanes in Dunedin makes them ineffective and dangerous, especially for high school students. When investing in cycling infrastructure, the wider context needs to be considered. For instance, for some, less confident cyclists, quieter routes that are not used by large or high-speed motor vehicles, or routes with lower volumes of traffic might be a preferred option for less confident and younger cyclists, even if those routes are less direct.

A complex range of factors appear to contribute to perceptions of cycling safety, including features of the built environment, perceptions of the built environment, traffic safety (including behaviors of other road users), previous cycling experiences (including accidents), and adolescents' cycling skills and on-road experiences. School program designed to increase ATS include bicycle storage, physical education and health curriculum that promotes ATS, adaptation of the physical environment in close proximity to the school, and school policies to promote ATS (Möser & Bamberg, 2008; Salmon et al., 2007). Our findings suggest that addressing parental safety concerns should also be a key element of any cycling promotion interventions, and this might also incorporate cycle skills training to assist high school students in gaining the

required competencies for on-road cycling (Mandic et al., 2016b). In this research, we did not assess the degree to which parents influenced how their children get to their school. Yet since children and adolescents are embedded in their family context (Ghekiere et al., 2016), their decision to cycle is likely to be strongly determined by parental perceptions of cycling. This research provides evidence of parental safety concerns. Research with primary school students found a strong positive correlation between parental perceptions of safety and the uptake of active transport (Weir, Etelson, & Brand, 2006; Henne et al., 2014). This research qualitatively suggests a similar pattern for high school students in terms of cycling to school. Further quantitative analysis is required to confirm this.

Perceived safety is an important but fluid term that needs further attention. Research in New Zealand has shown that cycling is perceived by high school students to be less safe than walking (Mandic et al., 2016c). In the present research, we found evidence of cyclists responding to risk and safety concerns by adapting their route and cycling on secondary roads which often lacked cycling infrastructure and presented alternative hazards (e.g. broken glass on the roads). Yet this was perceived to be a safer cycling experience than using the established cycling networks. Research on perceived versus observed risk has shown that public perceptions of route safety do not always reflect the evidence (Winters et al., 2012), and therefore more attention should be paid to the routes adopted by cyclists. Responsibility for safety was often articulated to be the responsibility of the individual cyclist, rather than the system of transportation or other road users. This framing of safety and responsibility is aligned with the dominant system of transport, and the hegemony of car-based travel. This includes narratives of roads being "for" cars, rather than bicycles, and therefore cyclists need to behave as a "guest" on the transport network. High school students appeared to be replicating these values, highlighting situations where cyclists were "taking up the whole lane," and frustrating motor vehicle drivers.

Research with primary school children has previously suggested that "socializing" cycling (i.e. encouraging children to cycle with friends) could increase the rates of cycling (Hume, Salmon, & Ball, 2007; Hume et al., 2009; Mandic et al., 2015a). Our findings not only support this, but also provide evidence that for high school students, solitude (i.e. "time alone") is a key attraction to cycling, which could be overlooked by interventions to increase socializability of cycling. Therefore, more research specifically focused on high school students is critical in order to acknowledge the differences in perceptions of cycling through childhood and adolescence, and the nuanced perceptions of socialization and solitude as attractive features of participating in active transport to school. Understanding the heterogeneous range of motivations, across gender and age, will be an important part of future research.

We also found important implicit school norms associated with cycling-related infrastructure on school grounds and school uniforms that perpetuate a culture of not cycling. The perceptions of incompatibility between the school uniform and cycling to school appears to be coupled with perceptions of cycling as a rigorous activity or "sport" that therefore requires "sport" clothing, which may differ from the norms, values, and practices of high-cycling countries. The types of bicycles used by students and within the wider society may also contribute to this perception, with mountain bikes and road bikes more common than "city bikes" in Dunedin. Moreover, students appeared to be largely unaware over whether they could cycle to school in sports clothes and change at school. Many students also appeared unsure about the availability of cycling racks. This could perpetuate a culture that prioritizes other modes, and not cycling.

The findings reported in this paper parallel with those found with other population groups including younger school students (e.g. Benson & Scriven, 2012; Ghekiere et al., 2015), and commuters (e.g. Whannell, Whannell, & White, 2012), and in a range of geographic contexts (e.g. Chataway, Kaplan, Nielsen, & Prato, 2014). This therefore suggests widespread normalization of discourses of cycling safety and cycling practice that pervade transportation norms and values, and influence the uptake of cycling to school. Literatures on the promotion of utility cycling highlight the importance of distance, infrastructure, access to bicycles and related items (e.g. helmets and locks), and cost of the uptake of cycling, and stress the research gaps related to the roles of individual factors and the social environment (see: Handy, van Wee, & Kroesen, 2014 for a review). In light of the similarities between the current findings, and those of other studies, we reiterate the need for policy and practical interventions that address the built environment as well as the barriers sustained by the dominance of car-based travel and the subjugation of active transport modes, including cycling.

6. Conclusions

Adolescents are an under researched but a vitally important research group. The mobility experiences and expectations adopted at this age are likely to continue through to adulthood; thus, forming normative behaviors and habits including the adoption of active transport modes could have both health and environmentally beneficial outcomes. Moreover, a research focus on children and younger adolescents has resulted in assumptions about high school students without accounting for large differences in mobility aspirations and behaviors. Parental concerns of the safety of cycling may be contributing to decreased rates of cycling to school, and are interwoven with a range of individual and social norms prioritizing car-based travel. Nevertheless, as highlighted in this paper, mass adoption of car based travel also contributes to lower perceived safety for cyclists due to higher volumes of traffic. Large-scale physical infrastructure developments alone are unlikely to increase *perceptions* of safety; driver behavior, proximity to traffic, volumes of traffic, and speeds of traffic also demand critical attention. Overcoming safety concerns and negative perceptions of cycling through behavioral and cultural interventions coupled with upskilling and thoughtful infrastructure might present a pathway to increase the rates of cycling.

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