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Correlates of the intention to use a bike library system among New Zealand adolescents from different settlement types

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ABSTRACT

Introduction: Bike library systems (BLS) are present in several cities around the world. These systems have been implemented as policies to promote physical activity and health, and to reduce, among others, traffic congestion and air pollution. The implementation of BLS could facilitate the use of bicycle in countries like New Zealand, where the proportion of adolescents using cycling as a mode of transport is quite low. This study examined the correlates of the intention to use a BLS in a sample of New Zealand adolescents living in different settlement types.
Methods: Adolescents (n = 2355; age: 13–18 years) from 23 secondary schools in the Otago region, New Zealand participated in this study. Participants completed an online questionnaire reporting their sociodemographic characteristics, transport to school, an interest in BLS and perceptions of cycling in general and cycling to school. Data were examined using multiple linear regression.
Results: Overall, 17.1% of adolescents stated that they would use a BLS if it was available in their area. In the regression model, positive correlates of the intention to use a BLS were participant's age, adolescents liking bicycle riding for recreational purposes, cycling often with friends, and cycling to school being perceived as interesting/pleasant/stimulating and a great way to get some exercise (all $p < 0.01$). Negative correlates were male gender and having two or more bicycles at home (all $p \leq 0.001$).
Conclusions: Different sociodemographic, individual and interpersonal factors were identified as significant correlates of the adolescents' intention to use a BLS. These findings can be used to assist in designing more effective interventions to promote bicycle use among adolescents based on the BLS implementation.

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1. Introduction

Nowadays, cycling is considered as a tool to promote public health (Egiguren et al., 2021; Nalmpantis, 2021). Cycling as a mode of transport contributes to the overall levels of physical activity and plays a significant role in the reduction of risk factors for chronic diseases (Molina-García et al., 2015; Bangsbo et al., 2016; Otero et al., 2018; Egiguren et al., 2021). Thus, the literature considers bicycle-related policies to be key public health interventions for a healthy urban design (Egiguren et al., 2021). Furthermore, after the COVID-19 pandemic, public transport promotion policy has been reoriented to a more active mobility promotion policy to reduce private vehicles and promote cycling as a mode of transport around the world (Nalmpantis et al., 2021).

Cycling could have a more significant role as a mode of transport in the general population if policies supporting cycling were widely implemented (Mason et al., 2015; Zukowska et al., 2022). In this regard, the implementation of bike library or bicycle-sharing systems has been a successful intervention policy to increase population-level cycling worldwide in cities across Europe, Asia and America (Hosford et al., 2019; Nieuwenhuijsen and Rojas-Rueda, 2020; Doğru et al., 2021). Bike library systems (BLS) are based on the availability of bicycles for shared use for a short-period of time (e.g., 30 min) at a low price or free of charge (Molina-García et al., 2015; Eren and Uz, 2020). These systems have been implemented for a variety of reasons, not only to promote cycling behaviour, but also to reduce traffic congestion and air pollution, and to facilitate the first and last miles of public transport (Rojas-Rueda et al., 2011; de Chardon, 2019; Nieuwenhuijsen and Rojas-Rueda, 2020). It seems that the BLS implementation in cities of New Zealand is currently lower compared to other developed countries based on the literature (Larsen, 2013; Elmashhara et al., 2022).

The proportion of adolescents using cycling as a mode of transport to school or to other destinations is quite low in developed countries like New Zealand (Mandic et al., 2016a, 2017b, 2022). The implementation of BLS could facilitate the use of bicycle in such settings. Understanding the correlates of adolescents' intention to use a BLS if it was available in their area would assist in designing more effective active transport interventions to promote bicycle use in young people.

Consistent with the foundations of the ecological model (Sallis et al., 2006; Panter et al., 2008), a complex set of personal, social, environmental and policy factors is related to cycling behaviour in adolescents (Hopkins and Mandic, 2017; Estevan et al., 2018; Mandic et al., 2022). Recently, Eren and Uz (2020) provided a review of factors influencing BLS user behaviour under categories such as socio-demographic characteristics, built environment characteristics, location of docking stations, temporal factors and safety. However, that review did not focus on any specific age group. Globally, evidence shows that the BLS users are frequently males, young adults, those living near docking stations, individuals without driving license or those who perceived their environment to be safe for cycling (i.e., a low risk of crashes) (Ogilvie and Goodman, 2012; Molina-García et al., 2015; Hyland et al., 2018; Hosford et al., 2019; Eren and Uz, 2020; Reilly et al., 2020; Pellicer-Chenoll et al., 2021). Studies specifically examining the correlates of the use of BLS among adolescents are very scant (Estevan et al., 2018; Eren and Uz, 2020). In a study carried out among Belgian adolescents about the factors influencing modes of transport to various destinations (Simons et al., 2013), participants considered BLS as practical systems of transport because they have characteristics that support bicycle use (i.e., short travel time, low cost and ease of access to transport facilities). Estevan et al. (2018) examined the correlates of BLS use for school travel among adolescents from Valencia (Spain). Findings showed that bicycle availability at home was positively associated with BLS use, whereas the number of vehicles at home and absence of docking stations near school were negative correlates.

Few studies analysed the characteristics of potential BLS users in adults, while there are no specific studies in adolescents that analysed these characteristics. In a study carried out on a sample of adults in Vancouver (Canada), Hosford et al. (2018) found that BLS potential users tended to be younger, have low income and were more likely to use public transportation as main mode of transport compared to current BLS users. The study findings showed that having docking stations near home and not owing a bicycle were motivators among potential users.

The present study uses an ecological framework for active commuting (Sallis et al., 2006; Panter et al., 2008; Molina-García et al., 2019) and variables from the theory of planned behaviour (Ajzen, 1991) to understand adolescents' perceptions regarding their interest in using a BLS. The use of these two conceptual frameworks has allowed research to understand specifically individual, interpersonal and environmental influences on active commuting behaviour (Bird et al., 2018; Mandic et al., 2022). The theory of planned behaviour is one of the behaviour change theories most frequently used to examine active commuting behaviour among young people, such as cycling to school (e.g., Frater et al., 2017a; Bird et al., 2018; Mandic et al., 2022). At the individual level, the theory of planned behaviour allows analysing the intention to carry out a behaviour as a previous step to its realization (Ajzen, 1991). Behavioural intention is determined by attitudes (e.g., personal beliefs and general evaluation of cycling behaviour), subjective norms (e.g., normative beliefs for peers or parents that are perceived as social pressure to act in a particular way) and perceived behavioural control (e.g., perception of the ease or difficulty of engaging in cycling behaviour) (Ajzen, 1991; Mandic et al., 2016a; Frater et al., 2017a; Molina-García et al., 2018; Ortiz-Sánchez et al., 2022). Behavioural intention along with perceived behavioural control determine actual behaviour (Ajzen, 1991). Specifically, this study examined correlates of adolescents' intention to use a BLS if it was available in their area. The sample was composed of New Zealand adolescents from different settlement types (i.e., urban and rural areas). At the time this research was conducted, no BLS had been implemented in the study areas. Thus, due to the lack of data on actual usage in these areas, this research aimed to analyse which factors could predict a possible demand (intention) for the use of the BLS with the idea of achieving more successful future implementations of this type of system among adolescents.

2. Methods

2.1. Participants

This research involved secondary analysis of data collected as part of the Built Environment and Active Transport to School (BEATS) Study (Dunedin, New Zealand, 2014–2015) (Mandic et al., 2015, 2016b) and BEATS Rural Study (Otago Region, New Zealand, 2018; White et al., 2021). Overall, 2769 adolescents (age: 13–18 years; school years 9–13) from 23 out of 27 secondary schools in the Otago region, New Zealand participated in the BEATS Student Survey (BEATS: n = 1780; BEATS Rural: n = 1014). Adolescent participants were recruited through their schools and signed consent prior to participation. For adolescents under 16 years of age, parental opt-in or opt-out consent were used in the BEATS Study based on schools' preferences. Parental consent was not required in the BEATS Rural Study. The University of Otago Human Ethics Committee approved the study protocols for both studies (BEATS: 13/203; BEATS Rural: 17/178).

Participants with missing student consent (n = 25), missing required parental consent (n = 41; BEATS Study only), and those with signed parental opt-out consent (n = 18), no survey data (n = 25) and with invalid surveys (n = 49) were excluded from this analysis. In addition, students boarding at school or privately (n = 196), missing home address or distance to school data (n = 22), having invalid transport to school data (n = 15) and missing data for the BLS survey item (n = 48) were also excluded. Therefore, data from 2355 adolescents (BEATS: n = 1422; BEATS Rural: n = 933) were included in this analysis. Participants attended schools located in a large urban area (n = 1116; 11 schools), medium urban areas (n = 213; 3 schools), small urban areas (n = 389; 4 schools) and rural settings (n = 637; 5 schools).

2.2. Procedures and assessments

Research methodology for both BEATS Study (Mandic et al., 2015, 2016b) and BEATS Rural Study (White et al., 2021) has been described previously. Briefly, adolescents completed a 30- to 40-min online survey during the school time under supervision of research staff. BEATS Student Survey items related to sociodemographic characteristics, transport to school, adolescents' interest in BLS and their perceptions of cycling in general and cycling to school were analysed for the purposes of this study. Adolescents' height and weight were measured by trained research staff at the time of the survey using standard measurement procedures, as described previously (White et al., 2021) and body mass index was calculated as weight divided by height squared ($kg{\cdot}m^{-2}$). Adolescents' weight status category was determined using international age- and sex-specific cut-points for body mass index (Cole et al., 2000).

Adolescents self-reported their date of birth, gender, ethnicity, number of cars and bicycles in a household and their home address. Home address was used to determine home neighbourhood level of deprivation using the New Zealand Index of Deprivation (Salmond et al., 2006). The New Zealand Index of Deprivation was expressed in deciles (1 = least deprived to 10 = most deprived) and was subsequently recoded into quintiles for data analysis (quintile 1 = least deprived to quintile 5 = most deprived). Home address was also geocoded to categorise adolescents' home locations into one of the six urban and rural categories defined by Statistics New Zealand (New Zealand Stats, 2021) and subsequently recoded into four categories ('large urban area', 'medium urban area', 'small urban area' and 'rural setting') as described elsewhere (Mandic et al., 2023b).

Adolescents self-reported the use of different transport to school modes with response categories "never", "rarely", "sometimes", "most of the time" and "all of the time" for each mode, as previously described (Mandic et al., 2017b). Modes used 'most of the time' and 'all of the time' were considered the dominant modes and were used to classify adolescents into active, motorized or mixed transport to school (Mandic et al., 2017b). Adolescents also reported their frequency of cycling to school in the previous two weeks with response categories "never", "almost never", "sometimes", "almost every day" or "every day" (Mandic et al., 2017b).

Adolescents' opinions about BLS were assessed using a statement "I would use a bike library if it was available in our area" with responses collected on a 4-point Likert scale ranging from 'strongly agree' to 'strongly disagree'.

Adolescents' perceptions of cycling in general included items related to enjoyment of cycling for recreation ('I like cycling for recreation'), cycling habits of their parents ('My parents cycle frequently') and adolescents' cycling with their parents and friends ('I often cycle with my parents' and 'I often cycle with my friends', respectively), as described previously (Mandic et al., 2016a).

Adolescents' beliefs related to their perceptions of cycling to school were examined using survey items informed by the Theory of Planned Behaviour (Ajzen, 1991). In both BEATS and BEATS Rural Studies, standard items related to attitudes towards cycling to school, subjective norm, perceived behavioural control and behavioural intentions were collected on a 7-point Likert scale (for specific questions, refer to previously published articles (Mandic et al., 2016a; Frater et al., 2017b; Molina-García et al., 2018; Mandic et al., 2017b; Mandic et al., 2022). As described previously (Mandic et al., 2016a, 2017b, 2022; Molina-García et al., 2018), given the conceptual similarities in items, composite scores were created for experiential beliefs (3 items, Cronbach's $\alpha = 0.94$), instrumental beliefs (3 items, Cronbach's $\alpha = 0.84$), subjective norm (2 items, $r = 0.85$), cycling capability (3 items, Cronbach's $\alpha = 0.90$), and behavioural intentions (2 items, $r = 0.80$). Additional items related to school's encouragement ('My school encourages me to cycle to school'), incentives for cycling to school including getting exercise ('Cycling to school is a great way to get some exercise') and opportunity to socialise ('I can chat to my friends on my bike ride to school') were assessed using a 4-point Likert scale (Mandic et al., 2017b).

2.3. Data analysis

Demographic characteristics were analysed using descriptive statistics. Bivariate linear regression models were used to identify

factors associated with the opinion that adolescents would use BLS if it was available in their area. Subsequently, significant correlates in the bivariate models (set at $p < 0.10$) were simultaneously entered into a multiple regression model to assess their unique contribution to adolescents' intention to use a BLS if it was available in their area after mutual adjustment. In the multiple regression model, a p-value <0.05 was considered statistically significant. Assumptions of linearity for the model were verified and multicollinearity was checked by examining the variance inflation factors. Multicollinearity was not evident in the multivariate regression model as demonstrated by variance inflation factors no greater than 2.50 and tolerance measures ≥0.40. Examination of histogram and normality plots, as well as skewness (1.09) and kurtosis (−0.10) values, revealed a departure from normality in the outcome variable that was not deemed severe. Descriptive data were reported as frequencies (percentage) for categorical variables and mean ± standard deviation for continuous variables. Data analysis was performed using SPSS Statistical Package version 27.0.

3. Results

3.1. Sociodemographic characteristics

The sociodemographic data is shown in Table 1. Most of the participants (age: 15.1 ± 1.4 years; 54.9% girls; 25.4% overweight/obese) had a bicycle available at home (79.3%) and did not cycle to school in the previous two weeks (89.3%).

The percentage of participants who either somewhat agreed or strongly agreed that they would use a BLS if it was available in their area differed by age, ethnicity, weight status, number of bicycles and number of vehicles in a household (Table 1).

Correlates of the intention to use a BLS if it was available.

Overall, 17.1% of adolescents (n = 404) agreed with a statement that they would use a BLS if it was available in their area with no

Table 1
Sociodemographic characteristics of study participants.

	Total sample	I would use a bike library if it was available in our area		p-value
		Agree	Disagree	
	n = 2355	n = 404	n = 1951	
Age (years)	15.1 ± 1.4	15.3 ± 1.6	15.1 ± 1.4	0.028
Gender [n(%)]				
Male	1062 (45.1)	173 (42.8)	889 (45.6)	0.313
Female	1293 (54.9)	231 (57.2)	1062 (54.4)	
Ethnicity [n(%)]				
New Zealand European	1743 (74.1)	269 (66.7)	1474 (75.6)	0.003
Māori	271 (11.5)	56 (13.9)	215 (11.0)	
Other	334 (14.2)	77 (19.1)	257 (13.2)	
Neighbourhood deprivation score [n(%)]				
1 (least deprived)	723 (31.5)	107 (27.3)	616 (32.4)	0.231
2	617 (26.9)	106 (27.0)	511 (26.9)	
3	475 (20.7)	83 (21.2)	392 (20.6)	
4	335 (14.6)	67 (17.1)	268 (14.1)	
5 (most deprived)	145 (6.3)	29 (7.4)	116 (6.1)	
Weight status [n(%)]				
Healthy weight or underweight	1614 (74.6)	267 (69.9)	1347 (75.6)	0.020
Overweight or obese	550 (25.4)	115 (30.1)	435 (24.4)	
Number of bicycles available to use to get to school [n(%)]				
None	487 (20.7)	97 (24.0)	390 (20.0)	0.015
One	474 (20.1)	94 (23.3)	380 (19.5)	
Two or more	1394 (59.2)	213 (52.7)	1181 (60.5)	
Number of vehicles at home [n(%)]				
None	57 (2.4)	17 (4.2)	40 (2.1)	0.005
One	531 (22.5)	105 (26.0)	426 (21.8)	
Two or more	1767 (75.0)	282 (69.8)	1485 (76.1)	
Settlement type for school location				
Large urban area	1116 (47.4)	204 (50.5)	912 (46.7)	0.102
Medium urban area	213 (9.0)	24 (5.9)	189 (9.7)	
Small urban area	389 (16.5)	66 (16.3)	323 (16.6)	
Rural setting	637 (27.0)	110 (27.2)	527 (27.0)	
Transport to school [n(%)]				
Active transport only	638 (27.1)	117 (29.0)	521 (26.7)	0.289
Motorized transport only	1404 (59.6)	227 (56.2)	1177 (60.3)	
Combination of active and motorized transport	313 (13.3)	60 (14.9)	253 (13.0)	
Frequency of cycling to school in the previous two weeks				
Never	1748 (89.3)	299 (86.7)	1449 (89.9)	0.153
Almost never	57 (2.9)	8 (2.3)	49 (3.0)	
Sometimes	64 (3.3)	16 (4.6)	48 (3.0)	
Almost every day	47 (2.4)	11 (3.2)	36 (2.2)	
Every day	41 (2.1)	11 (3.2)	30 (1.9)	

significant differences among adolescents attending schools in different settlement types ($p = 0.150$) (Fig. 1).

In the bivariate regression models, significant correlates ($p < 0.10$) of adolescents' perception that they would use a BLS were sociodemographic characteristics (age, gender, ethnicity, weight status, number of bicycles and vehicles at home) and variables related to attitudes towards cycling in general and cycling to school, subjective/perceived norm, perceived behavioural control, behavioural intentions and incentives for cycling to school (see Table 2 for details). Variables such as neighbourhood deprivation score, settlement type, type of transport to school (i.e., active or/and motorized transport) and frequency of cycling to school were not significant correlates of the intention to use a BLS in the preliminary bivariate models.

In the multiple regression model, positive correlates of the intention to use a BLS if it was available were age, adolescents' enjoyment of cycling for recreation, cycling frequently with friends, perceptions that cycling to school is interesting/pleasant/stimulating and perceiving cycling to school as a great way to get some exercise. Conversely, being male and having two or more bicycles available at home (compared to none) were negatively associated with adolescents' intention to use a BSL if it was available in their area (Table 2).

4. Discussion

This study examined correlates of adolescents' intention to use a BLS if it was available in their area. Nearly one in five adolescents indicated that they would use a BLS if it was available. Older age, favourable attitudes towards cycling as well as adolescents' perception of cycling as a great way to get some exercise were identified as positive correlates of the intention to use a BLS, whereas male gender and having two or more bicycles at home were negative correlates.

In the present study, 17.1% of New Zealand adolescents stated they would use a BLS if it was available with no significant difference across diverse settlement types, including both urban and rural areas. Our data are consistent with the study carried out by Hosford et al. (2018) on Canadian adults where findings showed that 23% of the non-users of BLS were potential users. Similarly, a study of university students in Spain found that almost 20% of the participants were BLS users after the implementation of a new BLS in the city of Valencia (Molina-García et al., 2015). Given these findings across studies, future studies could examine if adolescents' interest in the use of BLS vary based on the overall cycling culture in the area, topography and cycling safety-related factors including built environment features and traffic safety in different geographical settings.

It is noteworthy that in our study female adolescents expressed greater interest compared to male adolescents to use the BLS if it was available in their area. According to previous research with adults (e.g., Ogilvie and Goodman, 2012; Hosford et al., 2018; Eren and Uz, 2020; Reilly et al., 2020; Pellicer-Chenoll et al., 2021), BLS users are mostly males and younger individuals. The literature has shown similar gender differences not only in the use of BLS, but also in the use of the bicycle in general for transport or for recreation (Pellicer-Chenoll et al., 2021). In the case of BLS, gender differences seem to be related to the cycling trip purpose and to the environmental perceptions of safety and risk associated with cycling. Specifically, males tend to use BLS for instrumental purposes such as for commuting whereas females tend to use BLS for non-utilitarian cycling objectives (Goodman and Cheshire, 2014; Elmashhara et al., 2022). Female BLS users tend to avoid peripheral areas at night or job-dense areas, and choose off-street lanes or areas with parks and quieter roads (Goodman and Cheshire, 2014; Wang and Akar, 2019; Pellicer-Chenoll et al., 2021; Elmashhara et al., 2022). Considering the present findings, it is possible that, in adolescents, gender differences in the intention of using the BLS use are unlike those reported in studies carried out in adults. To our knowledge, there are no specific studies in adolescents that analysed possible gender differences in the use of BLS and future research in this area is warranted. Considering the existing evidence from studies conducted in adults, initiatives aimed at introducing BLS should take into account gender differences in reasons for using BLS and individuals' perceptions of environmental safety for cycling when implementing BLS systems. For example, distributing docking stations near different destinations, not only schools or workplaces, but also in parks or other destinations would allow use of BLS for non-utilitarian cycling behaviours.

To our best knowledge, no previous study examined whether age relates to adolescents' interest in using the BLS. Current evidence comes mainly from studies in adult population and shows that young adults are frequent BLS users (Eren and Uz, 2020; Elmashhara et al., 2022). In the present study, older adolescents showed more interest in potential use of a BLS if it was available in their area

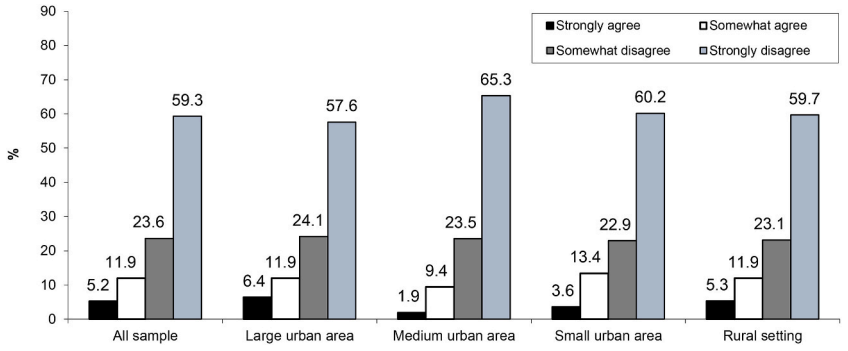

Fig. 1. Adolescents' responses to a survey item "I would use bike library if it was available in our area".

Table 2
Correlates of adolescents' perception that they would use a bike library system if it was available in their area.

	p-value from bivariate analysis	B	Std. error	p-value	95% Confidence interval	
					Lower bound	Upper bound
Sociodemographic characteristics						
Age	0.014	0.02	0.01	**0.001**	0.01	0.03
Gender (ref. female)	ns	−0.06	0.02	**0.001**	−0.10	−0.03
Ethnicity (ref. New Zealand European)						
Māori	<0.001	0.04	0.03	0.208	−0.02	0.09
Other	0.030	0.02	0.03	0.370	−0.03	0.07
Weight status (ref. overweight or obese)	0.017	−0.02	0.02	0.233	−0.06	0.02
Number of bikes available at home for cycling to school (ref. none)	0.013					
One		−0.05	0.03	0.103	−0.10	0.01
Two or more		−0.11	0.02	**<0.001**	−0.16	−0.06
Number of vehicles at home (ref. none)	0.005					
One		−0.07	0.06	0.249	−0.18	0.05
Two or more		−0.09	0.06	0.107	−0.21	0.02
Attitudes towards cycling in general						
I like bike riding for recreational purposes	<0.001	0.04	0.01	**<0.001**	0.02	0.06
I often cycle with my parents	<0.001	−0.01	0.01	0.602	−0.03	0.02
I often cycle with my friends	<0.001	0.04	0.01	**0.002**	0.01	0.06
Transport to school						
Attitudes						
Experiential beliefs composite score (Cycling to school is interesting/pleasant/stimulating)	<0.001	0.02	0.01	**0.002**	0.01	0.04
Instrumental beliefs composite score (Cycling to school is healthy/good/useful)	<0.001	0.00	0.01	0.622	−0.02	0.01
Subjective/perceived norm						
Subjective norm composite score (My parents/peers think I should cycle to school)	0.001	0.00	0.01	0.499	−0.01	0.01
My school encourages me to cycle to school	0.002	0.01	0.01	0.406	−0.01	0.03
Perceived behavioural control						
I have complete control over whether or not I cycle to school	0.050	−0.01	0.00	0.194	−0.01	0.00
Behavioural intentions						
Behavioural intention composite score (I want/intend to cycle to school)	<0.001	0.01	0.01	0.059	0.00	0.03
Incentives for cycling						
Cycling to school is a great way to get some exercise	<0.001	0.03	0.01	**0.003**	0.01	0.06
I can chat to my friends on my bike ride to school	0.005	0.00	0.01	0.757	−0.02	0.02

Note. All correlates significant at $p < 0.10$ in the bivariate analyses have been included in the fully adjusted model. Bold values indicate statistically significant differences ($p < 0.05$). ns: not significant. The amount of variance (R^2) in the outcome variable explained by the variables in the model was 0.093.

compared to their younger peers. This finding likely relates to the tendency of older youth to have higher rates of independent mobility and better motor skills and cognitive skills necessary for safely riding a bicycle on the road (Mandic et al., 2018a; Rodríguez-Rodríguez et al., 2021). To be effective and used by young people, future BLS interventions aimed at young people may need to be supplemented by school-based cycle skills training programmes for children (Mandic et al., 2018b) and adolescents (Mandic et al., 2016a, 2018a, 2023a) and implemented in the areas that have appropriate cycling infrastructure and traffic speed management measures in place.

The current research did not show a relationship between neighbourhood deprivation index and the intention to use a BLS. According to the review by Eren and Uz (2020), the existing evidence has shown a positive relationship between different levels of neighbourhood socioeconomic status (i.e., low, middle and high income) and the BLS demand. However, the strongest association with the BLS demand has been found with the high income areas (Eren and Uz, 2020). One of the explanations for this is that the BLS stations are usually located in high-income and densely populated neighbourhoods (Ricci, 2015). Future research should examine the relationship of the neighbourhood socioeconomic status and the adolescents' intention to use a BLS if it became available in their area.

In the present study, the availability of two or more bicycles at home for cycling to school was a negative correlate of adolescents' perception that they would use BLS if it was available. Our findings are in line with some previous studies in adults (e.g., Hosford et al., 2018), but they are not in line with the previous data from adolescents (Estevan et al., 2018). In the study of Hosford et al. (2018), which examined the profiles of current, potential and unlikely BLS users, one deterrent of BLS use among unlikely adult users was their preference for riding their own bicycle. However, among adults (Elmashhara et al., 2022), some studies associate bicycle ownership with higher BLS use, while others show the opposite. In a previous study among Spanish adolescents (Estevan et al., 2018), the use of the BLS was significantly higher among participants who had a bicycle at home. It is possible that the availability of a bicycle has a different influence on the intention to BLS use depending on perceived availability of the secure bicycle storage in adolescents' home neighbourhood and/or destination(s) they are cycling to or from. For example, an adolescent who perceives that there are no places to safely leave their bicycle in their neighbourhood and/or at destinations(s) would be likely to have more intention to use BLS to avoid the risk of bicycle theft.

This study also showed that positive attitudes towards cycling are related to adolescents' intention to use a BLS if it was available in their area. This is consistent with existing literature on various age groups (Therrien et al., 2014; Elmashhara et al., 2022), which has shown that having positive attitudes towards cycling increases the intention of using a BLS. Specifically, in our study, adolescents who cycle often with friends indicated they would be more likely to use a BLS. In line with previous studies from different geographical contexts including New Zealand (e.g., Frater et al., 2017b), these results support the significant influence of peers on cycling behaviours among adolescents. In addition, in our study, adolescents' enjoyment of cycling for recreation was also related to their interest in using a BLS. Future research among adolescents could examine the purpose of using BLS (i.e., cycling for transportation or/and for recreation).

Finally, our findings indicate that experiential beliefs related to cycling to school (i.e., considering cycling to school as an interesting, pleasant and stimulating behaviour) are associated with a higher probability of using the BLS. The perception that cycling to school is a great way to get some exercise was also positively associated with the intention to use of a BLS if it was available. Previous studies have already shown that it is important for adolescents to be aware of the health benefits of cycling behaviour in order to use the bicycle as a usual mode of transport (e.g., Molina-García et al., 2018). However, compared to walking to school, adolescents have less favourable attitudes towards cycling to school and their attitudes differ based on how far they live from their school (Mandic et al., 2017b, 2022). Therefore, additional initiatives may need to be considered to encourage adolescents to use BLS for their school travel, especially in cities where cycling to school rates are low.

These findings have significant implications for designing the BLS to meet the needs and preference of adolescents and ultimately encourage their use of the BLS if such systems are available in their area. Based on the present results, educational intervention programs for adolescents, such as school-based cycle skills training programmes (Mandic et al., 2016a, 2017a, 2023a), could be designed and/or targeted to improve adolescents' cycle skills (Mandic et al., 2018a). Moreover, these interventions would be more effective if they were based both on the development of positive attitudes towards cycling as a mode of transport to school and other destinations and on generating interesting and pleasant experiences related to cycling behaviour. For this purpose, intervention cycling programs could be developed in specific school subjects such as physical education or through global school programs.

4.1. Strengths and limitations

The strengths of this study include a large representative sample and recruitment of adolescents from different settlement types (i.e., urban and rural areas). The study setting in New Zealand added geographic and cultural diversity to previous BLS research. However, this study is not without limitations. The cross-sectional design prevents any conclusions about causality. The use of self-reported measures of beliefs and behaviours can be subjected to bias. Moreover, this study is focused on the intention to use a BLS. As is known, considering the theory of planned behaviour, intentions do not always predict actual behaviour (Ajzen, 1991, 2015). More research is needed to understand discrepancies between intention and actual behaviour when studying intentions to use a BLS (Cai et al., 2019). These discrepancies could explain to some extent the gender differences found in this study compared to similar studies with adults, i.e., some girls may believe they would use a BLS, if available, but that may not be necessarily the case in reality for a number of circumstances.

5. Conclusions

Nearly one in five of the surveyed New Zealand adolescents believed that they would use a BLS if it was available in their area. Different sociodemographic, individual and interpersonal factors were identified as significant correlates of the adolescents' intention to use a BLS. An older age, favourable attitudes towards cycling and adolescents' perception of cycling as a great way to get some exercise were positive correlates, whereas male gender and having two or more bicycles at home were negative correlates. These findings can be used to assist the design of effective interventions to promote bicycle use among adolescents based on the BLS implementation.

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Author statement

Molina-García: Conceptualization, Methodology, Analysis, Writing - original draft, Writing - review & editing.
Queralt: Conceptualization, Methodology, Writing - review & editing.
Flaherty: Conceptualization, Methodology, Data collection, Writing - review & editing.
García Bengoechea: Methodology, Funding acquisition, Writing - review & editing.
Mandic: Conceptualization, Methodology, Investigation, Data curation, Analysis, Funding acquisition, Supervision, Project administration, Writing - review & editing.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:Sandra Mandic is the founder and the director of the research consultancy AGILE Research Ltd. (www.agileresearch.nz) and Principal Advisor Transport Strategy at Wellington City Council (Wellington, New Zealand). Other authors have no conflict of interest.

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