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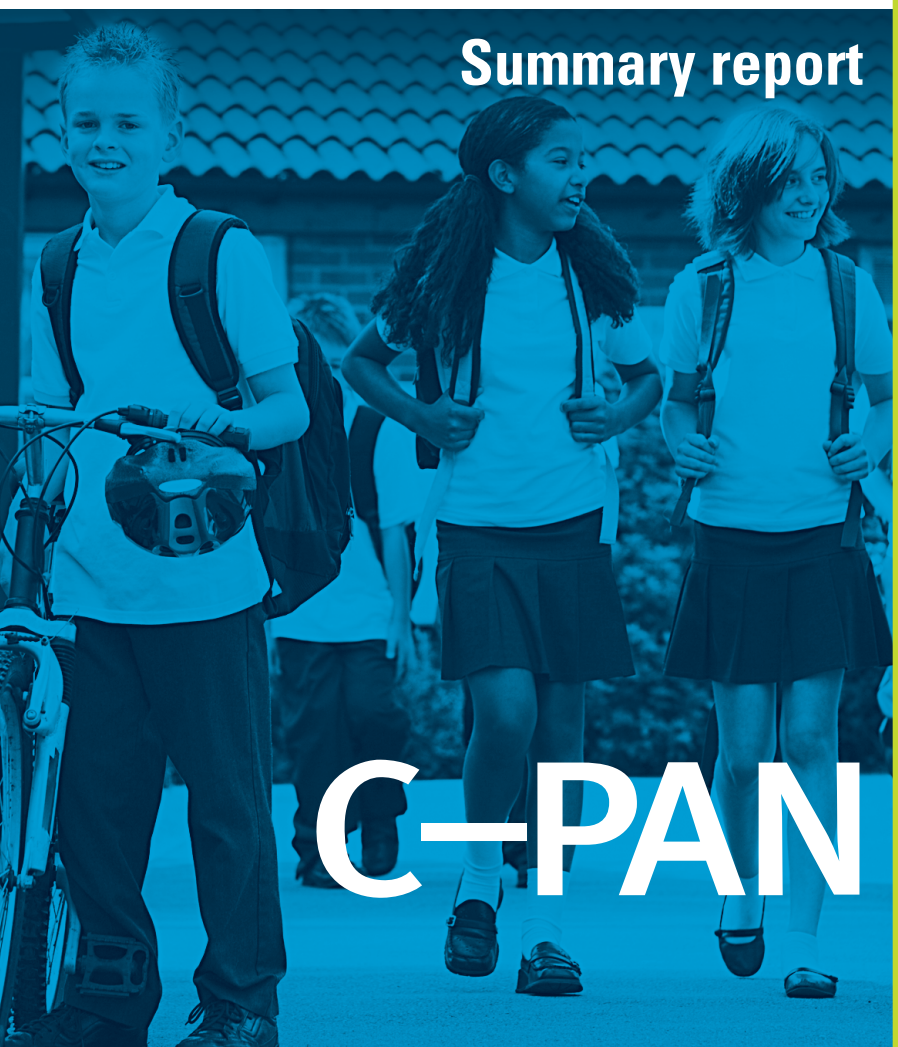
Children's independent mobility – is it influenced by parents' perceptions of safety?

Centre for Physical Activity and Nutrition Research



Summary report

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Executive summary

For young people, independent mobility (i.e. walking or cycling in the neighbourhood without adult supervision) is important for their physical, social, cognitive and emotional development. It appears, however, that many parents restrict their children's movement around their local neighbourhood due to safety concerns.

This study sought to understand how levels of independent mobility varied among boys and girls in two age-groups (children and adolescents), and how these levels changed over a two-year period. In addition, the study examined which aspects of neighbourhood safety were associated with independent mobility among children and adolescents, in order to inform interventions aimed at increasing independent mobility among youth.

The study had a longitudinal design and involved parents and children in metropolitan Melbourne over a two-year period from 2004 to 2006. In 2004, 484 parents were surveyed regarding their family demographics, the levels of independent mobility granted to their children and their perceptions of neighbourhood safety.

On average, boys in this study had greater levels of independence than girls, and children aged 8-9 years at the start of the study had greater increases in independent mobility over two years than did adolescents aged 13-15 years.

Findings of this study confirm the importance of perceptions of neighbourhood safety in relation to independent mobility among children and adolescents. In particular children had greater increases in independent mobility if their parents perceived that local traffic was slow and that there were traffic calming features (e.g. speed humps) on local streets.

This report describes and discusses the key findings of the study. It will be of interest to parents and families of children and adolescents; teachers and schools; policy makers; health professionals; and others interested in promoting independent mobility among youth.

Background and study aims

1.1 The importance of physical activity in childhood

The health benefits of physical activity for children are well established. For example, children who are highly active have more favourable cardiovascular risk profiles and bone health, as well as leaner body mass and enhanced psychological and psychosocial well-being [1,2], compared with children who are less active. These benefits also relate to children's future health. Rising levels of childhood obesity [3] and an increased incidence of type 2 diabetes and other diseases of sedentary living [4] provide further support for investigating children's physical activity.

In recognition of these health benefits, national guidelines for children's physical activity recommend that they perform at least 60 minutes of moderate- to vigorous-intensity physical activity (MVPA) every day [5]. The types of activities typically classified as moderate-to vigorous-intensity include brisk walking, using playground equipment, and playing netball or football. Recent studies have shown that participation in MVPA decreases significantly between ages 9 and 15 years [6].

1.2 Children's independent mobility

Children's independent mobility is defined as the ability of children and adolescents to walk or cycle around their neighbourhood without adult accompaniment.

Children's levels of independent mobility may influence their physical, social, cognitive and emotional development [7]. For example, freedom of movement unaccompanied by an adult has been shown to be significantly associated with physical activity among children [8]. In addition, those who are more independent play more often with their peers, both indoors and outdoors [9]. In terms of cognitive development, independent mobility helps children

to learn mapping and to navigate within their neighbourhood[10]. From an emotional point of view, it also helps them to build social relationships beyond their immediate family [11, 12], and with the natural environment [13]. Independent mobility during childhood has also been shown to be associated with a stronger sense of community, less fear of crime, and reduced feelings of loneliness during adolescence [14].

It has been suggested that compared with previous generations, children today are more restricted in terms of where they are allowed to go outside the home and are subject to greater adult supervision [15,16]. Declines in walking and cycling to school have been reported in Australia and the United States. For example, an Australian study [17] found that between 1985 and 2001, the proportion of children aged 9-13 years who walked to school declined by around 50% in areas of high socioeconomic status. It also found that the proportion of children who cycled to school at least once per week declined by 77% in areas of low socioeconomic status.

In the United States, children's active commuting to school declined by 37% between 1977 and 1995 [18].

Several studies have compared levels of independent mobility among boys with those of girls. It has been shown that boys have greater independent mobility and fewer parental restrictions than girls of a similar age [9, 19] and that boys become independent at an earlier age than girls [20]. One study has also indicated that girls have a different form of independent mobility from boys, which is based more on the use of public transport, visiting people and places across greater distances and doing more things in the company of friends [20].

1.3 What influences children's independent mobility?

Numerous studies have shown that restrictions on children's independent mobility are mostly due to parental concern about road safety[21-23], and about strangers and social dangers[22-24]. An English study found that over 40% of parents restricted schoolchildren aged 7-11 years from coming home alone from school because of traffic danger[21]. Two Australian studies found that perceptions of unsafe road environments were negatively associated with walking and cycling among 10-12 year olds[25] and adolescents[26].

The decline in children's independent mobility increases the time that parents spend chauffeuring their children[27]. Furthermore, the accompaniment of children by adults on the journey to school has altered the work-patterns of women, in particular, with many mothers choosing to work part-time to facilitate this[28].

1.4 Study aims

In order to inform policy and strategy development in relation to children's physical activity, this study aimed:

1) To examine independent mobility among children and adolescents, as well as changes in their independent mobility over a two year period.

2) To examine associations between parental perceptions of neighbourhood safety and independent mobility among children and adolescents.

Study design and methods

2.1 Study design

This longitudinal study, known as the 'Children Living in Active Neighbourhoods' study or 'CLAN', examined independent mobility among children and adolescents over a two-year period. It also examined associations between independent mobility and parents' perceptions of safety in their neighbourhood.

The study involved surveys of parents seeking information about their child's independent mobility in 2004 and 2006, and their perceptions of safety of various elements within their local neighbourhood (2004).

Approval to conduct all phases of this study was received from the Deakin University Human Research Ethics Committee, from the Victorian Department of Education and from the Catholic Education Office. Consent for participation in the study was provided by the parents on behalf of themselves and their child.

2.2 Study participants

Children and their parents were recruited to the Children's Leisure Activities Study (CLASS) in 2001 from ten primary schools in the eastern suburbs (high SES) and nine primary schools in the western suburbs (low SES) of metropolitan Melbourne. All children aged 5-6 years and 10-12 years, and their parents were eligible to participate in the study. Participants in CLASS in 2001 were re-contacted in 2004 to be part of the follow-up study (Children Living in Active Neighbourhoods, or CLAN), and again in 2006. This report contains information collected from parents of children and adolescents participating in the CLAN study in 2004 and 2006.

In 2004, participants were:

- Children aged 8-9 years
- Adolescents aged 13-15 years

In 2006, participants in the follow-up study were:

- Children aged 10-11 years
- Adolescents aged 15-17 years

2.3 Measures of independent mobility

In order to measure children's independent mobility at each time-point (2004 and 2006) parents were asked how much they agreed or disagreed with the following statements:

- My child is allowed to walk/cycle to school with other children (no adult supervision)
- My child is allowed to walk/cycle to school on their own
- My child is allowed to walk/cycle to places in our local neighbourhood (other than school) with other children/their friends (no adult supervision)
- My child is allowed to walk/cycle to places in our local neighbourhood (other than school) on their own

Responses were based on a six point scale: 'strongly agree', 'agree', 'neither', 'disagree', 'strongly disagree', 'don't know/doesn't apply'. These responses were grouped into two categories; a value of 1 was assigned for 'strongly agree/agree' and a value of 0 was assigned for the other responses. A score for independent mobility at each time-point was computed by adding the values for the four items. Possible values for this score ranged from 0 (no independent mobility) to 4 (highest level of independent mobility).

2.3 Measures of parents' perceptions of safety

In order to assess parents' perceptions of safety in their local neighbourhood they were asked how much they agreed with the following statements:

Road safety

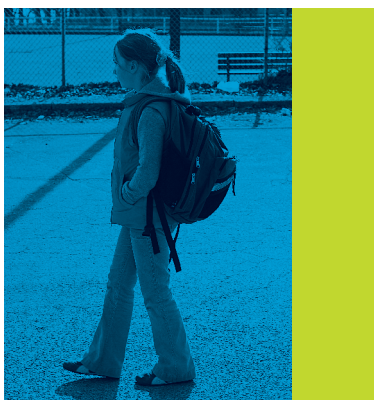
- There are major barriers to walking/cycling in my local neighbourhood that make it hard for my child to get from place to place (e.g. freeways, major roads)
- There are no lights/crossings for my child to use
- My child would have to cross several roads to get to areas where he/she can play or hang out

- There is heavy traffic in our local streets
- There are traffic slowing devices (e.g. speed humps) in our local streets
- The speed of traffic in our local streets is usually slow (50km/h or less)
- Road safety is a concern in our neighbourhood
- There are footpaths on most streets in our local neighbourhood
- There are lots of parked cars on my street

Other aspects of safety

- My neighbourhood is generally free from litter, rubbish, graffiti
- I am worried about trouble-makers hanging around my neighbourhood
- It is safe for my child to play or hang out in the street outside our house
- Lots of children play or hang out in our street
- There is a high crime rate in our local neighbourhood
- My neighbourhood is safe for my child to walk/cycle around the block alone in the daytime
- My child would be safe walking home from a bus or train stop at night
- Stranger danger is a concern of mine
- I am worried that my child might be assaulted when out alone in our neighbourhood
- Streets in my neighbourhood are well lit at night

Responses were based on a six point scale: 'strongly agree', 'agree', 'neither', 'disagree', 'strongly disagree', 'don't know/doesn't apply'. These responses were grouped into two categories; a value of 1 was assigned for 'strongly agree/agree' and a value of 0 was assigned for the other responses.



Study findings

3.1 Characteristics of study participants

Table 1 shows the characteristics of the children and adolescents who participated in the study, and for whom parent survey data for 2004 and 2006 were reported. The majority of parents in the study were married and, on average, children in the study had one other child aged under 18 years living in the house. Maternal education, which is commonly used as an indicator of family-level socioeconomic position, varied, although more than one-third of mothers had university/tertiary education

Table 1. Family characteristics of children and adolescents, 2004

	Children		Adolescents	
	Boys (n=83)	Girls (n=84)	Boys (n=120)	Girls (n=165)
Child age - mean years (SD)	9.06 (±0.34)	14.51 (±0.42)	14.46 (±0.62)	9.05 (±0.63)
Parental marital status (%)				
Married	81.9	76.2	85.0	77.0
Defacto/living together	4.9	11.9	3.3	6.7
Separated/divorced	9.6	11.9	9.2	14.5
Never married	3.6	-	2.5	1.2
Widowed	-	-	-	0.6
Number of other children aged <18yrs living in the house (mean (SD))	1.4 (±0.8)	1.5 (±1.1)	1.2 (±0.9)	1.2 (±0.8)
Maternal education level (%)				
Some high school or less	13.4	25.3	21.8	25.8
High school or technical cert.	34.2	26.5	38.7	28.3
University/tertiary	52.4	48.2	39.5	45.9

3.2 Levels of independent mobility

Key findings:

- **Boys in each age-group had higher levels of independent mobility than girls.**
- **Adolescent boys had the highest levels of independent mobility while younger girls had the lowest levels of independent mobility in 2004.**
- **Over half of the younger girls had no independent mobility at all in 2004.**
- **Almost all adolescents had some degree of independent mobility in 2004.**

The mean scores for independent mobility (possible range 0 to 4, with 0 being the lowest level and 4 the highest) are shown in Table 2.

In 2004, the younger boys had, on average, greater independent mobility than the younger girls. Similarly, adolescent boys, on average, had greater independent mobility than the adolescent girls. As expected, adolescents boys and girls also had far greater independent mobility than younger children.

A higher proportion of younger girls (57%) compared with younger boys (41%) had no independent mobility at baseline (indicated by a score of 0), while very few adolescent boys (3%) and girls (8%) had no independent mobility at baseline.

Table 2. Levels of independent mobility in 2004

	Independent mobility score Mean score (SD)	No independent mobility (zero score) (%)
Younger boys	1.29 (1.36)	41%
Younger girls	0.82 (1.17)	57%
Adolescent boys	3.42 (1.00)	3%
Adolescent girls	2.96 (1.33)	8%

3.3 Change in independent mobility between 2004 and 2006

Key findings:

- **Children had greater increases in independent mobility than adolescents between 2004 and 2006.**
- **The independent mobility of adolescents increased only slightly between 2004 and 2006 suggesting that levels of independent mobility are established by age 13-15 years.**

The score for change in independent mobility between 2004 and 2006 was calculated by subtracting each participant's independent mobility score for 2004 from their corresponding score for 2006. The results are presented in Table 3.

As might be expected, the mean scores for change in independent mobility were far greater for younger boys and girls (aged 8-9 years at baseline) than for adolescent boys and girls (aged 13-15 years at baseline). The mean scores for change in independent mobility for younger boys and girls were similar to each other, as were the scores for adolescent boys and girls.

Table 3. Change in independent mobility scores from 2004-2006

	Change in independent mobility score Mean (SD)
Younger boys	1.55 (1.48)
Younger girls	1.54 (1.46)
Adolescent boys	0.23 (0.97)
Adolescent girls	0.34 (1.17)

3.4 Parental perceptions of neighbourhood safety

Key findings:

- **Among parents of adolescents, there was less concern about the following issues in their neighbourhood, compared with parents of children:**
  - **main roads being barriers to walking/cycling**
  - **road safety**
  - **stranger danger**
  - **the risk of their child being assaulted while out alone.**

- **Among parents of adolescents, there was more agreement that it was safe for their child to undertake the following activities, compared with parents of children:**
  - **play or hang out in the street outside their home**
  - **walk/cycle around the block alone in daytime**
  - **walk home from a bus or train stop at night.**

Perceptions of road safety are presented in Table 4 for parents of children and adolescents. Perceptions of other aspects of neighbourhood safety are presented in Table 5 for parents of adolescents. There were several differences in the perceptions of children's parents compared with those of adolescents' parents. Concerns about road safety and the presence of major roads being a barrier to their children's walking/cycling around the neighbourhood were less prevalent among parents of adolescents. In addition, perceptions that it was safe for their children to play on local streets, walk or cycle around the neighbourhood or walk home from a bus stop or train station at night were more prevalent among parents of adolescents. Concern about harm from strangers, and their children being assaulted if venturing out alone in the neighbourhood were more common among parents of children than parents of adolescents.

Table 4. Perceptions of road safety among parents of children and adolescents (2004)

	Children		Adolescents	
	Parents of boys	Parents of girls	Parents of boys	Parents of girls
Parental perceptions of road safety	**Agree [a] (%)**	**Agree [a] (%)**	**Agree [a] (%)**	**Agree [a] (%)**
There are major barriers to walking/cycling in my local neighbourhood that make it hard for my child to get from place to place (e.g. freeways,major roads)	27	26	9	12
There are no lights/crossings for my child to use	40	38	24	21
My child would have to cross several roads to get to areas where he/she can play or hang out	35	51	45	35
There is heavy traffic in our local streets	32	42	34	37
My child would have to cross several roads to get to areas where he/she can play or hang	35	51	45	35
There are traffic slowing devices (e.g. speed humps) in our local streets	37	42	39	46
The speed of traffic in our local streets is usually slow (50km/h or less)	58	45	68	66
Road safety is a concern in our neighbourhood	56	61	46	45
There are footpaths on most streets in our local neighbourhood [b]	99	100	100	100
There are lots of parked cars on my street [b]	100	100	100	100

[a] i.e. response to statement about neighbourhood was "strongly agree" or "agree"

[b] These items were excluded from further analyses due to homogeneity of data.

Table 5. Perceptions of other aspects of safety among parents of children and adolescents (2004)

	Children		Adolescents	
	Parents of boys	Parents of girls	Parents of boys	Parents of girls
Parental perceptions of other aspects of safety	**Agree [a] (%)**	**Agree [a] (%)**	**Agree [a] (%)**	**Agree [a] (%)**
My neighbourhood is generally free from litter, rubbish, graffiti	75	80	88	87
I am worried about trouble-makers hanging around my neighbourhood	27	34	23	26
It is safe for my child to play or hang out in the street outside our house	55	48	69	75
Lots of children play or hang out in our street	25	25	25	34
There is a high crime rate in our local neighbourhood	8	11	8	7
My neighbourhood is safe for my child to walk/cycle around the block alone in the daytime	55	46	95	84
My child would be safe walking home from a bus or train stop at night	7	7	34	22
Stranger danger is a concern of mine	79	86	57	69
I am worried that my child might be assaulted when out alone in our neighbourhood	40	64	27	35
I am worried that my child will get bullied if he/she walks/cycles to or from school	12	11	7	8
Streets in my neighbourhood are well lit at night [b]	99	96	97	96

[a] *i.e. response to statement about neighbourhood was "strongly agree" or "agree"*

[b] *These items were excluded from further analyses due to homogeneity of data.*

3.5 Associations between parents' perceptions of safety and children's / adolescents' independent mobility in 2004

Key findings:

- **Parents' concerns about other aspects of neighbourhood safety (i.e. stranger danger) were more frequently associated with lower levels of independent mobility among children and adolescents than parents perceptions of road safety issues.**
- **Perceptions of road safety were important for independent mobility among girls in both age-groups.**

Significant associations between parents' perceptions of road safety and children's / adolescents' independent mobility in 2004 are shown in Table 6. Similarly, significant associations between perceptions of other aspects of neighbourhood safety and independent mobility are shown in Table 7.

Table 6. Significant associations between parents' perceptions of road safety and children's / adolescents' independent mobility in 2004

Road safety factors showing significant association with independent mobility	Study group for whom the association was significant	Regression coefficient (95% CI)
There are major barriers to walking/cycling in my local neighbourhood that make it hard for my child to get from place to place (e.g. freeways, major roads)	Adolescent girls	–1.15 (–1.76, –0.55)***
There are no lights/crossings for my child to use	Adolescent girls	–0.79 (–1.27, –0.30)**
There are traffic slowing devices in our local streets (such as speed humps, roundabouts, traffic islands)	Younger girls	0.60 (0.10, 1.10)*

Table shows significant ($p<0.05$) associations only
** $p<0.05$; ** $p<0.01$; ***, $p<0.001$*

Table 7. Significant associations between parents' perceptions of other aspects of neighbourhood safety and children's / adolescents' independent mobility in 2004

Other aspects of safety showing significant association with independent mobility	Study group for whom the association was significant	Regression coefficient (95% CI)
It is safe for my child to play or hang out in the street outside our house	Adolescent boys	0.41 (0.02, 0.80)*
My neighbourhood is safe for my child to walk/cycle around the block alone in the daytime	Younger boys Younger girls Adolescent boys Adolescent girls	0.90 (0.33, 1.48)** 0.60 (0.10, 1.10)* 2.23 (1.54, 2.91)*** 1.28 (0.75, 1.80)***
My child would be safe walking home from a bus or train stop at night	Adolescent girls	0.59 (0.10, 1.08)*
I am worried about trouble-makers hanging around my neighbourhood	Adolescent girls	–0.62 (–1.08, –0.16)**
Stranger danger is a concern of mine	Adolescent girls	–0.45 (–0.89, –0.01)*
I am worried that my child might be assaulted when out alone in our neighbourhood	Younger girls Adolescent girls	–0.95 (–1.44, –0.46)*** –0.66 (–1.08, –0.24)**
I am worried that my child will get bullied if he/she walks/cycles to or from school	Adolescent girls	–1.13 (–1.87, –0.39)**

Table shows significant ($p<0.05$) associations only
** $p<0.05$; ** $p<0.01$; ***, $p<0.001$*

These cross-sectional data show that perceptions of road safety were related to independent mobility among girls only. In particular, adolescent girls whose parents considered main roads to be a barrier to walking around the neighbourhood, and who perceived there to be a lack of pedestrian crossings had less independent mobility than those whose parents did not share these views. However, younger girls whose parents reported that there were traffic calming measures on local streets had greater independent mobility.

In terms of general safety, the perception of the neighbourhood being safe for solitary walking or cycling was associated with greater independent mobility

among boys and girls in both age-groups. Overall there were more associations between perceptions of safety and independent mobility among adolescent girls. In particular, adolescent girls whose parents were concerned about strangers and trouble-makers hanging around, and who were worried about their daughters being assaulted or bullied had less independent mobility than those whose parents did not share these concerns.

3.6 Associations between parents' perceptions of safety and changes in independent mobility between 2004 and 2006

Key findings:

- **Parents' perceptions of road safety were more strongly associated with children's independent mobility as they grew older and their independent mobility increased. For example, low traffic speeds were associated with greater increases in independent mobility among younger boys and girls.**
- **Adolescent boys had less increase in independent mobility if their parents perceived the local crime rate to be high.**
- **Compared with the younger children, there were fewer associations between parental perceptions of neighbourhood safety and change in independent mobility among adolescents.**

The study explored whether parents' perceptions of safety were associated with changes in levels of independent mobility of children and adolescents between 2004 and 2006. Significant results are shown in Table 8 (road safety) and Table 9 (other aspects of safety).

Perceptions of road safety in the neighbourhood were associated with change in independent mobility among children but not among adolescents. Children had greater increases in independent mobility if their parents considered the speed of traffic on local streets to be slow. Younger girls had less of an increase in independent mobility if their parents perceived that major roads were barriers to walking or cycling in their neighbourhood. Younger boys had less of an increase in independent mobility if their parents reported a lack of pedestrian crossings in their neighbourhood. In contrast, however, girls had greater increases in independent mobility if their parents reported that there were traffic calming devices such as speed humps on local streets.

There were no associations between parental perceptions of neighbourhood safety and change in independent mobility among adolescents, except that adolescent boys had smaller increases in independent mobility if their parents considered their local crime rate to be high. However, only 8% of parents of adolescent boys held this view.

Table 8. Significant associations between parents' perceptions of road safety and changes in independent mobility of children and adolescents between 2004 and 2006

Road safety factors showing significant association with changes in independent mobility	Study group for whom the association was significant	Regression coefficient (95% CI)
There are major barriers to walking/cycling in my local neighbourhood that make it hard for my child to get from place to place (e.g. freeways, major roads)	Younger girls	–0.80 (–1.45, –0.14)*
There are no lights/crossings for my child to use	Younger boys	–0.57 (–1.13, –0.01)*
The speed of traffic in our local streets is usually slow (50 km/h or less)	Younger boys Younger girls	0.59 (0.05, 1.13)* 0.67 (0.09, 1.25)*

Table shows significant (p<0.05) associations only
** p<0.05; ** p<0.01; ***, p<0.001*

Table 9. Significant associations between parents' perceptions of other aspects of neighbourhood safety and changes in independent mobility of children and adolescents between 2004 and 2006

Other aspects of safety showing significant association with changes in independent mobility	Study group for whom the association was significant	Regression coefficient (95% CI)
My neighbourhood is safe for my child to walk/cycle around the block alone in the daytime	Younger girls	0.92 (0.33, 1.51)**
There is a high crime rate in our local neighbourhood	Adolescent boys	–0.52 (–0.97, –0.07)*

Table shows significant (p<0.05) associations only
** p<0.05; ** p<0.01; ***, p<0.001*

Study conclusions

The CLAN study is one of the first studies internationally to examine independent mobility longitudinally among a sample of children and adolescents, and to explore associations between perceptions of neighbourhood safety and changes in independent mobility over a two-year period.

The study found that children aged 8-9 years at baseline (2004) had greater increases in levels of independent mobility over two years to 2006 than participants who were adolescents in 2004. While independent mobility has been shown to increase with age [9], earlier research [24] suggests that the granting of greater independent mobility to children begins, in particular, with the transition from junior to senior school. At this time, children may have to travel further than before, possibly by public transport, and may engage in different social activities, which encourage increased independence [24]. This study demonstrates increases in independent mobility occur among children even prior to that transition. Although similar increases in independent mobility were demonstrated for younger boys and girls, younger boys had more independent mobility at baseline than younger girls. This concurs with the findings of an Italian study that found that boys are more independently mobile at an earlier age than girls [9].

Although concerns about road safety were more prevalent in 2004 among parents of children than among parents of adolescents, there were few associations between perceptions related to road safety and children's independent mobility at that time. This may have been due to low levels of independent mobility among children at age 8-9 years. It is possible that many of these children were usually accompanied by adults when walking or cycling in their neighbourhood. This is to be expected as research suggests that children under the age of ten years have yet to acquire the skills to cross a road safely without adult assistance [29].

Several perceptions of road safety were associated with increases in children's independent mobility over the two-year period. In particular, the importance

of physical infrastructure designed to calm traffic (e.g. speed humps) and to aid pedestrians (e.g. crossings) was highlighted in relation to increases in children's independent mobility. Neighbourhoods with traffic calming features such as speed humps may therefore help to promote independent mobility. Recent research [30] has demonstrated an association between speed humps on local streets and physical activity among adolescent boys. Speed humps have also been associated with reduced likelihood of child pedestrian injury [31]. Furthermore, traffic calming interventions in the Netherlands are associated with low child pedestrian injury rates [32, 33] and high participation rates in active transport [34].

For adolescents, parental perceptions of neighbourhood safety were more strongly associated with independent mobility in 2004, than with change in adolescents' independent mobility between 2004 and 2006. The lack of association in the latter may be because there was little change in adolescents' independent mobility over this period. It is possible that their independent mobility was established by age 13 to 15 years and increased little after that.

In 2004, most of the significant associations between perceptions of neighbourhood safety and independent mobility were for adolescent girls rather than adolescent boys. In particular, there were lower levels of independent mobility among adolescent girls whose parents were concerned about a broad range of issues including road safety, danger from strangers, trouble-makers hanging around, assault and bullying. The finding regarding road safety aligns with that of another Australian study in which parental perception of heavy traffic was associated with less walking and cycling among adolescent girls [26].

Younger girls were found to have less independent mobility if their parents were concerned about them being assaulted, while those whose parents reported the presence of local traffic calming measures had greater independent mobility. These cross-sectional findings for girls may be related to evidence that, even from an early age, parents are more protective of daughters than sons [35]. In addition, an English study found that almost twice as many parents of adolescent girls as boys restricted their child from venturing out alone due to fears of molestation or assault [21]. Similar concerns were also reported by parents of girls in a New Zealand study [36].

A possible limitation of the study lies in the measurement of independent mobility among children and adolescents. The four-item scale is perhaps too crude a measure of independence and favours those who lived within walking/cycling distance of their school. Future research should incorporate the development of a more intricate scale, which includes particular individual destinations. Furthermore, a broader range of explanatory measures should be examined in relation to independent mobility, such as the number of siblings and the number of friends residing in the same street as the child or adolescent. In addition, objective measures of the local road environment and local crime figures should be examined in relation to children's independent mobility.

This research may inform urban planners, policy makers and local governments in the development and design of neighbourhoods. In particular it highlights the importance of traffic calming measures and pedestrian crossings in relation to increased independent mobility. It also highlights the importance of general perceptions of neighbourhood safety for walking, cycling or playing, which may be improved through initiatives aimed at fostering social interactions. This may be achieved, for example, through walking groups for adolescent girls and walk-to-school programs for children such as the Walking School Bus[37].

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Summary report