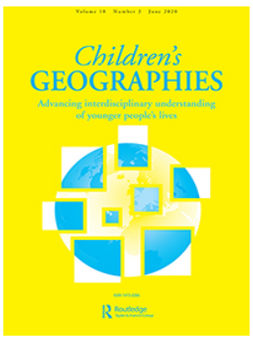

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Children's independent mobility: the role of school-based social capital

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ABSTRACT

Research has documented the decline in children's independent mobility (CIM) globally. CIM is a measure of the level of a child's freedom to move about his or her local neighbourhood without direct adult supervision. This paper explores the effectiveness of three intervention programmes to change travel behaviours of children to and from school in 26 Catholic primary schools in a range of urban and regional settings in Victoria, Australia. Using pre and post intervention surveys with 1600 students and parents, and interviews with school principals, we measured the influence of a range of individual, social, and built environment factors on the effectiveness of these intervention programmes. The degree of social connectedness of the school and the individual was found to have the most impact on the effectiveness of the intervention programmes to change behaviours, while the interventions themselves were not greatly effective without being embedded in a supportive school culture.

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Children's independent mobility; intervention programmes; Catholic schools; journey to school; social capital; connectedness

Introduction

Children's independent mobility (CIM) is defined as the capacity of children to travel around their neighbourhood *without* adult supervision or accompaniment (Hillman, Adams, and Whitelegg 1990; Tranter 1993). Intervention programmes were developed partly in response to a global decline in CIM (Hillman, Adams, and Whitelegg 1990; McDonald 2007; Mitra, Papaioannou, and Habib 2016; Van Der Ploeg et al. 2008), with the attendant negative health outcomes including increasing obesity in children and adolescents (Brussoni et al. 2015; Pabayo et al. 2009; Whitzman et al. 2009). The key predictors of CIM include the child's age (Hillman, Adams, and Whitelegg 1990; Tranter 1993), gender (Brown et al. 2008; Carver et al. 2014; Giles-Corti et al. 2011), distance travelled (Hillman, Adams, and Whitelegg 1990; Panter et al. 2013), the built environment in which they travel (Curtis, Babb, and Olaru 2015; McMillan 2005; Villanueva et al. 2014), parental attitudes and perceptions (Hillman, Adams, and Whitelegg 1990; Malone 2007; Mammen et al. 2012; Mitra et al. 2014) and social capital (Hume, Jorna, et al. 2009; Hume, Timperio, et al. 2009; Trapp et al. 2012).

Behaviour change or intervention programmes that encourage more children to use Active Travel (AT) modes – including walking, cycling and public transport – independently have existed for some time. Most of these programmes emphasise the journey to school and are based in school curricula. TravelSmart (2015) was implemented first in the UK in the 1990s, Ride to School (Bicycle Victoria 2009) in Victoria in the early 2000s, Walking School Bus in 1993, and Safe Routes to School (SRTS) (Couch, Mccutcheon, and Cirocco 2001) in 1970s in Denmark. While some countries such as the US

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have continued support for school-based intervention programmes such as SRTS (McDonald et al. 2014; SRTS 2019) often via infrastructure funding, government support for AT intervention programmes has declined across Australia (Whitzman 2013), particularly in Victoria with the demise of Travel Smart (2015) and SRTS (2006). Poor performance and declining outcomes have caused these to be discontinued or defunded following reviews.

While the effectiveness of individual programmes has been studied (Couch, Mccutcheon, and Cirocco 2001; Garrard and Crawford 2010; Hubsmith 2006; Mammen et al. 2014b; McDonald et al. 2014; Peddie and Somerville 2006; Rose 1999), the role that schools themselves play in their effectiveness has been somewhat neglected (Garrard and Crawford 2010). Mammen et al. (2014a) recognised the key role of schools in their implementation when reporting on trials of the School Transportation Planning programme, which operated in Canada in 2010–2012. Conversely, Buliung et al. (2011) concluded that school-based intervention programmes played a significant role in mobilising surrounding communities. However, few studies have measured the comparative effectiveness of intervention programmes based in schools; an exception being Buttazzoni et al. (2018).

Based on research we conducted in 26 Catholic schools in Melbourne, the second most populous city in Australia, we focus on school-based social capital. Many social theorists have written at length on social capital going back to Bourdieu, Coleman and Putnam (Lewis 2010). Several forms of it have been defined – bonding, bridging, and linking (Lin 2001; Putnam 2000). Lewis' understanding of social capital is used in this study (Lewis 2010). It is sometimes described as 'social connectedness' or just 'connectedness'. He recognises that social capital is a multi-level, active concept, characterised as action within networks by individuals. It is relational, and so there is an expectation of reciprocity, from which trust may be the outcome. Social capital then becomes a deliberate choice of individuals, such as community leaders, to take actions on behalf of themselves or their community. This leads eventually to a connection to the roles of the parent and the school.

The parent or caregiver is the gatekeeper of their children's behaviours. The level of risk that they perceive in the environment (Mitra et al. 2014; Rothman et al. 2015) and their assessment of the child's competence to navigate that environment safely (Gill 2007; Prezza, Alparone, and Cristallo 2005) will determine the licence's that they grant their child to explore it independently (Tranter 1993). This research posits that social capital of the school and community is required to overcome the strong parental fears relating to their child's safety in the course of that travel.

Several conceptual models (Garrard 2009; McMillan 2005; Mitra 2013) exist that explain the interaction of factors discussed above to influence a parent/caregiver's decision. This research adopted a socio-ecological model to hypothesise about CIM, informed by previous research into children's travel behaviour (Hume et al. 2009; Mitra 2013). We hypothesised multiple layers of influence on CIM, which include (1) the individual behaviours and socio-demographic characteristics of a child, homogenous socio-economic characteristics of the household and school, (2) social capital characteristics of the household and school, social preferences and attitudes of the child and parent, and (3) built environment characteristics of the neighbourhood and the neighbourhood environmental qualities (in this context, subjective perceptions of parents and child).

Methods

This paper derives from a research project which surveyed 26 Catholic schools across Melbourne and regional areas in Victoria, Australia between 2009 and 2012. A previous paper examined the qualitative outcomes of that mixed-methods research (Love and Whitzman 2018). This paper addresses the quantitative dimensions, focusing on the role of social capital in mediating other factors.

In Victoria, Australia, one-third of primary students and almost half (45%) of secondary students attend a non-government school, including Catholic schools (Melbourne 2014). All non-government schools, including Catholic schools, have larger catchment areas than an equivalent-sized government school. Parent/caregivers have chosen them specifically rather than a local government school, which are often closer, for specific reasons including academic results, facilities, educational

or pastoral programmes, a particular faith environment, or purely for convenience. Understanding the reasons for this choice may provide more insight into levels of CIM in students attending non-government schools. Catholic schools in a study in Melbourne were found to have lower CIM than government schools (Carlin et al. 1997), but there has been little research since then into the levels of CIM in relation to Australian Catholic schools.

The study used a mixed methods approach to measure the effectiveness of three intervention programmes – TravelSmart, Ride to School and SRTS – which were run voluntarily by the schools over a one-year period to increase active travel behaviours of children aged 9–12 years. This age cohort is associated with behaviour-change competency years when they begin to travel independently on school journeys (Hillman, Adams, and Whitelegg 1990; Jago et al. 2009; Tranter 1993). Surveys were distributed to children and their parents at baseline, and follow-up (12–18 months post-baseline). Interviews with principals were held to better understand factors that influenced the effectiveness of the intervention programmes.

The Programmes

Safe Routes To School (SRTS) is a school travel planning programme designed around five key elements –education, encouragement, engineering, enforcement, and evaluation. Steps included site assessments, mapping student locations, designing safe routes, development of an action plan, recommending infrastructure changes to improve safety, and education programmes i.e. road and bicycle safety programmes. It involves local council travel engineers, community and police representatives. In this iteration of SRTS, no funds were available to schools for infrastructure improvements, but a small amount of funding ($2000) was available to cover implementation costs (Sustrans 2015).

Travel Smart is a similar programme, facilitated by a coordinator from a government transport agency, but emphasised educational behaviour-change strategies over engineering solutions. Schools received funding ($10000) to cover implementation costs and infrastructure changes (Peddie and Somerville 2006; TravelSmart 2015).

Ride2School is a strategy-based programme delivered externally through online support, which provides schools with incentives, resources and strategies to implement the programme. It encourages active transport generally, emphasising cycling to school. No funds were available to schools (Bicycle Victoria 2009).

Recruitment of schools and participants

Thirty-six Catholic primary schools were selected to voluntarily participate in one of three intervention programmes or to be a reference school. The sample was equally distributed across four urban regions – inner, middle, outer and peri-urban or regional locations (Melbourne 2014) – and targeted schools with a range of socio-economic conditions. (ABS 2017). Twenty-six schools agreed to participate and implemented a one-year programme (response rate 77.7%).

Four surveys were distributed to collect relevant data (Table 1). Two surveys were designed to collect baseline personal, neighbourhood perceptions and travel behaviour information from each child, and social demographic, built environment and social perceptions of parents or caregivers. Race and ethnicity data were not collected. Two surveys were distributed post-intervention, a final travel behaviour survey completed by the child, between twelve and eighteen months after the baseline survey, and a survey completed by school principals. It collected their perceptions about travel behaviours, and social capital of the school community (Caldwell and Harris 2008),

To supplement quantitative data on the influence of social capital on the effectiveness of the intervention programmes, a 90 min semi-structured interview with school principals and programme leaders was conducted after the programme ended.

Outcome variable: children's independent mobility

A categorical variable of CIM status was computed from children's responses in baseline and final surveys. Three categories (0, 1 or 2) were created depending on travel mode to and from school and adult accompaniment. (O = not independent, 1 = independent one way, 2 = independent both ways). A binary categorical variable was created by combining 1 and 2.

The Change in CIM variable was calculated by recording any decline post-intervention e.g. 2–1, as 'Decreasing IM', and any increase e.g. 0–2 as 'Increasing IM'. Those who did not change, were described as 'No Change' in status. A binary dependent variable was created by combining 'Decreasing IM' and 'No change' into 'Not increasing IM'.

At the school level, we created a (continuous) dependent variable called 'Increased IM' by calculating the percentage whose IM had increased.

Independent variables

Independent variables were categorised into three groups: (1) individual characteristics including travel behaviours; (2) social capital at neighbourhood and school community levels; and: (3) objective and perceived neighbourhood built environment variables. These are summarised in Table 1.

Street connectivity

The travel behaviours of primary school aged students who lived outside a cyclable distance, estimated to be two kilometres (SRTS 2015) for children of this age, would be unlikely to change. The mean shortest road distance from home to school for students in the study was also 2.1 kms (using OpenStreetMaps). Using network function of ArcGIS v17 software street connectivity (proportion of the school catchment reached in a journey of 2.1 km) was calculated, becoming the pedshed for each school. Although more accurate (Buliung et al. 2013), it was not feasible to use GPS technology to measure distance-travelled with this sized cohort.

Analysis

Descriptives

Frequency tables summarise key descriptives of the sample, including the number of students by school, gender breakdown by age, SES of the students, parental education, and urban classification of the school (Table 2).

Regression models

Using SPSS (Version 17), each of the measures in Table 1 was tested with the dependent variables (CIM at baseline and change in CIM) using bivariate cross-tabulations. Results with a p-value less than 0.1 were included in regression models, to ensure that all variables found to be important in the literature and research design were included.

Two regression models – one at individual student level, one aggregated up to the school level – were constructed using the independent variable measures identified above, and used to explore associations with baseline CIM status, and the change in CIM post-intervention. (See Tables 3–6) These were introduced to the multinomial linear regression (at school-level) and binary logistic regression (individual level) models in three groups using a backwards stepwise process, starting with individual, then social capital, then built environment factors, reflecting the socio-ecological model hypothesised. The cut-offs for exclusion during the stepwise processes were controlled by SPSS using the Wald statistic, so were not mandated manually.

Table 1. Variables collected in surveys and included in models.

Groups	Variables (Survey*)	Categories	Source
Individual characteristics, travel behaviours and preferences	*Child (B and F)*:		Tranter (1993)
	• age, year-level, gender, home address;		
	• Travel Mode (to / from); preferred mode;	Walk/Bike/Car/PT /other & preference	
	• Adult accompanied child	Yes/No	
	• IM Licenses	Cross busy streets, ride on main roads, use PT, visit friends	
	Household measures (PB)		
	• Vehicles owned	0–4+;	
	• Occupation	}Coded using standard	
	• education	}ABS Census codes	
	• employment status	}	
	Travel mode: Preferred mode of travel to school for their child;	Car/walk/cycle/scooter/bus/ tram/ other	
	Parent Attitudes:		
	• Encourages child's CIM;	Yes/No plus preference	McMillan (2007), Hillman et al.(1990), and Tranter (1993), Hume et al.(2009);
	• Strategies to increase AT;	}Taken from Travel	
	• Reasons for actual travel mode;	}Smart survey	
	• Factors inhibiting child's IM on school journey;	}	
		}	
	• Attitudes to intervention programme	5 pt Likert scale – highly likely – not likely at all;	Travel Smart survey of behaviours of school children
	Child (B): Level of IM outside school; Frequency of (independent) weekend travel	Count of destinations visited by mode 3 categories – none, 1–2, 3+	Tranter (1993)
Social capital variables at neighbourhood and school community levels	*Child social preferences (B&PB)*:		
	• plays with other children in the street;	}5-pt Likert: strongly	Hume, Timperio, et al. (2009)
	• knows neighbours well;	}disagree – strongly agree	
		}	
	Reasons for school choice (PB)	5 Categories: locally based, distance, convenience, academic quality, facilities. Dichotomised into: (1) locally based/distance reasons; (2) other	CEM survey of school choice
	Neighbourhood social network factors (PB):	}	
	• knowledge of neighbours,	}5-pt Likert: strongly	Hume, Jorna, et al. (2009)
	• friends in the area,	}disagree – strongly agree	
	• good place to grow up,	}	
	• people get along,	}	
	• shared values,	}	
	• neighbourhood cooperation	}	
	• neighbourhood liveability	}	
	School-based measures (PB):		
	• Involvement in school groups;	}5-pt Likert: strongly	Putnam (2000), Caldwell and Harris (2008)
	• knowledge of other parents;	}disagree – strongly agree	
	• knowledge of school's community affiliations;	}	
		}	
	• community group involvement, i.e. sports club;	}	
		}	
	• attends meetings regularly;	}	
	• volunteers at school functions or other groups;	}	
		}	
	• SES of school.	}Calculated SEIFA-like	*ABS*
		}	

(*Continued*)

Table 1. Continued.

Groups	Variables (Survey*)	Categories	Source
	Principal Surveys:		
	• Encouragement for CIM	5-pt Likert: A lot – not at all	Caldwell and Harris (2008)
	• Connectedness with parents / families through school newsletters, education boards, forums & social activities;	5-pt Likert: very connected – not connected	
	• Active engagement with local community / business organisations external to school, including sponsorships & educational programmes;	5-pt Likert: very engaged – not engaged	
	• Involvement of local orgs. on-site in school activities;	Count of organisations (0, 1–2, 3–4, 5+);	
	• Involvement of students with local orgs. for activities off-site;	Count of organisations (0, 1–2, 3–4, 5+)	
	• Knowledge of involvement of local organisations by parents;	5-pt Likert: high – low or little involvement	
	• Student voice encouraged and evidenced in educational programmes in school.	5-pt Likert: highly encouraged – few or limited opportunities	
Objective and perceived neighbourhood built environment variables	*Street connectivity*: Pedshed analysis of school catchment using average student home-school distance 2.1 km & 2.1 km buffer around school	Calculated from home address, using network functions of ARCGIS	Giles-Corti (2011)
	Travel Distance: Euclidean and road network distances in kms from home to school		
	Urban classification: Based on geographical location of school	4 categories – inner,middle, outer and regional (by SGS Economics and Planning)	CEM (2014)
	Traffic: Traffic volume around the school, parking spaces	Counts before/after school (Converted to per student basis)	
	Built environment perceptions (PB):		
	• Satisfaction with Ped. Cross.	}5-point Likert: strongly	Hume, Timperio, et al. (2009)
	• lack of car parking at school	}disagree – strongly agree	
	• enough traffic lights in area	}	
	• traffic volumes are high	}	
	• public transport is limited	}	
	• stranger danger is a concern	}	
	• road safety is a concern		

Note: *B – Child baseline survey, F Child Final survey, PB Parent baseline survey.

Results

Twenty-six schools participated, of which seven were non-intervention schools, eight ran SRTS, five ran Ride2School, and six ran TravelSmart programmes. At baseline, 1598 nine to twelve year olds participated of 3400 eligible students (47%). Of these, 1136 surveys had usable data for the baseline study, caused by lost linkages between surveys, producing a final response rate of 33%. 831 final surveys were returned, of which 598 were able to be linked with their baseline surveys. All twenty-six school principals completed post-programme surveys.

Sample characteristics

The sample characteristics at baseline are summarised in Table 2 below.

This profile is consistent with the broader characteristics of students in Catholic schools, except for the proportion of students from higher SES schools (>105). Although the school sample was constructed with the final mean SES of 101, differing student response rates within schools caused a noticeable skew of the sample of students, resulting in higher male and female SES levels.

Table 2. Sample characteristics of students.

Sample Characteristic %	Proportion of Students (%)	
Total 1136	Boys ($n = 552$)	Girls ($n = 570$)
Age of Child (16 missing)	%	%
9 or less	29.5	29.7
10	31.4	32.5
11	29.7	31.8
12	9.5	6.0
Socio-Economic Status of School (mean = 101)		
<95	19.4	19.8
95–105	33.5	30.5
>105	47.1	49.6
Urban Classification		
Inner	10.5	14.0
Middle	46.0	42.5
Outer	39.9	37.5
Regional or Peri-urban	3.6	6.0
Parental Education*		
Less than Secondary	9.1	8.1
Secondary Education/trade certificate/ diploma	55.5	52.1
Bachelor Degree or higher	35.4	39.8

Note: Highest educational attainment categories based on ABS Census categories. Urban classification categories based on definitions created by SGS Consulting for all Catholic schools (CEM 2014).

Associations with CIM at baseline

About one quarter (24.5%) of all students aged between 9 and 12 were independently mobile, and half of these travelled independently to from and school at the start of the intervention. Table 3 shows the ten independent variables that were retained in the final logistic regression model from the 28 variables that were introduced. Table 3 below displays a summary of the results at an individual level. Table 4 shows school-level results.

The model in Table 3 retains ten of the 28 eligible items: five variables from the individual characteristics; two social factors; three built environment factors. All factors in the model except licence to visit friends and traffic volumes were significant to $p < .05$.

The gender of the child was not retained in the final model despite support in the literature for gender differences within CIM. The urban classification of the school was also not retained, despite recording a significant bivariate association with CIM.

Table 4 below shows the school level results of a linear regression of CIM at baseline with a range of covariate factors.

At the school level, twelve factors in the model are distributed across all three bands of characteristics: one individual factor, three built environment factors and eight social capital factors.

All factors in the final model except one were associated significantly ($p < 0.05$) with CIM at baseline.

Unlike model 1 (individual baseline prediction model), neither physical counts of traffic effects nor parent-perceived traffic exposure was retained at the school level model.

Social capital factors such as neighbourhood connectedness – parents' indication of children's regular play in the street and the parent perceptions that the neighbourhood is a good place to grow up and people are willing to help each other – reflect safe, strong communities around the school. Similarly, there were significant contributions to the model from two school community factors – the level of connectedness of parents with each other (knowing each other) and with the school (willingness to get involved).

Both of these factors had small negative associations with CIM, explained by the fact that the principal response is reversed. A negative correlation indicates that the principal strongly agreed with the statements.

Table 3. Binary logistic regression of CIM factors at baseline.

Groups	Variables	Categories	Odds & Confidence Intervals OR	95% CI Lower	95% CI Upper
Individual					
	Year Level	4			
		5	1.88*	1.06	3.33
		6	2.33**	1.32	4.11
	Mode from School	Walks	24.17**	13.69	42.69
		Cycles	62.76**	30.77	128.03
		PT or other	4.34*	1.30	14.48
		Car	1.00		
Licences to Travel Independently					
	Weekend Independent Travel	None	1.00*		
		Some CIM (1–2)	2.09*	1.28	3.40
		Frequent CIM (>3)	2.79*	1.17	6.64
	Licence to ride on main roads	Yes	1.66*	1.01	2.72
		No	1.00		
	Licence to Visit friends in same suburb	Yes	1.40	0.87	2.28
		No	1.00		
Social capital					
	Parent Perceptions				
	People willing to help neighbours here	D	1.00		
		N	0.31*	0.10	1.02
		A	0.56	0.18	1.72
Reasons for choosing school					
	It is close by	No, not important	1.00		
		Yes, important	1.87*	1.13	3.09
Built Environment					
Physical					
	Distance by road from home to School (log 10 of km)		0.42*	0.20	0.86
Parent Perceptions					
	Traffic volumes high	Disagree	1.00		
		Neutral?	1.23	0.43	3.50
		Agree	0.59	0.24	1.42
	Allows indep. travel at home	Disagree	1.00**		
		Neutral	1.78	0.90	3.53
		Agree	3.11**	1.85	5.23

Note: PT = Public Transport D = Disagree, N = Neutral, A = Agree * Significant $p < .05$, ** Significant $p < .001$.
#The final model reported a Chi-squared value of 498.8, ($p < .001$), and −2 Log likelihood score of 516.8.
The Nagelkerke R^2 statistic reported was .628.

Table 4. Linear regression of school level factors associated with CIM.

School level variables by group	Beta	t
Individual		
Percent of cohort taking AT from school	−0.21*	−2.9
Built Environment factors		
Stranger danger not a concern % agree(P)	0.5*	4.1
Road safety not a concern (SP)	5.1**	6.3
Parent allows child to be active independently at home % agree (P)	0.9**	11.1
Social Capital Factors – School		
SES of school	−0.40**	−5.1
People willing to help neighbours% agree (P)	0.2	1.8
Child plays often in street % agree (P)	−0.4**	−5.2
Neighbourhood good place to live % agree (P)	1.2**	6.1
People willing to help neighbours % Agree (SP)	−5.8**	−5.1
Neighbourhood good place to grow up (SP)	20.4**	6.7
Parents know each other well (SP)	−11.7**	−5.3
Parents not difficult to get involved (SP)	−4.4*	−3.3

Note: P = parent response, C = child response, SP = school principal response (principal response increase from strongly agree to strong disagreement) AT = Active Transport *Significant $p < .05$ ** Significant $p < .001$.
The final model reported a Sum of Squares of 3487.6 with an F value of 57.87, ($p < .001$). The Adjusted R^2 statistic reported was .971. The Durbin Watson statistic for the model was 1.6.

Associations with change in CIM (post-intervention)

The results were analysed at individual and school levels. Table 5 below sets out the change in CIM at an individual level, with all the variables included in the binary logistic regression, with relevant odds and p values.

Table 5. Model 4 – binary logistic regression of change in CIM with individual, social capital, and built environment variables.

		95% Confidence Interval	
Individual, social capital & built environment characteristics and intervention programmes	OR	Lower	Upper
Intervention Programmes			
TravelSmart	0.53	0.12	2.32
Ride2School	1.29	0.30	5.45
SRTS	0.92	0.24	3.49
Non-intervention	1.00		
Individual Characteristics			
Age#			
9	1.00		
10	1.93	0.80	4.63
11+	1.71	0.55	5.34
Gender			
M	1.00		
F	0.76	0.38	1.51
Parent Education Bachelor or higher			
No	0.93	0.44	1.98
Yes	1.00		
Mode from School			
Walks	51.7**	15.5	171.7
Cycles	92.0**	25.9	326.2
Car and other	1.00		
Weekend Independent Travel			
No trips	0.33*	0.13	0.84
1–2 trips	0.30*	0.12	0.77
3+	1.00		
Social capital			
Socio-Economic Status	1.00	0.94	1.06
Child plays in street often			
D	1.00		
N	0.71	0.22	2.32
A	0.95	0.46	1.98
Child knows neighbours well			
D	1.00		
N	1.67	0.33	8.50
A	4.53*	0.96	21.33
Parent knows neighbours well			
D	1.00		
N	0.72	0.19	2.73
A	0.71	0.19	2.65
Parent has several friends in area			
D	1.00		
N	0.96	0.21	4.50
A	0.77	0.19	3.03
Parent shares same values			
D	1.00		
N	0.11*	0.20	0.64
A	0.13*	0.02	0.75
Parent thinks neighbours willing to help			
D	1.00		
N	11.40		
A	14.35*		
Choice of school – local Catholic /close			
N	1.00		
Y	2.44	0.81	7.39

(*Continued*)

Table 5. Continued.

Individual, social capital & built environment characteristics and intervention programmes	OR	95% Confidence Interval Lower	Upper
Built Environment			
School distance (kms)	1.00	0.49	2.05
Walk Score	1.00	0.97	1.03
Urban classification			
Inner	0.24	0.03	2.13
Middle	0.26	0.04	1.62
Outer	0.36	0.05	2.46
Regional	1.00		
Car parks lacking at school			
D	1.00		
N	1.06	0.33	3.39
A	0.68	0.25	1.84
Enough traffic lights at intersections D	1.00		
N	1.21	0.46	3.17
A	0.96	0.44	2.11
Child allowed active independence D	1.00		
at home N	0.87	0.33	2.32
A	1.33	.061	2.93

Notes: D = Disagree, N = Neutral, A = Agree *Significant $p < .05$ **Significant $p < .001$. Model summary information: Population includes any child living within 2.1 km of the school (Euclidean). Total cases 421, missing 7.4%, −2 Log likelihood = 242.6, Omnibus test Chi Sq. = 178.7 df = 36, $p < .001$. Negelkerke R-square statistic = .557. #Age included in place of year level as there were approximately equal numbers of missing values in both.

The model in Table 5 retained five of the 20 eligible variables introduced into the regression: two individual, three social capital, but no built environment variables. The model also did not retain the intervention programmes as predictors.

The most powerful predictor of change in IM at the individual level is the mode of travel from school at baseline. Children who walk or cycle to school are respectively 52 and 92 times more likely to have increased their level of IM than the children driven to school by the end of the programme. The second individual factor is the number of independent trips on the weekend, which is associated negatively with increasing independent mobility on the school journey. When compared to children who take three or more independent trips, children who take no independent trips are one-third as likely to be independent going to school. The other three significant factors relate to social capital and the perceptions that parents and children have about their neighbourhoods. If a child believes he or she knows their neighbours well, then they are four and a half times more likely to increase their independent mobility. If parents have a perception that the neighbours are willing to help each other, in other words have a strong sense of community and responsibility, then the child is fourteen times more likely to have increased independent mobility on the school journey.

The third social capital factor appears to contradict this, as it appears to say that parents who don't share values with their neighbours are about eight times more likely to have children who are increasing their independent mobility than those who do, once other factors are adjusted for.

School level analysis and the influence of social capital

The full list of 20 variables included in the individual level were re-calculated using the techniques described in Methods section above. These variables were put into a linear regression model with change in CIM as the continuous dependent variable. The purpose was to determine the relative influence of the social capital factors on change in CIM at the school level. The results are listed in Table 6 below.

The model retained three factors only, Weekend Travel (% frequent and IM), school choice – close by, and local organisation involved on the site. The last two were significantly associated

Table 6. Backward stepwise linear regression model between change in CIM at school and explanatory variables.

Category	Variable Name	Beta	t	Beta	t
Individual	Weekend travel (% frequent)	0.39	1.97	0.39	1.97
	Modes from school (% AT)	−0.12	−0.36		
Built Environment	Sufficient pedestrian crossings (% agree P)			0.18	0.06
	Stranger danger not a concern (% agree P)			0.23	0.074
	Traffic Volumes are high (SP)			−0.21	−0.60
	Road safety not a concern in area (SP)			2.33	0.73
Social capital	Plays in street often (% Agree child)	0.23	0.81		
	School choice – close by (% agree P)	0.57*	3.05	0.57	3.05
	Several Friends in area (% agree P)	−0.18	−0.72		
	Good place children to grow up (% agree P)	−0.52	−0.20		
	Local organisations involved on school site (SP)	6.61*	2.15	6.61	2.15
	Safe for children to play in street (SP)	−3.99	−1.01		
	Number of businesses involved in school (SP)	2.44	0.50		
	Parents attend meetings regularly (SP)				
	Intervention programmes assist community to change (SP)	3.80	1.09		

Notes: SP = School Principal, P = Parent *Significant $p < .05$. Adjusted R^2 for regression is .525, Sum of squares is 4561.3. Durbin Watson statistic is 2.01.

with increasing independent mobility at school level. Both measure a desire of the parents or the school itself to be actively associated with local community.

Discussion

This paper had two objectives: firstly to investigate the baseline picture of 9–12 year old students' independent mobility in Catholic primary schools in Victoria and the key factors associated with CIM; and secondly to investigate the effectiveness of three intervention programmes in changing children's travel behaviours and the role of social capital in mediating that change.

Student's independent mobility in Catholic primary schools

What becomes apparent in looking at the behaviours of children in Catholic schools in Victoria is that they are typical of students in schools elsewhere when it comes to the factors that predict their independent mobility status, except that levels of CIM in Catholic schools are approximately half to three-quarters of levels that government school students display (Carlin et al. 1997; Curtis, Babb, and Olaru 2015; Nicholson et al. 2014). With the notable exception of gender, factors such as the child's age (Curtis, Babb, and Olaru 2015; Hillman, Adams, and Whitelegg 1990; McMillan 2007; Tranter 1993), the distance they live from school (Buliung et al. 2013; Hillman, Adams, and Whitelegg 1990; McMillan 2007; Mitra 2013; Tranter 1993), the licence to ride independently on main roads (Tranter 1993), the amount of independent travel undertaken on weekends (Tranter 1993), and travel mode to and from school (Carlin et al. 1997), were all key predictors of CIM in this study, and reflect previous evidence.

The finding in this study that gender was not associated with of CIM at baseline is contrary to most studies (Brown et al. 2008; Hillman, Adams, and Whitelegg 1990; McMillan 2005; Tranter 1993). There are studies in which gender has not found to be associated with AT modes to school in the Australian and Melbourne context (Carlin et al. 1997), and in Canada (Mammen et al. 2014a). Despite this, the more likely explanation is that gender has been reflected in other variables such as the mode of transport to school, where cycling is dominated by boys. Therefore this result should not be a rationale for neglecting to focus on strategies to assist girls to be more independent.

This study found that built environment factors were associated with CIM at the individual level, including objectively-measured shortest distance by road to the school, and parent perceptions of traffic volumes. Although previous studies have shown that this is an important correlate of CIM (B Giles-Corti et al. 2011), it has not always been shown to be more important than other factors

(McMillan 2007; Villanueva et al. 2014). Further, the results demonstrated that perceived high levels of stranger danger and road safety risks by parents and school leaders were associated with less IM, supporting the literature that cites stranger danger and road safety as barriers to CIM or active travel to school (Foster et al. 2014; Gill 2007; Hume et al. 2009; Malone 2007).

The principal's concern about road safety responds to wider concerns around roads and traffic. If the school treats road safety skills regarding traffic very seriously, this may reassure parents, who in turn may be more likely to allow independent mobility for the child after school and on the weekend, both of which are strong predictors of CIM on school journeys.

The urban classification of the geographic location (suburb) of the school was not significant in either the individual or school model to predict IM behaviours. Schools in outer suburbs did record lower levels of CIM, but other built environment variables were more reliable factors, such as the distance from the school and parent perceptions of traffic volumes.

Factors that change behaviours as a result of intervention programmes in schools

While these built environment factors were associated with CIM at baseline, they did not significantly predict the change in IM as a result of the intervention programmes. Children living in built environments that are conducive of AT may be more likely to have higher level of IM than those that live in constrained environments, but this research demonstrates that the factors that change behaviours, even in environments that are conducive to IM, are the personal, social and cultural factors (Garrard and Crawford 2010). Where the built environment has been shown to be associated with positive behaviour changes, these are generally over longer time periods than the relatively short one year period of the present study and involve adults (Hirsch et al. 2014).

This research has found that the intent of the parent to allow a child to walk or cycle is vital. Their confidence in allowing their child to travel independently around the neighbourhood reflects confidence in their child's competency. The child's confidence in their neighbourhood i.e. knowing their neighbours, is also associated with an increase in the IM. Both of these convey that a sense of trust in their neighbourhood is a precondition for change; obviously the parents trust is the key element and has the greater effect before the child's trust can be acted on. Similarly, at the school level, parents' confidence in allowing a child to travel independently around the neighbourhood was also associated with IM but the attitude of the school to the child's competency levels and their management of risk becomes important.

The school's attitude is firstly reflected in the school's attitude to the wider community. The involvement of other organisations on site displays an outward-facing stance of the school to the community, called connectedness. A deliberate decision of the school leadership is required to be outward-facing, which conveys a relationship of trust with the wider community on and off site. This is a measure of the active social capital of the school, which as we noted above, builds the trust of the parent in that community (Lewis 2010).

Secondly, when the school confirms that they have competency in training their child to be responsible on roads and in traffic, it conveys a culture of care to the parent.

These are indicators to the parent of risk being managed, controlled by the programme of the school, and incorporated in its culture. These two factors are significantly associated with changed behaviours. This finding is reflected in research elsewhere (Buliung et al. 2011; Crawford and Garrard 2013).

Whilst no intervention programme was found to be more effective of itself, the role of school culture in supporting the programme's intent was critical. In principal interviews, the schools that employed a whole-of- school approach i.e. programmes were embedded in the school's culture, were also most effective in changing behaviours (Love and Whitzman 2018).

Creating a school culture in which CIM is valued, yet one in which risks are acknowledged and managed, reassures the parent. They may not feel so isolated nor out-of-step with the values of the

school or the majority of the community (Nicholson et al. 2014). Children walking or cycling to school independently is not yet a socially accepted practice, so parents need support. This finding is applicable for all schools. The policy implication for health authorities when implementing intervention programmes is clear – intervention programmes designed to leverage the school's social capital will have more probability of success.

Finally, this research was unique in focussing on Catholic schools. It is appropriate to acknowledge a key difference to Government schools around school choice also impacts the effectiveness of the intervention programmes. Our finding that school selection based on local proximity or connection to community increases the likelihood of change in independent mobility on the school journey is important for Catholic schools to understand. This reflects findings of Canadian research into IM which was associated with the reasons for selecting a neighbourhood (Mammen et al. 2012). This may well relate to the proximity of their home to the school, or to a particular relationship they have with the local Catholic community. Regardless, it may be important for non-government schools to address the reasons for school choice for an intervention programme to be more effective. It is further affirmation of the importance of a person's relationship with place when encouraging change to personal mobility.

Limitations

This study had several limitations with regard to design and analysis of the findings. These include the small sample of schools doing each programme, the limited built environment variables especially the street connectivity measures with regard to the lack of GPS technology and robust traffic data for inclusion in the pedshed analysis. In addition, the loss of baseline records diminished the reliability of the results. Regarding the analysis, the lack of factorial analysis of the variables may have contributed to the contradictory finding about gender.

While not the focus of this article, further rigorous qualitative research investigating the implementation of intervention programmes in schools could be helpful. Capturing how schools influence the design of the programme internally and utilise their social capital, may lead to more effective programmes within schools. This might also extend to post-intervention interviews with children to gain their insights into success or otherwise of the intervention programmes.

Conclusion

At the most fundamental level, the research found that children attending Catholic primary schools are typical of students in government schools once the increased distance from school to home is allowed for. Predictors of the level of CIM at baseline are also consistent with previous studies, except that the initial reason for the choice of a local nearby school was found to be a factor in Catholic non-government schools.

The research has shown that no one intervention programme is more successful in changing behaviours of children, but social capital has a role in improving the effectiveness of whatever travel behaviour change programme is implemented in the school. This occurs mainly through the influence of the school culture. Intervention programmes implemented in an embedded fashion in the school are able to overcome the powerful reluctance of parents to allow children to travel unaccompanied.

Because of this reluctance on the part of parents, it is important that schools be involved in intervention programmes because schools and school leaders can activate their social capital through the networks that they control or participate in to build the trust necessary for parents to allow their children to be independently mobile. Further, the school will benefit by achieving higher social capital and more connectedness with and within the community if they do implement them in this fashion.

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