



RAPID REVIEW OF EVIDENCE:

POLICY AND PROVISION OF PHYSICAL
ACTIVITY FOR AUSTRALIAN SCHOOL
CHILDREN, WITH SPECIAL CONSIDERATION
OF SAFE ACTIVE TRAVEL TO SCHOOL

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REVIEW RECOMMENDATIONS



REVIEW RECOMMENDATIONS

FOR SCHOOL COMMUNITIES

Recommendation

1



School communities should be supported to provide more opportunities for children to be physically active daily through active school travel, free play and peer-play so that they are able to develop better all-round fitness, a wider range of social skills, and greater mental resilience.

Recommendation

2



Engagement

Engagement with children and parents/ carers should be a major part of any change process and implementation — it is *their* community and *their* right to have *their* say in how policies and environments should be shaped for them.

REVIEW RECOMMENDATIONS

FOR SCHOOL COMMUNITIES

Recommendation

3



There is a pressing need for a radical rethink of preventive health education and policy to focus on the behaviours that avoid the real drivers of poor health, which are (in priority order for Australia):

- not to smoke or take illegal drugs;
- keep body weight (BMI) within the optimum range for age, sex and stage of development;
- maintain a healthy diet, including adequate fruit and vegetable intake and limiting salt, sugar and saturated fat intake;
- get plenty of good quality physical activity — 60 minutes daily of at least moderate level and using most parts of the body is the established standard; and
- get plenty of opportunity to play, including free unstructured play, and social play with peers or family.

Recommendation

4

Physical activity



Physical activity opportunities should offer at least 60 minutes of moderate physical activity daily to every child. Examples include:

- walking or cycling to school,
- structured sport,
- outdoor play with friends,
- evening walk with family.

REVIEW RECOMMENDATIONS

FOR SCHOOL COMMUNITIES

Recommendation

5



Children should receive greater health-related education, road safety education and skills training as an important part of their learning at school. As far as is feasible, they should be supported to establish healthy lifestyle behaviours as a part of normal school life so that they may carry these into adult life.

Recommendation 6



Pedestrian priority

A societal response is required. It is impossible for an individual to make the changes required, for example, to street infrastructure, public transport options available or road user behaviours. Successful modification of collective behaviour will only be achieved with strategically well-planned and fully integrated policies and local measures including:

- prioritising walking and cycling, particularly at busy intersections or in 'pedestrian priority' or 'school children priority' zones;
- traffic calming and traffic separation e.g. in high throughput lanes in school zones at peak times;
- integration with transit;
- driver training, road safety education and training (especially for children and parents);
- establishing a culture of active travel (walking, cycling and access to public transport); and
- regulation.

REVIEW RECOMMENDATIONS

FOR SUPPORT COMMUNITIES

Recommendation

7



A comprehensive and well-coordinated package of activities is needed to change current norms and this should incorporate the following components (the 7 Es):

- **Engineering:** operational and physical improvements to the built environment infrastructure, including bespoke urban planning and design for the safe active school journey
- **Education:** materials and activities to teach the importance of active travel; walking and cycling safety training sessions and practice activities
- **Encouragement:** events and activities to promote active travel for children
- **Enforcement:** partnerships with local law enforcement to ensure traffic laws are obeyed in school neighbourhoods; crossing guard programs, if needed
- **Evaluation:** data collection and program monitoring to inform future intervention components and monitor trends
- **Equity:** efforts to ensure that intervention components reach everyone within a school community and address potential barriers to participation for certain groups (e.g., low-income, people from different ethnic groups, those with disability)
- **Enabling:** co-design work with children, teachers and parents to identify needs, barriers and preferences, to establish program ownership and contributions to the overall design solution.

Recommendation

8



Everyone should understand that active school travel is a high return investment. Public understanding of this point could be developed with a well-designed and delivered media campaign or timely targeted mailing to parents of new school starters on how to plan for active travel and support their children to become comfortable and confident active school travellers.

REVIEW RECOMMENDATIONS

SPECIAL CONSIDERATIONS

Recommendation

9



Early intervention and support

Socioeconomic disadvantage needs to be given special consideration. Australia is considered to be an affluent nation yet there are still many children who face adverse circumstances in their home lives or who do not receive adequate nutrition. This can mean that they fall behind early on physical development, learning, in social skills or show signs of behavioural difficulties. Early intervention and support through provision of basic needs, opportunities to play and targeted social skill development can often prevent serious problems from becoming established and allow children to catch up lost ground quickly.

Recommendation

10



Hands-up survey

Currently there is no routine standardised measurement of modes of travel to and from school. This makes it difficult to gauge baseline practice in schools, to benchmark targets, to evaluate trends and assess program reach. We recommend that such a system should be considered at least for an interim period while changes are being implemented. As with attendance, which is recorded daily, we propose that a simple system based on class tallies in a hands-up survey (only taken on a limited number of occasions annually) could be implemented in schools.

ABOUT THIS REVIEW



This Rapid Review provides an overview of current research evidence and other related literature on the value of physical activity and play for children. Both forms of activity have declined markedly in recent decades to the extent that only a minority of children in Australia meet the recommended guideline of 60 minutes of moderate physical activity per day. Emerging evidence indicates that these late 20th century – 21st century societal changes have been detrimental to children’s development, their current health and, in all probability, their future health prospects. We illustrate these latter points in Part 1 of this review with data gathered from within the Australian Capital Territory, and in some cases across Australia, with a particular focus on the emergence of metabolic, cardiovascular and mental health problems in young people (i.e. those aged below 25 years of age). In this regard the review is timely.

These issues were discussed at an International Forum, Shaping Spaces for Gen-Z, held in Canberra in March 2017 to identify priority actions for change. Provision for safe active travel to school was strongly endorsed as the highest priority, best value-for-money action from this Forum.

The review has been conducted in three parts:

- 1 Evidence supporting the need for change in policy for children’s development, health and well-being
- 2 Interventions to improve use of safe active travel to school
- 3 Resources to support road safety education and active travel to school

Unlike a full systematic review, this review has, in the interests of timeliness and urgency, used an abbreviated appraisal process for the individual items of evidence retrieved. That said, a large portion of the research reviewed is based on several full systematic reviews that were conducted within the review period. The majority of the further evidence gathered comes from peer-reviewed papers published in leading research Journals. Individual items of evidence have not been graded nor has full quality appraisal been undertaken (apart from that already carried out in the systematic reviews retrieved). This report provides an update of current knowledge on physical activity policy and provision for Australian school children, including a special focus on safe active school travel. It aims to support policy makers in their decision-making. We hope that it provides a basis for future policy planning and development.

BACKGROUND

A GOOD START IN LIFE IS THE CORNERSTONE OF CHILDREN'S DEVELOPMENT AND OF THEIR FUTURE PROSPECTS

A good start in life through early experiences and education is the cornerstone of children's development. It should provide the basis for future good health, give children the resilience to deal with life's challenges and the knowledge and skills to make a valued contribution to society. Child development is a slow and natural process. It takes around 8000 days from birth to adulthood. Physical growth and strength, the function of bodily organs and social and emotional skills must be built up slowly in manageable increments. The interplay between genetic inheritance and life experiences literally shapes a child's development, particularly, in the early years, the architecture of the developing brain. The active element in this development lies in the nature of the child's relationships with their parents and siblings in the earliest days and, later, their interactions with peers and other members of their community.

All interactions are important in these developmental years. Brain architecture, bodily structure and developing abilities, both physical and mental, are built up from the child's starting base, with simple circuits, structures and skills initially providing the scaffolding for more advanced circuits, structures and skills over time. Positive fulfilling interactions and experiences lead to healthy development and progression. Negative interactions and experiences or the lack of experiences and social interactions, particularly in the most formative periods, say from birth to about age nine, may damage the developing brain and lead to lifelong problems with learning, social skills and behaviours.

Giving children the right start in life, where the balance of interactions and experiences is strongly in favour of the positive, is likely to be better and less costly to society than allowing problems to become established and trying to deal with them later on. Responsible investments in services for young children and their families should focus on greatest benefits for those who need it most. Services that do not deliver this benefit are a careless use of financial resources from a societal perspective. The need to address significant inequalities in opportunity, beginning in the earliest years of life, is a critical investment in Australia's moral, social and economic future.

UNWELCOME TRENDS AND EMERGING ISSUES FOR YOUNG PEOPLE

There is abundant evidence, reviewed in detail below, that changes in lifestyle norms over the last four decades have been detrimental for many children and young people in Australia. Levels of physical activity and fitness fall well below recommended guidelines, predisposing children and young people to earlier development of cardiovascular disorders. Play and other forms of meaningful social interaction have declined, particularly in those from disadvantaged communities. This increases the risk of social and mental problems in young people and establishes mental health conditions that remain difficult to manage, in many cases, for the rest of life. Twenty five per cent of children across the whole of Australia are overweight or obese before they leave primary school, imposing significant metabolic overload and further exacerbating mental health challenges for young people. On the other hand, there are also unacceptably large numbers of young people particularly in disadvantaged communities, and again across the whole of Australia, who do not even receive adequate nutrition.





THE NEED FOR CHANGE

Most, if not all, of these conditions are avoidable, but this will not occur without a significant paradigm shift in prevalent policy and practice. Leadership and policies that go beyond individual knowledge and ‘freedom to choose’ are needed if we are to turn around these unwelcome trends and rediscover a better and fairer Australian way of life.

Policies that promote supportive relationships and positive learning opportunities for young children create a strong foundation for achievement and self-satisfaction that reap a return later through greater contributions in the workplace and a stronger sense of belonging in the community.

Practices that recognise the rights of children and families to play their part in designing change for their needs should also be recognised. A societal response is required because it is impossible for individuals to make the changes required, for example, to street infrastructure, public transport options available or driving behaviours or to make meaningful collective behaviour change. These bigger decisions must be made by others but children and families can, and should, certainly indicate what will work best for them.

The issues were debated at a community consultation Forum, *Shaping Spaces for Gen-Z*, hosted by the University of Canberra and Urban Synergies Group in March 2017¹, with the aim of developing priorities for action to create better environments for children. Increasing the proportion of children travelling actively to school emerged as best value for money area for action. This Rapid Review has been conducted to gather timely information on current best practice to promote active school travel and the types of resources that have been developed to support it. It is hoped that the review will assist policy makers in setting the change agenda to address the deficit in physical activity and meaningful social development opportunities available to young people in Australia. By paying attention to children’s emotional, social, cognitive and physical needs, as well as to their mastery of literacy and numeracy, we maximise the positive impact on their development and preparedness for success in life. Implicit in this change is that children’s development would be monitored in-line so that the emergence of potential problems requiring attention can be identified in timely fashion. Intervention can then be provided before more serious issues become established.

¹ *Shaping Spaces for Gen-Z Forum Summary*, Cochrane T, Davey R (University of Canberra) & Mews G (Urban Synergies Group), Canberra, May 2017

EVIDENCE HIGHLIGHTS

Key evidence highlights from each of the three parts of this evidence review are summarised below. Table numbers given at the end of each highlight refer to where the detailed evidence extracts and pointers to the specific supporting materials can be found (Supplement B).

1. THE NEED FOR CHANGE IN POLICY FOR CHILDREN'S DEVELOPMENT, HEALTH AND WELL-BEING

- Elevated body mass index (BMI) contributes significantly to a number of serious cardio-metabolic health conditions in Australia. The high prevalence of elevated BMI (~ 25% before leaving primary school) is likely to lead to earlier development of cardiovascular conditions and metabolic conditions such as diabetes and, potentially, earlier mortality. From a public health perspective greater priority needs to be given to **reducing** current levels of overweight and obesity in children. A societal approach will be needed since individuals have limited capacity on their own to make the changes that will be required to reverse the trends of the last four decades. (Table 1.1) (see Figure 1).
- Loss of opportunities for free play, particularly peer play, has been associated with increasing deficits in executive function (the mental processes that enable us to plan, focus attention, remember instructions, and juggle tasks successfully) in children and young people. This has led to rising rates of mental health problems. More attention needs to be given to these areas of children's development. This should be targeted appropriately across the child-adult continuum since different approaches are needed for each key stage of growth. Special attention, but not sole attention, to the early years may be warranted because of the importance of early brain development and social functioning and the potential for timely intervention. (Table 1.2)
- Since mental resilience and function are amenable to development through free play, it is feasible to consider an integrated play curriculum as part of normal school day activity. (Table 1.2)

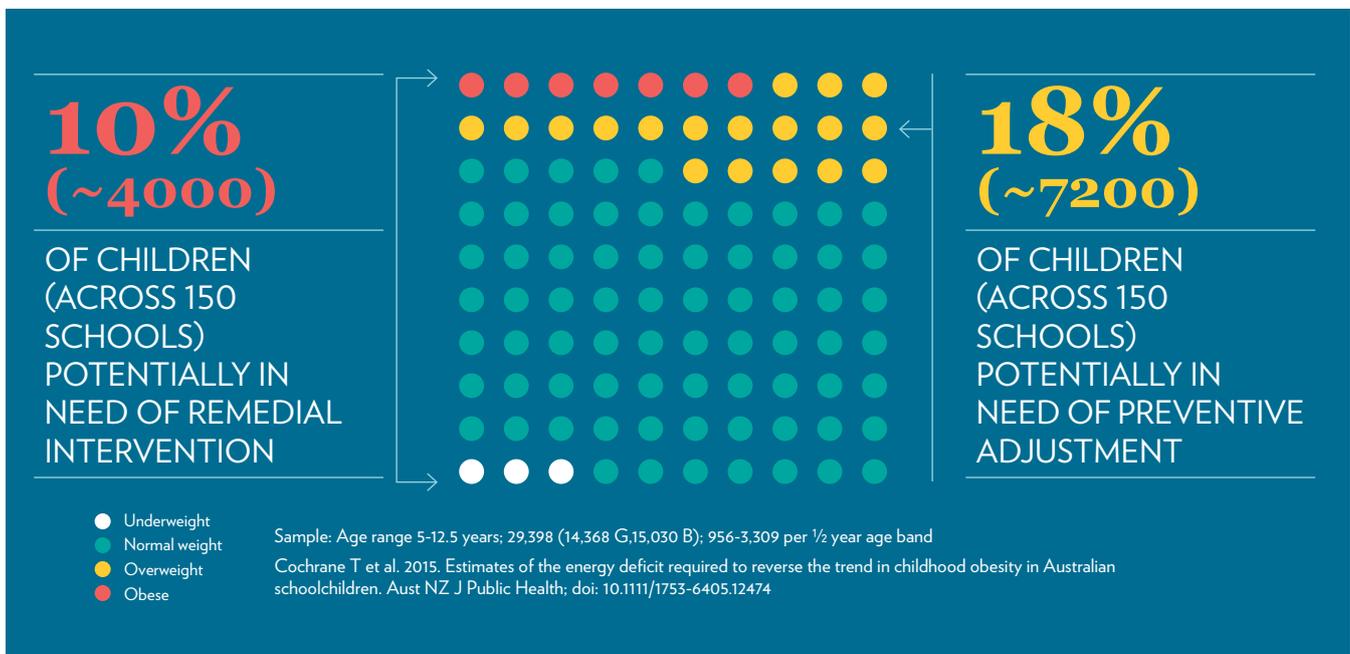


FIGURE 1
Proportions of Australian school children in body weight categories between 2000 and 2011 (n=29,398).

Cochrane T et al. 2015. Estimates of the energy deficit required to reverse the trend in childhood obesity in Australian schoolchildren. *Aust NZ J Public Health*; doi: 10.1111/1753-6405.12474.

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- More emphasis should be given to the importance of developing healthy lifestyle behaviours in children in order to reverse recent rises in the prevalence of precursors of serious cardiovascular, metabolic and mental health conditions in young people (aged below 25 years). (Table 1.3) (see Figure 2)
- There is a pressing need for a radical rethink of preventive health education and policy to focus on behaviours that avoid the real drivers of poor health, which are: i) not to smoke or take illegal drugs, ii) keep body weight (BMI) within the optimum range for age, sex and stage of development, iii) maintain a healthy diet, including adequate fruit and vegetable intake and limiting salt, sugar and saturated fat intake, iv) make sure to get plenty of good quality physical activity – 60 minutes daily of at least moderate level and using most parts of the body is the established standard, and v) get plenty of opportunity to play, including free play, and with peers or family. (Table 1.4)
- The potential synergy between our health and education sectors is currently undervalued and significantly underdeveloped. Shared investment and better selection and targeting of resources could reap a high return for Australia’s future. It is important also to recognise that current built and regulatory environments and established lifestyle patterns are not suitable for the safe and sustained practice of the changes advocated in this review. Successful modification of collective behaviour will only be achieved with strategically well-planned and fully integrated policies and local measures including: prioritising walking and cycling, particularly at busy intersections or in human-centred spaces such as ‘pedestrian priority’ zones or shared spaces; traffic calming and traffic separation; integration with transit; compact development (as opposed to the urban sprawl policies of the late 20th century); driver training,

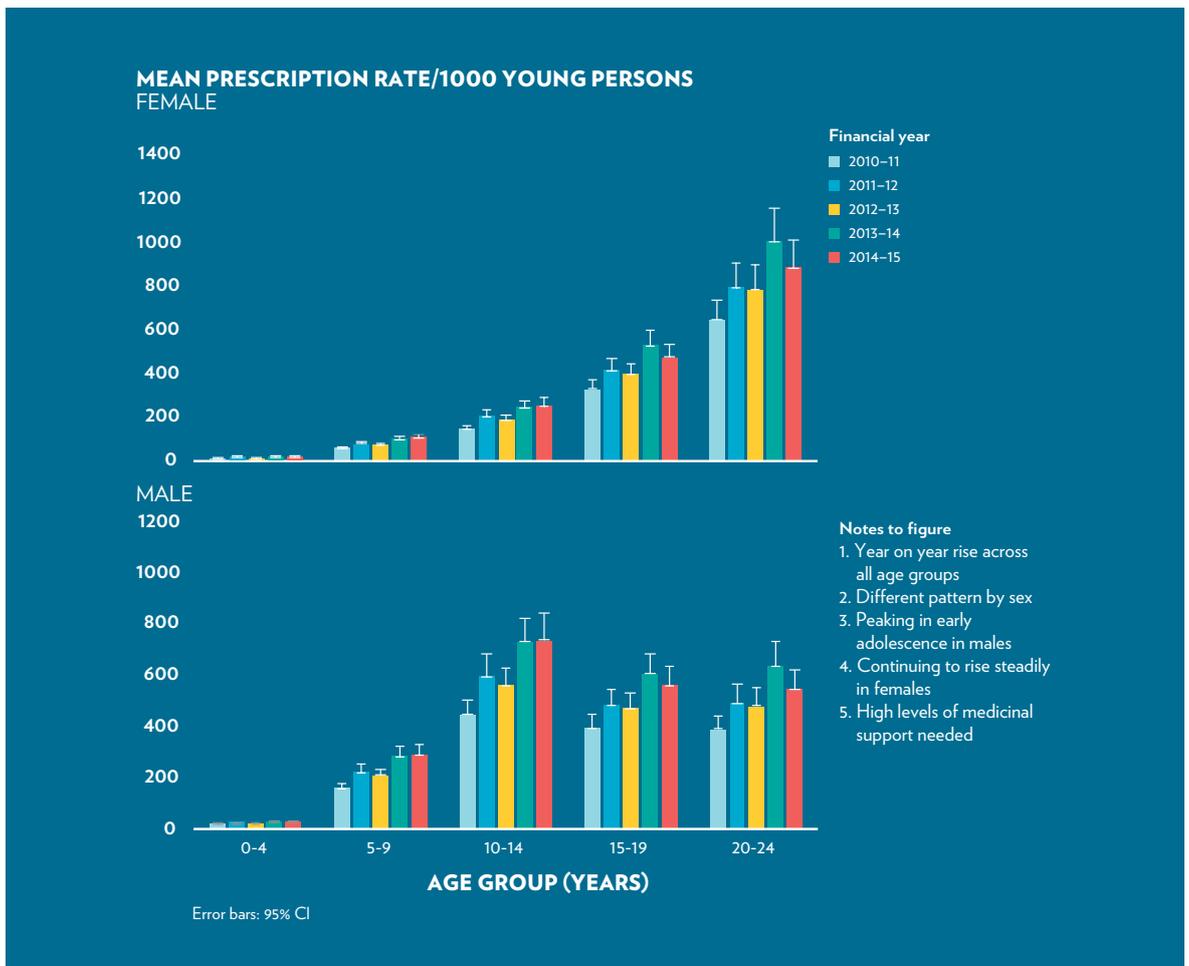


FIGURE 2
Mean number of prescriptions for cardio-metabolic and mental health conditions per 1000 young people (aged < 25 years) Australia by District (Statistical Area level 3 in the Australian Statistical Geography Classification).

Data presented are for the whole of Australia for the financial years 2010–11 to 2014–15, grouped by 5-year age band by sex. Error bars indicate 95% confidence intervals. Original data provided by the Australian Institute of Health and Welfare on 17th June 2018.

71%

OF PRIMARY SCHOOL CHILDREN DO NOT ACHIEVE THEIR BASIC FITNESS POTENTIAL

FREQUENCY

2000

1500

1000

500

0

0

20

40

60

80

100

% ACHIEVABLE FITNESS STANDARD

Achievement

Limited 9.6%

Partial 61.4%

Satisfactory 23.6%

High 5.2%

Excellent 0.2%

Mean = 31.94

Std. Dev. = 12.638

N = 21,712

FIGURE 3

Fitness standards for primary school children in the Australian Capital Territory between 2000 and 2011 (n=21,712).

Data from: Cochrane T, Davey RC, de Castella RF. Influence of school community and fitness on prevalence of overweight in Australian school children. *Preventive Medicine* 81 (2015) 433–437.

- road safety education and training (especially for children and parents) and regulation; plus, if necessary, complementary pro-active travel policies such as restricted parking, higher registration and licensing fees and fuel pricing; and establishing a culture of active travel. (Table 1.4 and Table 3.3)
- Physical activity opportunities should be provided so that all children are able to meet the recommended guideline of 60 minutes of at least moderate activity daily. (Table 1.5) (see Figure 3).
- More needs to be done to eliminate or mitigate the effects of socio-economic disadvantage on children, which is a persistent and widening blight on Australian society. (Table 1.6) (see Figure 4).
- The benefits of physical activity and play to developing children are established beyond reasonable doubt. Yet, the majority of children across the whole of Australia do not get the recommended daily amount of physical activity to derive these benefits. Greater efforts should be made, say, through a public media campaign or targeted mailing to parents of new school starters to promote the importance to children of not missing out on their daily physical activity. At the same time, children should receive educational activities and opportunities to practice skills so that healthy lifestyle behaviours become established. These lessons and activities can easily be accommodated within the school curriculum. (Table 1.7)

50% OF DEVELOPMENTAL VULNERABILITY BY AGE 5 IN AUSTRALIA POTENTIALLY ATTRIBUTABLE TO DISADVANTAGE

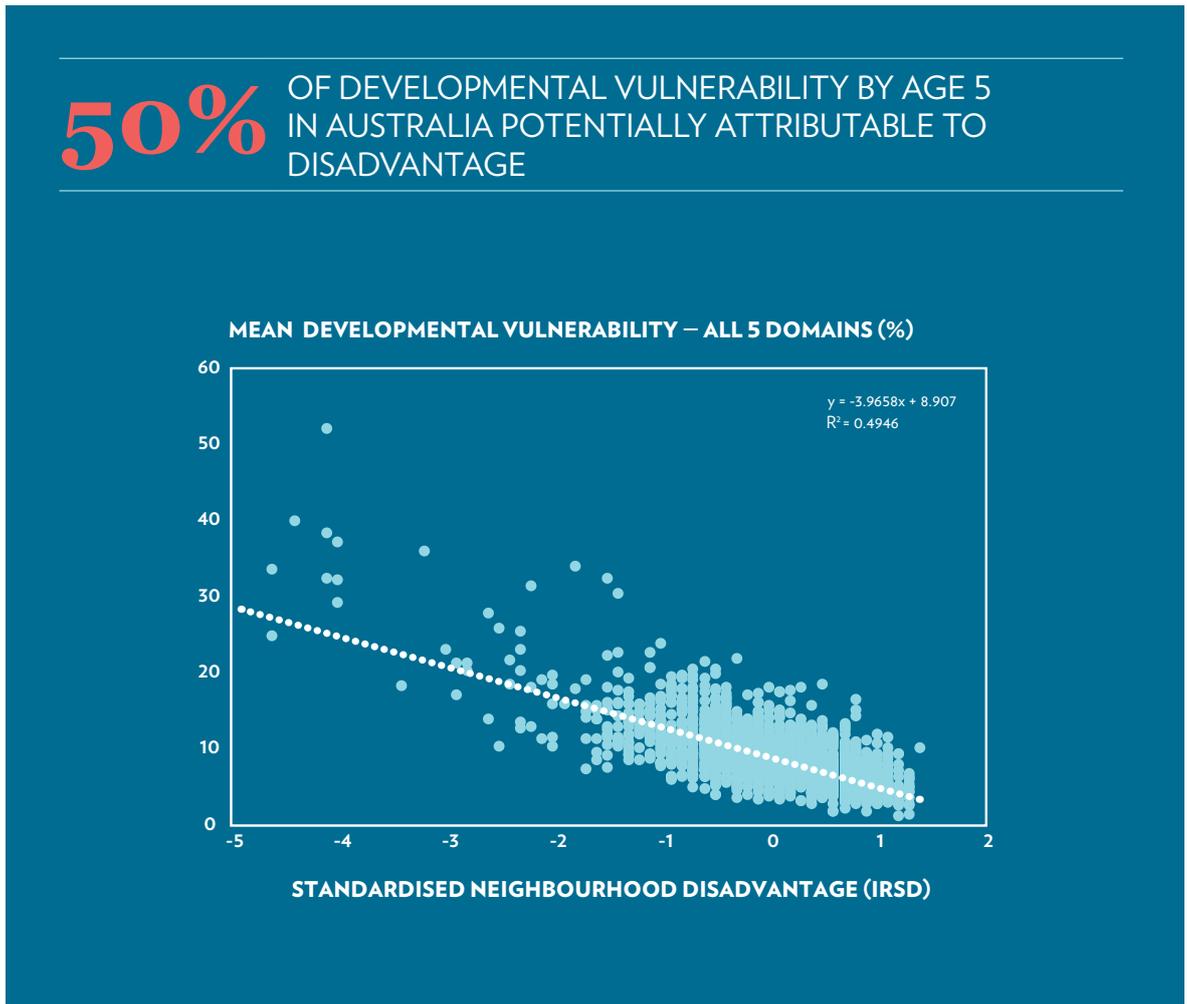


FIGURE 4
Average developmental vulnerability (%) (DV) across all five domains of the Australian Early Development Census (AEDC) (2009, 2012, 2015) by suburb plotted against standardised disadvantage (IRSD) – Australia.

AEDC data downloaded from <https://www.aedc.gov.au/> on 13th September 2017. Disadvantage was defined by the Index of Relative Socio-Economic Disadvantage (IRSD) derived from data gathered in the 2011 census by the Australian Bureau of Statistics. The rank order of the 57,523 SA1s nationally for Australia was used to calculate an ordered index of disadvantage at SA3 level using the population weighted average of the constituent SA1s in each SA3. These data have been standardised for ease of use in computations; values to left – greater disadvantage

2. INTERVENTIONS TO IMPROVE USE OF SAFE ACTIVE TRAVEL TO SCHOOL

- Stand-alone events and competitions such as walk and ride to school days have limited effects on active travel to school. They do raise awareness and should be used in conjunction with other types of intervention strategies to have the best results. (Table 2.1)
- Walking School Buses (WSB) do increase physical activity during the program execution and give parents the peace of mind that their child will arrive safely to school. However, they mimic car travel and consequently do not improve independent mobility or sense of direction for children. A further disadvantage of WSB is that they impose a significant overhead on volunteer parent support and this can be difficult to sustain or generalise. (Table 2.2)
- Bicycle training programs improve interest in cycling and cycling skills but this may not be enough to encourage and increase active travel to and from school. (Table 2.3)
- School travel plans appear the most comprehensive and most promising type of intervention used to increase active school travel to date. In principle their intent is to include extensive planning and use co-design to develop goals and targets for the whole school community. Most implementations to date in Australia have failed to deliver significant impact in changing active travel norms. Typically the failure to deliver substantial change may be explained by one or more of the following reasons: 1) the initiative is not owned by and driven by the school

community, 2) it focuses on safety education only, giving insufficient attention to the reasons why active travel is important to children's development, 3) there is inadequate engagement with children and families (enabling and empowerment) to discover their needs and barriers that need to be overcome, 4) it does not include adequate consideration of the practice activities (and resource) that would be needed to establish the change behaviours and, perhaps most important of all, 5) there is perceived competition for curriculum space with the established role of primary education to deliver literacy and numeracy outcomes. (Table 2.4)

3. RESOURCES TO SUPPORT ROAD SAFETY EDUCATION AND ACTIVE TRAVEL TO SCHOOL

- Education on the importance of active school travel, how children can use it safely and how the community can facilitate it has the potential to change active school travel behaviour and attitudes. It is important to educate parents, schools and the wider community as well as the children themselves. School community support is crucial to success. (Table 3.1)
- Lessons need to be joyful, inclusive and playful and to be supported by adequate opportunities to practise and establish the desired behaviours. (Table 3.1)
- Active school travel represents, if successful, a high return investment. This single activity provides at least 22 known benefits and is likely to contribute to better future health for children. This alone is likely to justify the investment. (Table 3.2)
- Comprehensive and well-coordinated packages of activity will be needed to achieve the required change in societal norms, including some or all of the following components (the 6 Es + 1E that we have added following this Rapid Review):
 - **Engineering:** operational and physical improvements to the built environment infrastructure
 - **Education:** materials and activities to teach the importance of active transportation; walking and cycling safety training sessions and practice activities
 - **Encouragement:** events and activities to promote active travel for children
 - **Enforcement:** partnerships with local law enforcement to ensure traffic laws are obeyed in school neighbourhoods; crossing guard programs
- **Evaluation:** data collection and program monitoring to inform future intervention components and monitor trends
- **Equity:** efforts to ensure that intervention components reach everyone within a school community and address potential barriers to participation for certain groups (e.g., low-income, people from different ethnic groups, people with disability)
- **Enabling (the +1 E added here):** co-design work with children, teachers and parents to identify needs, barriers and preferences to establish program ownership and contributions to the overall design solution. (Table 3.3)
- There has been a large amount of material produced to encourage and support active school travel. Most of this material has had little or no impact in shifting physical activity norms in Australia, especially the use of active travel to and from school. Collectively across Australia, however, there are examples of most of the components that are required to reset social norms for active school travel (see Table 3.3). Individually, however, they all fall short of being able to achieve significant sustained change in population levels of active travel for children within their own jurisdictions. Examples of promising approaches, from within Australia and from other countries, that could be brought together to increase adoption of active school travel are summarised in the final evidence extract. In essence, these include: comprehensive and well-coordinated planning and delivery (the 7 Es) of the opportunity for all children to incorporate physical activity with peers, siblings or parents into their school day; education on the value of physical activity to children's development coupled with practice to establish healthy behaviours; safety education and practice; all supported with good quality, accessible education resources. (Table 3.4)

LIMITATIONS AND EVIDENCE GAPS

LIMITATIONS

There is an overwhelming amount of published research and other materials relating to active school travel. However, most of the published research is of low quality. The heterogeneous nature of school communities, the resources available to them and the fact that they are very busy places makes it extremely difficult to set up and evaluate interventions. This leads to wide variation in intervention approaches and the measures used to assess process and outcomes. This in turn makes it difficult to compare or pool outcomes from different studies. For example, only four research teams were able to perform a meta-analysis on their reviewed studies but even these had to use different definitions of effect size because of differences in the outcome measures used.

A crucial limitation in the vast majority of school-based research is that it is almost impossible to develop and deliver studies with strong randomised or cluster randomised controlled trial design either for implementation or for evaluation. Before and after comparisons, even, are not always easy because of variations in, for example, weather, loss to follow-up or other events taking place in schools or in school neighbourhoods. Given the challenges, it is not surprising that only small numbers of good quality studies become available for review. This limits the range of environments that are included, making it difficult to generalise findings beyond those studied.

Variation of regional policies, for example, the mix of land uses, street network and intersection design, the surface types mix, width and location of footpaths, cycle paths and roads add additional influences on behaviour that complicate the implementations and comparison of interventions.

We did not find any examples of fully comprehensive and well-coordinated interventions in Australia, although the *Safe Active Routes to School Toolkit* developed by the City of Darwin, Northern Territory (NT) incorporated a number of attractive features and the city reports the highest proportion of children (50%) using active travel in Australia.

EVIDENCE GAPS

There are no routine standardised measures of modes of travel to and from school e.g. routine hands-up surveys of class groups. This makes it difficult to gauge baseline practice in schools, to benchmark targets, to evaluate trends and program reach.

Overall, there is limited meaningful solution-oriented engagement with children, parents, teachers and other members of school communities. More direct involvement should be a requirement for future work in this area. The status quo is failing to give our children the best possible start in life and needs to change.

SUPPLEMENT A: SUMMARY OF REVIEW METHODS

The review was conducted in three parts each with a different type of objective or material for review and, therefore, requiring a different search strategy. The methods used are described below.

PART 1 – THE NEED FOR CHANGE IN POLICY FOR CHILDREN’S DEVELOPMENT, HEALTH AND WELL-BEING

SEARCH STRATEGY

There is rising concern about the prevalence of overweight, lack of physical activity, general fitness and opportunity to play in Australian children. Furthermore, the persistent failure to make any real impact on reversing these conditions remains a serious threat to public health. In the first part of this Rapid Review we consider these early lifestyle related threats to the public health of young people (i.e. those aged below 25 years of age) and potential policy changes that might be more successful in reducing these risks to future health.

For ease of gathering relevant evidence, this part of our review has been divided into seven themed areas. Despite the lack of

success in achieving significant change to the status quo, the area has been, and continues to be, heavily researched. Thus, we began each themed area by searching for recent summations of evidence: systematic reviews, reviews of reviews, meta-analyses, expert commissions or large influential longitudinal studies with linked follow-up of morbidity or mortality outcomes (which we refer to as seed references below). In many cases relevant research papers were already available from personal research lists. Where no recent seed materials were available, we constructed Google or Google Scholar searches using combinations of key words for each themed area to quickly find existing review evidence. For example, the search ‘overweight OR obesity cardiometabolic conditions children AND (“systematic review” OR meta-analysis OR commission OR longitudinal)’ was used to find review material linking overweight or obesity in children to cardiometabolic conditions. In many cases, very recent review material was already available. Where this was not the case, we performed top-up searches (similar to the example above but without the systematic review etc. qualifiers) to find relevant research using key words from each theme area within databases: SPORTDiscus, ScienceDirect, MEDLINE /PubMed, informit, CINAHL, Cochrane Library and Google Scholar.

SEARCH RESULTS

THEME 1:

Early overweight/obesity as a key driver of cardio-metabolic and other conditions in children, adolescents and young adults

Seed references 2: 1, 11, 12, 24, 28, 30, 32, 33, 39
References providing evidence extracts: 1–45 (n=45)

THEME 2:

Decline in children’s free play and peer-play and the rise in mental health problems in children, adolescents and young adults

Seed references: 50
References providing evidence extracts: 46–63 (n=18)

THEME 3:

Healthy lifestyle leads to better long term health and greater life expectancy. Unhealthy lifestyle leads to poorer long term health and lower life expectancy

Seed references: 64, 65, 69, 75
References providing evidence extracts: 64–83 (n=20)

THEME 4:

Public health policy options to counter trends in overweight, declines in physical activity and fitness and loss of free play for Canberra’s children and adolescents

Seed references: 84, 92, 93, 94–6
References providing evidence extracts: 84–98 (n=15)

THEME 5:

Evidence supporting the link between physical activity, cardiovascular disease (CVD) and premature mortality

Seed references: 99, 100, 103–4, 106
References providing evidence extracts: 99–106 (n=8)

THEME 6:

Effects of socioeconomic disadvantage and adverse childhood experiences (ACE)

Seed references: 107–110, 113
References providing evidence extracts: 107–113 (n=7)

THEME 7:

Value of active travel/physical activity to developing children

Seed references: 114, 118–9, 122
References providing evidence extracts: 114–123 (n=10)

2 Numbers refer to references listed in References: Part 1. Numbers in brackets gives the number of items providing evidence extracts.

PART 2 – INTERVENTIONS TO PROMOTE SAFE ACTIVE TRAVEL TO SCHOOL

SEARCH STRATEGY³

The 2nd electronic search, on ‘Active school travel interventions’, was conducted for the period from January 2011 through to June 2018. Three categories of search terms were identified: 1) age, 2) active transportation, and 3) interventions. Relevant publications that contained at least one term from each of the 3 categories in the full text were identified. The search term, *school*, was restricted to title and abstract to avoid its inclusion in the author’s affiliation. The following terms were used for each category:

- **Age:** *adolescent* OR child OR children OR youth OR student* OR pupil OR pupils AND*
- **Active transportation:** *bike OR bikers OR biking OR bicycle* OR cycle OR cycling OR cyclist* OR commute* OR commuting OR transportation OR travel* AND*

- **Intervention:** *intervention* OR implement* OR evaluate* OR change OR pilot OR project OR environment* OR engineer* OR encourage* OR planning OR impact OR “walk to school” OR “safe routes to school” OR “walking schoolbus” OR “walking school bus” OR “walking school buses” AND School: “school” [Title/Abstract]*

DATABASES SEARCHED

Seven databases were searched: SPORTDiscus, ScienceDirect, MEDLINE/PubMed, informit, CINAHL, Cochrane Library and Google Scholar. Recent Transportation and Urban Planning literature was also reviewed to update the earlier extensive reviews of Chillon *et al.*^{1/119}, Larouche *et al.*^{1/122} and Pucher *et al.*^{3/23}.

INCLUSION/EXCLUSION CRITERIA

	Include	Exclude
Study Type	All levels of evidence Systematic reviews/meta-analysis Randomised control trials Quasi-experimental Observational Case control and cohort studies Relevant grey literature e.g. Government reports etc.	
Population	Main or significant focus on primary school aged children (aged 5–13)	Adults Studies only focusing on adolescents
Study Design	Include at least one intervention focusing on increasing active transport to/from school	
Study Setting	School setting	Recreational active travel
Intervention	Primary aim of intervention to promote active school transport	Focus on increasing physical activity with no measure of active travel
Outcome	Active transport, physical activity, cardio-metabolic/respiratory measures	
Publication Status	English-language Published from January 2011 to June 2018 Peer-reviewed publications and grey literature included	

³ To be consistent with earlier systematic reviews we have replicated the search terms used by Chillon P, Evenson KR, Vaughn A, Ward DS. A systematic review of interventions for promoting active transportation to school. *Int J Behav Nutr Phy* (2011) 8:10 <http://www.ijbnpa.org/content/8/1/10>

SEARCH RESULTS

Initial searching and title screening was performed by one researcher (SJ). Both researchers screened abstracts, full texts and agreed the evidence extracts. Figure S.1 provides a flow diagram summary of the process.

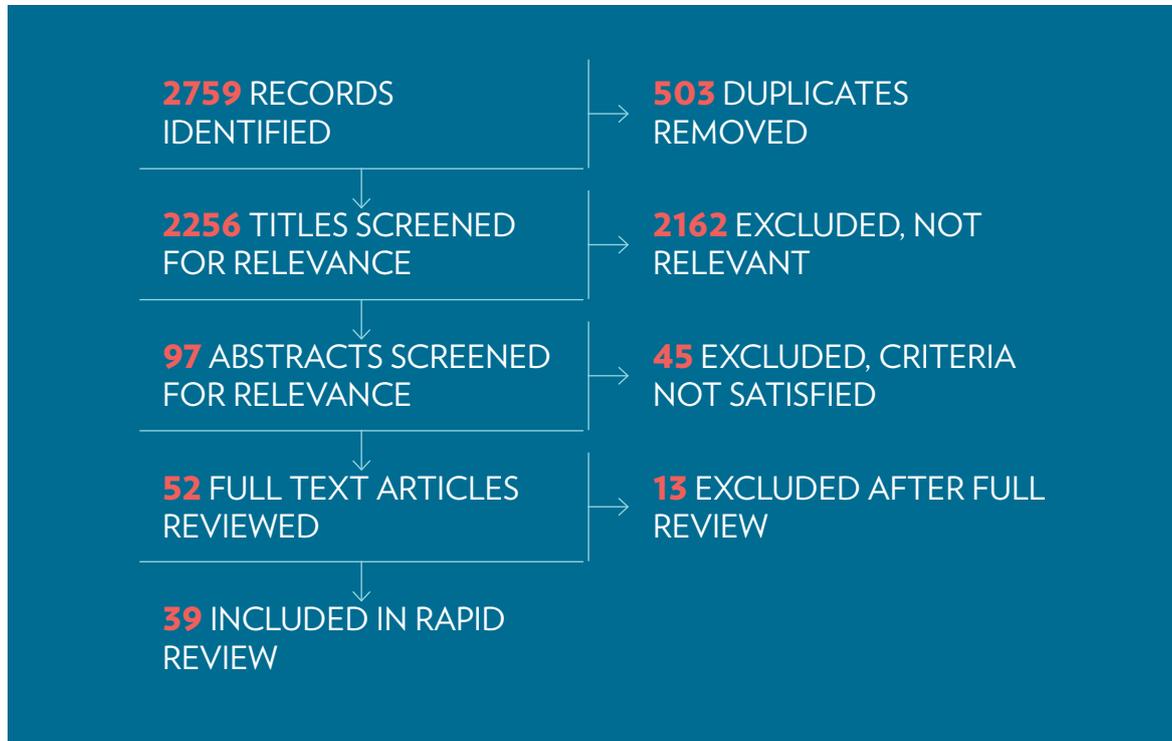


FIGURE S.1

Search results: Rapid Review Part 2 – Interventions to improve use of safe active travel to school.

Thirty nine references were retained for review; 16 of which provided evidence extracts for the Rapid Review.

PART 3 – RESOURCES TO SUPPORT ROAD SAFETY EDUCATION AND ACTIVE TRAVEL TO SCHOOL

The grey literature was searched for resources to support road safety education and the development of safe active school travel behaviours in primary school children. Databases included the Grey Literature Report, Proquest Dissertations, Theses Global and Google. The following search terms were used in searches carried out between 1st October 2018 and 30th November 2018:

- Active travel to school lesson plans
- Parent education safe active travel to school
- Resources road safety education for schools
- Healthier routes to school
- Safe routes to school

- Active commuting to school
- Active school travel *AND* “list”*
- Co-design active travel to school
- School travel planning *AND* “list”
- Sustrans active travel to school resources

* “list” refers to a list of geographical qualifiers that were used to search for materials covering different regions. “list” terms included were: Australian States, Territories and capital cities; Canada, United States, New Zealand, England, Scotland, Wales, Northern Ireland; Netherlands, Denmark, Germany.

In Google searches, search items up to level 5 (first 50 most relevant items) were reviewed for each search. Related search terms appearing in the Google window, usually about three for each search term, were also searched. Overall, 3909 resources were screened; 43 were selected for inclusion in the Rapid Review.

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TABLE 1 Evidence supporting the need for change in policy for children’s development, health and well-being

1.1 Early overweight/obesity as a key driver of cardio-metabolic and other conditions in children, adolescents and young adults	
Findings	Evidence type
A large body of international evidence demonstrates that overweight and obesity in childhood and adolescence have adverse consequences on morbidity and premature mortality in adulthood. ¹ Cardio-metabolic morbidity ²⁻¹² Other morbidity ¹⁵⁻²¹ Premature mortality ²²⁻²⁹	Systematic review ¹ Peer review papers ²⁻²⁹
Rapidly developing nations, such as China, have experienced the emergence of high levels of cardio-metabolic disease risk associated with changes in diet, reduced levels of physical activity and increases in overweight and obesity, particularly abdominal obesity. ³⁰	Peer-review paper ³⁰
<i>“The rise in the rates of overweight and obesity over the past two decades has very serious implications for the future burden of disease. Overweight and obesity are major modifiable risk factors for heart disease and stroke, as well as for type 2 diabetes, chronic kidney disease, some cancers and osteoarthritis, among others.”</i> ³¹ High body mass index (BMI), poor diet and physical inactivity were major contributors to cardiovascular disease in Australia. ^{31, p20} Elevated BMI contributed almost 25% to the total expenditure on cardiovascular disease and type 2 diabetes, estimated to be \$3.9 billion in 2011–12 and projected to reach \$16.9 billion by 2031–32. ^{31, p27}	Commissioned report ³¹
BMI was a strong indicator of adverse changes in several cardio-metabolic risk factors (mid-blood pressure, fasting glucose level, triglycerides and total cholesterol) in adults of various ages (ranges 30–40, 40–50 and 50–60 years) observed over a 10 year period. ³²	Peer-review paper ³²
A cluster of risk factors — overweight and obesity, high blood pressure, high blood glucose, high triglycerides and reduced high-density lipoprotein cholesterol — have all been indicated as strong risk factors for cardiovascular disease, cancer and diabetes. ³³	Joint Scientific Statement ³³
Several other studies have linked obesity, particularly central obesity, with the development of metabolic risk factors. ^{34–38}	Peer-review papers ^{34–38}
Today’s food environments exploit people’s biological, psychological, social, and economic vulnerabilities, making it easier for them to eat unhealthy foods. This reinforces preferences and demands for foods of poor nutritional quality, furthering growth of unhealthy food environments. Regulatory actions from governments and increased efforts from industry and civil society will be necessary to break these vicious cycles. The six papers in this Lancet Series review: i) progress since the 1 st Lancet Series on Obesity and new ways of thinking ⁴⁰ ii) considers how smart food policies can be developed for obesity prevention ⁴¹ iii) argues for strengthening the underexploited role of the public in demanding policies for obesity prevention ⁴² iv) frames child and adolescent obesity as part of the bigger picture ⁴³ v) warns that health professionals are currently poorly prepared to tackle obesity or care for patients with obesity ⁴⁴ and vi) calls for a strengthening of accountability systems across all actors and proposes a four-step framework to do so. ⁴⁵	2 nd Lancet Series on Obesity ³⁹ Peer review papers ⁴⁰⁻⁴⁵

TABLE 1 Evidence supporting the need for change in policy for children’s development, health and well-being (continued)

1.2 Decline in children’s free play and peer-play and the rise in mental health problems in children, adolescents and young adults	
Findings	Evidence type
Over the latter decades of the 20 th century and the first two decades of the 21 st century, many nations globally, including Australia, have experienced significant declines in opportunities for children’s free play with other children. Over the same period, anxiety, depression, suicide, feelings of helplessness and excessive self-interest (narcissism) have increased sharply in children, adolescents and young adults.	Peer-review paper ⁴⁶
Executive function and self-regulation skills are the mental processes that enable us to plan, focus attention, remember instructions, and juggle multiple tasks successfully. When children have adequate opportunities to develop their executive function and self-regulation skills they, and the rest of society, experience lifelong benefits. These skills depend on three types of brain function: working memory, mental flexibility, and self-control. Children are not born with these skills—they are born with the potential to develop them. Whether they develop them or not depends on the relationships and interactions with their peers and adults within their social environments. Providing the support that children need to build these skills at home, in early care, in education settings, and in other settings they experience regularly is one of society’s most important responsibilities. The best environments and experiences provide children with the infrastructure that helps them practice necessary skills before they must perform them alone. It is also important for children to exercise their developing skills through activities that foster creative play and social connection, teach them how to cope with stress and other psychological challenges, involve vigorous exercise, and over time, provide opportunities for directing their own independent actions with decreasing adult supervision. <small>Adapted from ⁴⁷</small>	Institutional website ⁴⁷
Play is essential to development because it contributes to the cognitive, physical, social and emotional well-being of children and youth. Play also offers an ideal opportunity for parents to engage fully with their children. Despite the benefits derived from play for both children and parents, time for free play has been markedly reduced for many children. This report offers guidelines on how paediatricians can advocate for children by helping families, school systems and communities consider how best to ensure that play is protected as they seek the balance in children’s lives to create the optimal developmental milieu. ⁴⁸	Peer-review paper ⁴⁸
The importance of executive functions to children’s education begins in early childhood and continues throughout development. This study explores contributions of child and family factors in early childhood to the development of executive function in adolescence. Findings suggest that children’s early self-regulatory capacities are the basis for later development of executive function in adolescence when capabilities for planning and problem-solving are important to achieving educational goals.	Peer-review paper ⁴⁹
The evidence from this systematic review indicates overall positive health effects of increased risky outdoor play. Specifically, play where children can disappear /get lost and risky play supportive environments were positively associated with physical activity and social health, and negatively associated with sedentary behaviour. ^{51–60} Engaging in rough and tumble play did not increase aggression and was associated with increased social competence for boys and popular children. However, results were mixed for other children. ^{61,59,62,60} There was also an indication that risky play supportive environments promoted increased play time, social interactions, creativity and resilience. ^{59,60} These positive results reflect the importance of supporting children’s risky outdoor play opportunities as a means of promoting children’s health, mental health and active lifestyles.	Systematic review ⁵⁰ Peer review papers ^{51–62}
This study revealed that variety in the diet, physical inactivity and sedentary behaviour in childhood are independently associated with the development of internalizing disorders in adolescence. These findings suggest that health promotion programs aiming to improve children’s diets and physical activity behaviours may also contribute to the prevention of mental disorders, providing further evidence that health behaviours and mental health are linked. ⁶⁵ Internalizing disorders include: depression, anxiety, distress, and mood disorder.	Peer-review paper ⁶⁵

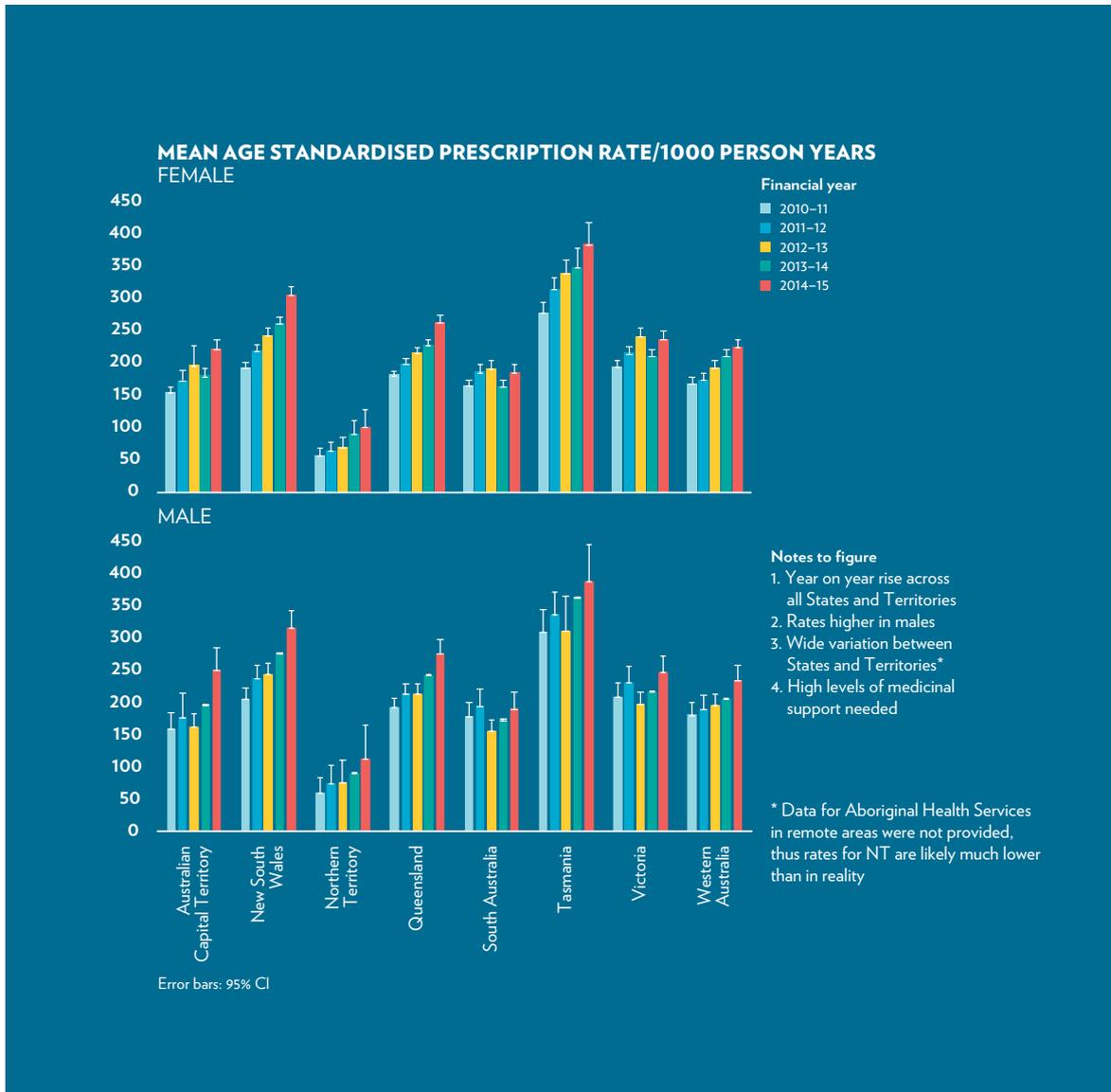


FIGURE 5
 Direct age standardised prescription rates per 1000 person-years for cardio-metabolic and mental health conditions (population aged < 25 years): Australia by State/Territory (by SA3) for the financial years 2010-11 to 2014-15.
 Error bars indicate 95% confidence intervals. Original data provided by the Australian Institute of Health and Welfare on 17th June 2018.

TABLE 1 Evidence supporting the need for change in policy for children’s development, health and well-being (continued)

1.3 Healthy lifestyle leads to better long term health and greater life expectancy. Unhealthy lifestyle leads to poorer long term health and lower life expectancy	
Findings	Evidence type
Most of the burden of ill health in Australia today is caused by a short list of behavioural risk factors: alcohol and drug use, high body mass index, poor nutrition (including diets low in fruits and vegetables and high in sodium and saturated fats), tobacco use and low physical activity.	Institutional website ⁶⁴
The impact of pursuing a healthy lifestyle on life expectancy has been assessed recently using data from two large longitudinal studies in the US, the Nurse’s Health study (n = 78865, 1980–2014) and the Health Professionals Follow-up study (n = 44354, 1986–2014). The authors concluded that adopting a healthy lifestyle could substantially reduce premature mortality and prolong life expectancy in US adults. ⁶⁵	Peer-review paper ⁶⁵
Chronic diseases such as cardiovascular disease (CVD) and cancer are the commonest and costliest of all health problems but are considered largely preventable. ⁶⁶ More than 2 decades ago, it has been suggested that major national health policies should move to emphasize reducing unhealthy lifestyles. ^{67,68}	Peer-review papers ^{66–68}
A meta-analysis of 15 studies including 531804 participants from 17 countries with a mean follow-up of 13.24 years suggested that ≈60% of premature deaths could be attributed to unhealthy lifestyle factors, including smoking, excessive alcohol consumption, physical inactivity, poor diet, and obesity. ⁶⁹ A healthy lifestyle was associated with an estimated increase of 7.4 to 17.9 years in life expectancy in the following countries: Japan, the United Kingdom, Canada, Denmark, Norway, and Germany. ^{70–74}	Meta-analysis ⁶⁹ Large longitudinal studies ^{70–74}
In a recent longitudinal study from the US with 3.2 million person-years of follow-up between 1964 and 2015, obesity was associated with shorter longevity and significantly increased risk of cardiovascular morbidity (CVD) and mortality compared with normal BMI. Overweight individuals had similar longevity but significantly increased risk of developing CVD at an earlier age, resulting in a greater proportion of life lived with CVD. ⁷⁵ Given that around 7% of children in Canberra are obese and around 18% are overweight before they reach the age of 15 years ⁷⁶ , the implications for future public health in the ACT are stark.	Peer-review papers ^{75,76}
In 2010, 63% of deaths from cardiovascular diseases, chronic kidney disease, and diabetes were attributable to four cardio-metabolic risk factors — high blood pressure, high blood glucose, high serum cholesterol, and high BMI. The mortality burden of cardio-metabolic risk factors has shifted from high-income to low-income and middle-income countries. Lowering cardio-metabolic risks through dietary, behavioural, and pharmacological interventions should be a part of the global response to non-communicable diseases.	Multi-national collaboration Report ⁷⁷
From the beginning of the 20 th century until about 1980, life expectancy in the US rose steadily to almost double its value at the end of the 19 th century. In the late 1970s, this trend began to slow, leading some to predict that life expectancy would decline in the United States by the mid-21st century. ⁷⁹ Preliminary evidence of this slow down or reversal has already been reported. ⁸⁰ National and local policies are needed that shift away from low-quality foods and instead encourage production and purchase of high-quality proteins, fruits, vegetables, nuts, and other whole foods. Sensible reforms involving taxes, subsidies, and nutrition assistance programs could help make nutritious foods more accessible and affordable. ⁸¹ In addition, greater investment in schools should be made so that children eat high-quality meals on school premises and have regular physical education and after school recreation opportunities. Children should be protected from predatory advertising.	Expert Viewpoint ⁷⁸ Peer review papers ^{79–81}
Nyberg <i>et al.</i> ⁸² pooled data from 10 large International studies to gain estimates of the number of years free from major non-communicable diseases in adults who are overweight and obese, compared with those who are normal weight. Mild obesity was associated with the loss of one in ten, and severe obesity with the loss of one in four potential disease-free years during middle and later adulthood. This increasing loss of disease-free years as obesity becomes more severe occurred in both sexes, among smokers and non-smokers, the physically active and inactive, and across the socioeconomic hierarchy.	Peer-review paper ⁸²
Decreasing moderate to vigorous physical activity (MVPA) emerged as a significant predictor of increases in waist circumference over a 10 year period. Increasing TV viewing time was also influential, but its impact was much weaker than MVPA.	Peer review paper ⁸⁵



	ACT total	≥ 10% < 15%	≥ 15% (95% CI)	Total
Females	56,739	2,610 (2,213–3,007)	1,872 (1,532–2,213)	4,482 (3,745–5,220)
Males	53,722	9,186 (8,488–9,885)	7,252 (6,608–7,897)	16,439 (15,096–17,782)
Total	110,461	11,796 (10,701–12,892)	9,125 (8,140–10,110)	20,921 (18,841–23,002)

The *HeartLink* programme confirmed a large, currently unmet, need for preventive cardiovascular disease related services in the ACT. A coordinated approach to population risk assessment and management was deemed by most stakeholders to be a welcome addition to general practice and was successful in reducing CVD risk (though numbers completing the program were small in this pilot so due caution is warranted). The approach bridges policies related to population health, primary care delivery and chronic disease management at the ACT and Commonwealth levels. This coordinated, “whole of system” approach has considerable potential to reduce the overall disease burden in the ACT.

Heartlink Final Report to ACT Health, October, 2014

10,351

IN THE 5 YEAR PERIOD 2009–2013 THERE WERE 10,351 HOSPITAL ADMISSIONS FOR CIRCULATORY DISEASE EPISODES IN THIS AGE GROUP IN ACT PUBLIC HOSPITALS.

FIGURE 6

Estimates of the population aged between 45 and 74 years at risk of cardiovascular disease-related events in the next 5 years in the Australian Capital Territory.

From: *Heartlink* Final Report to ACT Health, October 2014.

TABLE 1 Evidence supporting the need for change in policy for children’s development, health and well-being (continued)

1.4 Public health policy options to counter trends in overweight, declines in physical activity and fitness and loss of free play for Canberra’s children and adolescents	
Findings	Evidence type
<p>The National Center for Chronic Disease Prevention and Health Promotion at the Centers for Disease Control and Prevention funds a program to boost progress in reducing the prevalence and incidence of multiple chronic diseases and their associated risk factors. This program is based on the four domains of public health action:</p> <ol style="list-style-type: none"> 1 epidemiology and surveillance 2 environmental approaches 3 health care system interventions 4 community programs linked to clinical services.⁸⁴ <p>Despite significant levels of funding and coordination, for example \$US 79.5 million in 2014, there is little evidence of any perceivable effect on the prevalence or incidence of the chronic diseases being targeted or their risk factors. Radical new approaches are needed, and quickly.</p> <p>Recent epidemiological evidence at the multi-national level provides important clues to new approaches that may be worth considering. In developed nations at least, the Global Burden of Disease studies⁸⁵ herald the success of clinical care throughout the middle part of the 20th century and the transition to global dominance of chronic diseases that are predominantly behaviour driven and, therefore, considered largely preventable. The threats are well known – alcohol and drug use, high body mass index, poor nutrition (including diets low in fruits and vegetables and high in sodium and saturated fats), tobacco use and low physical activity.</p> <p>This has been the case for decades now. In fact, the situation worsens inexorably year on year. Health and social care costs, inevitably, follow suit.^{86,87} In Australia, the prevalence of overweight and obesity, for example, is approaching two thirds of the population – ‘normal is no longer the norm’. Only about 30% of primary school children achieve the recommended daily 60 minutes of physical activity. Social and economic disadvantage are widespread and widening.⁸⁸</p> <p>We propose that there is a need for a radical re-think of preventive policy to focus on the real drivers of poor health and to invest in education and behaviour development strategies that really do equip children and young people with the skills, opportunity and resilience to meet the demands of 21st century living. We know (or, rather, we should know) that the best things we can teach our children to insure their future health and well-being are to:</p> <ol style="list-style-type: none"> 1 not smoke or take illegal drugs 2 keep their weight (BMI) within the optimum range for their age, sex and stage of development 3 maintain a healthy diet, including adequate fruit and vegetable intake and limiting salt, sugar and saturated fat intake 4 make sure that they get plenty of good quality physical activity – 60 minutes daily of at least moderate level and using most parts of the body is the established standard, 5 get plenty of opportunity to play, including free play, with their peers. <p>Yet our practice, taken as a whole, does not achieve any of these ‘educated lifestyle’ standards. Smoking and illicit or prescription drug taking is common and increasing in adolescents and young adults. Overweight and obesity is 1 in 4 on leaving primary school and 2 in 3 by mid-adulthood. Average diet quality is poor. Our children are driven and dropped at school and are deprived of almost all opportunity for free play or to develop independence. Would it not be better to turn this status quo around and invest in our children’s future so that they have both the knowledge and the practice of the behaviours that will give them the best opportunity to enjoy a healthy, long and productive life? This would mean: providing more opportunities for daily physical activity and free play; tackling unsafe and toxic (car dominated) environments in school zones and designated play spaces and enabling children to travel freely and safely within them; keeping a watchful eye on weight (underweight, though less common, and overweight) and diet; knowing how to say “No thanks, I don’t need it” to drugs and smokes. This should not be left to the vagaries of individual choice, important though that is. Many children in Canberra are not given any choice. Coordinated collective effort will be required. After all, our forebears had to overcome the individual choice of the time when sanitation and sewerage were established in the latter half of the 19th century, accelerated by the <i>Great Stink</i> of 1858 in London.</p> <p>⁸⁹ Incidentally, in so doing we would be returning to children Rights 12, 13, 18, 29 and 31 of the UN Convention on the Rights of the Child that have been denied or partially denied them for decades.</p>	<p>Peer-review paper⁸⁴</p> <p>Special topic: State Public Health Actions to Prevent and Control Chronic Diseases</p> <p>Institutional Reports⁸⁵⁻⁸⁸</p> <p>Online Encyclopedia⁸⁹</p>

1.4 Public health policy options to counter trends in overweight, declines in physical activity and fitness and loss of free play for Canberra's children and adolescents

Findings

A recent Editorial in the *Lancet Public Health* called for more concerted effort to be given to tackling global obesity. In a linked Commentary in the same Journal Issue, attempting to explain what caused the rise in prevalence of obesity in the USA, where this epidemic first appeared in developed nations, Rodgers *et al.*⁹¹ looked at the nationally representative survey data (National Health and Nutrition Examination Survey, NHANES) gathered between 1960 and 2000. They noted that most people became heavier at about the same time, starting in the late 1970s, across the whole US population. This rise continued over the remainder of the observation period across all ages in both females and males. The authors argued that it is implausible that this population-wide change could be explained by a simultaneous decline in individual willpower related to maintaining healthy dietary intake or level of exercise. Rather, they proposed that it is important to consider factors that have a mass exposure, are widely distributed, and act with short time-lags. The US farm bills in the 1970s appear as a strong candidate, which they note, “led to a rapid increase in food production and thus an increase in food portion sizes; accelerated marketing, availability, and affordability of energy dense foods; and widespread introduction of cheap and potent sweetening agents, such as high-fructose corn syrup, which infiltrated the food system and affected the whole population simultaneously”. The US population of the times was thus subjected to both over-supply and over-demand, with dire consequences for the nation.

Bann *et al.*⁹² in a further article in this Issue raise another important topic. These authors noted that over the studied period (1953–2015) in the UK, socioeconomic-associated inequalities in children's weight reversed and those in height narrowed, whereas differences in BMI and obesity emerged and widened. These substantial changes highlight the impact of societal changes on child and adolescent growth and the insufficiency of previous policies in preventing obesity and its socioeconomic inequality. Bann *et al.* conclude that new and effective policies are required to reduce BMI inequalities in childhood and adolescence. We believe that such policy imperatives apply equally to Australia.⁹³ Governments and health policy makers need to take bolder, more definitive steps to tackle the obesity epidemic—it will not be reversed without such decisive leadership.

Evidence type

Lancet Public Health Editorial⁹⁰
 Commentary⁹¹
 Peer-review papers^{92,93}

TABLE 1 Evidence supporting the need for change in policy for children’s development, health and well-being (continued)

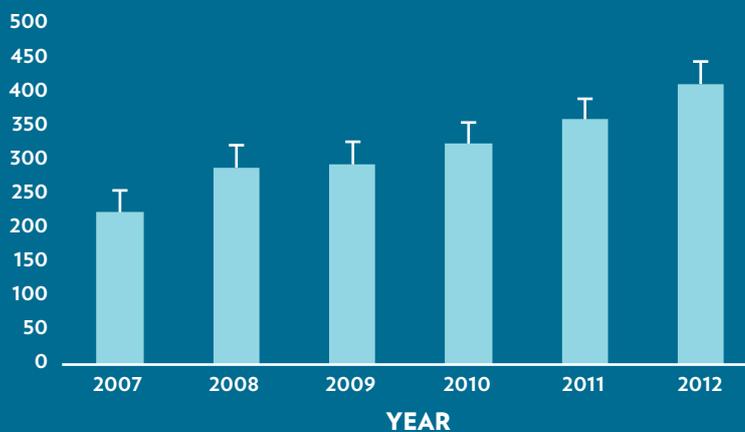
1.4 Public health policy options to counter trends in overweight, declines in physical activity and fitness and loss of free play for Canberra’s children and adolescents	
Findings	Evidence type
<p>Bundy <i>et al.</i>⁹⁴ provide an overview of the analyses from volume 8 of Disease Control Priorities, 3rd edition, published by the World Bank, entitled Child and Adolescent Health and Development.⁹⁵ This volume identifies cost-effective, scalable health interventions during middle childhood (5–9 years) and adolescence (10–19 years) that can promote physical, cognitive, and intellectual development. The key messages from this important report highlight the relative neglect of the middle childhood and adolescent development phases and indicate ways in which better policy through co-investment in education and health alongside co-design with the rest of the community could reap a high return for society. These key messages are replicated here:</p> <ul style="list-style-type: none"> • It takes some 8000 days for a child to develop into an adult. Sensitive phases shape development throughout this period, and age-appropriate and condition-specific support is required throughout if a child is to achieve full potential as an adult. • Investment in health during the first 1000 days is widely recognised as a high priority, but investments are often neglected in the following 7000 days of middle childhood and adolescence. This neglect is also reflected in the investment in research on these age groups. • At least three phases are crucial to health and development during the next 7000 days, each requiring a condition-specific and age-specific response: middle childhood growth and consolidation phase (5–9 years) when infection and malnutrition remain key constraints on development, and mortality rates are higher than previously realised; adolescent growth spurt (10–14 years) when body mass increases rapidly and substantial physiological and behavioural changes associated with puberty occur; and adolescent growth and consolidation phase (15–19 years), which brings further brain restructuring, linked with exploration, experimentation, and initiation of behaviours that are lifelong determinants of physical and mental health. • Broadening of investment in human development to include scalable interventions during the next 7000 days can be achieved cost-effectively. Two essential packages were identified: the first package addresses the needs in middle childhood and early adolescence through a school-based approach; the second focuses on older adolescents (15–19 years) through a mixed approach also involving the community, media and health systems. Both packages offer high cost-effectiveness and benefit-cost ratios. • Well-designed health interventions in middle childhood and adolescence can leverage the current substantial investment in education, and improved design of educational programmes can improve health. The potential synergy between health and education is undervalued and the returns on co-investment are rarely optimised. <p>An earlier Lancet Commission⁹⁶ had made a similar case regarding unprecedented social, economic, and cultural challenges faced by adolescents and young adults across the globe and called for transformation of health, education, and community support systems to keep pace with these changes. A similar case was made for better cross-sector synergies, arguing that the returns on the investment in adolescent engagement, health and wellbeing would be greater than the sum of its parts.</p>	<p>Review^{94,95} Lancet Commission⁹⁶</p>
<p>Oliver <i>et al.</i>⁹⁷ make an impassioned case and call for better policy and greater resource to be committed to supporting active travel in the United Kingdom. In essence, they call for a better (for health, social engagement and connectedness) mix of travel options to be easily and safely available to people. The authors go on to give examples of tried and tested multipronged interventions that, given a greater share of public investment, could contribute positively to economic growth, reduced carbon emissions, improved health, and promote equity of opportunity and quality of life,⁹⁸ particularly in urban areas. We believe that a similar case can be made for Australia, which has followed a similar trajectory of change to that seen in the UK. The ACT is very well placed to lead this change.</p>	<p>Editorial⁹⁷ Book chapter⁹⁸</p>

1.5 Evidence supporting the link between physical activity, cardiovascular disease (CVD) and premature mortality

Findings	Evidence type
<p>Lear <i>et al.</i> examined whether different amounts and types of physical activity are associated with lower mortality and CVD in countries at different economic levels (high, medium and low income countries). The researchers carried out a prospective cohort study including 130,843 participants without pre-existing CVD from 17 countries. The mean follow-up period was 6.9 years. Higher physical activity, both recreational and non-recreational, was associated with a lower risk of mortality and CVD events in individuals from low-income, middle-income, and high-income countries. Increasing physical activity is a simple, widely applicable, low cost global strategy that could reduce deaths and CVD in middle age.</p>	Peer-review paper ⁹⁹
<p>Bell <i>et al.</i>, using data from 1826 participants in the Avon Longitudinal Study of Parents and Children in the UK, ¹⁰⁰ demonstrated beneficial associations of physical activity with many metabolic traits. These effects were small in magnitude and appeared to be associated more with current activity than with previous activity. This suggests that if the beneficial effects of physical activity are causal, the activity would need to be maintained to retain the benefit.</p>	Peer-review paper ¹⁰⁰
<p>McMurray and Ondrak reviewed recent evidence (2008–2012) regarding the influence of physical activity on cardio-metabolic risk factors in children. The majority of evidence suggests that greater habitual PA is related to lower CVD risk factor levels, independent of obesity. The relationships between PA and blood lipids are not as strong but still in the expected direction.</p> <p>Current knowledge suggests that PA can modify the CVD risk profile of children.¹⁰² However, the question remains as to how much PA is needed to affect CVD risk factors in children. Recommendations by the US Centers for Disease Control and Prevention suggest that 30 to 60 minutes of daily moderate-to-vigorous PA are needed to improve health.¹⁰³ The Canadian guidelines are more specific and broken down by age ¹⁰⁴: infants (<1 year) should be active several times daily, through interactive floor-based play; toddlers (1–2 years) and pre-schoolers (3–4 years) should accumulate at least 180 minutes of PA throughout the day and include a variety of activities in different environments, activities that develop movement skills, and progression toward at least 60 minutes of energetic play by 5 years of age, similar to the guideline for older children.¹⁰⁵</p>	Themed Review ¹⁰¹ Peer-review paper ¹⁰² Peer-review Guideline ¹⁰³⁻¹⁰⁵
<p>European Guidelines on cardiovascular disease prevention in clinical practice have been published recently.¹⁰⁶ This is a compilation of the best available evidence leading to a coordinated set of actions, at the population level or targeted at the individual, that are aimed at eliminating or minimizing the impact of CVDs and their related disabilities. Guidance on weight management and physical activity are included as part of the lifestyle adjustments to maintain cardiovascular health.</p>	Joint Societies Guidelines ¹⁰⁶



RATE PER 100,000 PERSON YEARS



83%

CARDIO-METABOLIC ADMISSIONS IN YOUNG PEOPLE HAVE RISEN 83% IN JUST 6 YEARS

FIGURE 7

Hospital admission rates/100,000 for endocrine and circulatory disease conditions in public hospitals in the Australian Capital Territory.

Data shown are for the population aged < 25 years over the period 1st January 2007 to 31st December 2012. Original data provided by ACT Health on 26th February 2015.

TABLE 1 Evidence supporting the need for change in policy for children’s development, health and well-being (continued)

1.6 Effects of socioeconomic disadvantage and adverse childhood experiences (ACE)	
Findings	Evidence type
<p>This study presents findings from a systematic review and meta-analysis of studies measuring associations between multiple ACEs and health outcomes. Thirty-seven studies were included providing relative risk estimates (odds ratios, OR) for 23 health or mental health related outcomes. The research reviewed included a total of 253,719 participants. Individuals with at least four ACEs were at increased risk of all health outcomes compared with individuals with no ACEs.</p> <p>Associations were weak or modest for physical inactivity, overweight or obesity, and diabetes (ORs < 2); moderate for smoking, heavy alcohol use, poor self-rated health, cancer, heart disease, and respiratory disease (ORs 2–3), strong for sexual risk taking, mental ill health, and problematic alcohol use (ORs > 3 or ≤ 6), and strongest for problematic drug use and interpersonal and self-directed violence (ORs > 7).</p> <p>Interpretation: To have multiple ACEs is a major risk factor for many health conditions and a continuing threat to future generations. To improve public health there is a need to shift focus to include prevention of ACEs, resilience building, and ACE-informed service provision.</p>	Systematic Review ¹⁰⁷
<p>Kivimäki <i>et al.</i> carried out a nationwide population-based cohort study in Finland using data from The Young Finns Study, which included 3467 participants aged 6–18 years at baseline followed up for over 30 years via eight repeated biomedical examinations and linkage to electronic health records. High neighbourhood socioeconomic disadvantage was characterised by decreased fruit and vegetable intake as early as age 6 years; decreased physical activity, and increased prevalence of daily smoking from adolescence (12 years) onwards; and decreased insulin sensitivity and increased fasting glucose and insulin concentration from early adulthood (27 years). Individuals consistently exposed to high neighbourhood socioeconomic disadvantage were more likely to be obese (OR = 1.44), hypertensive (OR = 1.83), have a fatty liver (OR = 1.73), and diabetes (OR = 3.71), compared with those who were consistently exposed to low neighbourhood socioeconomic disadvantage.</p> <p>Interpretation: Living in socioeconomically disadvantaged areas can shape health in childhood and adulthood. Neighbourhood socioeconomic disadvantage is associated with differences in health risks across the life course, including detrimental lifestyle factors from childhood and adolescence onwards and worse glucose metabolism from early adulthood. By middle age, cumulative neighbourhood socioeconomic disadvantage is associated with increased cardio-metabolic risk factors and increased incidence of diabetes.</p>	Peer-review paper ¹⁰⁸
<p>This study by Lee <i>et al.</i> ¹⁰⁹ used survey data (n = 1054) from two waves of the Midlife in the U.S. Study (MIDUS 1 and 2) and biomarker data collected at MIDUS 2. Their results showed that individuals who were disadvantaged in early life are more likely to participate in physical activity related to work or chores, but less likely to participate in leisure-time physical activity, the domain most consistently linked with health benefits. Women from low SES families were exceedingly less likely to complete recommended amounts of physical activity through leisure. Men from low SES consumed more servings of unhealthy foods and fewer servings of healthy foods. The observed associations between childhood SES and health lifestyles in adulthood persisted even after controlling for adult SES. For men, lack of leisure-time physical activity and unhealthy food consumption largely explained the association between early-life disadvantage and the metabolic syndrome (MetS) — a combination of abdominal obesity, insulin resistance, dyslipidemia, and elevated blood pressure. For women, leisure time physical activity partially accounted for the association, with the direct effect of childhood SES remaining significant. Evidence that material deprivation in early life compromises metabolic health in adulthood calls for policy attention to improve economic conditions for disadvantaged families with young children where behavioural pathways (including gender differences therein) may be shaped. The findings also underscore the need to develop gender-specific interventions in adulthood.</p> <p>In a similar study from Japan, ¹¹⁰ Sagesaka <i>et al.</i> demonstrated that fasting plasma glucose was elevated at least 10 years before diagnosis of diabetes, and this was also the case in those who developed prediabetes. Glucose dysregulation precedes diagnosis of diabetes at least for 20 years.</p>	Peer-review papers ^{109,110}

TABLE 1 Evidence supporting the need for change in policy for children’s development, health and well-being (continued)

1.6 Effects of socioeconomic disadvantage and adverse childhood experiences (ACE)	
Findings	Evidence type
<p>The Australian Institute of Health and Welfare ¹¹¹ reported on the link between socioeconomic inequality and cardiovascular disease mortality and hospitalisations in 2006, highlighting that:</p> <ul style="list-style-type: none"> • In 2002, adults from the most disadvantaged areas of Australia had significantly higher death rates from cardiovascular disease (CVD), coronary heart disease (CHD) and stroke than adults from the least disadvantaged areas, between 1.6 and 1.9 times as high. • If everyone experienced the same death rates as those in the least disadvantaged areas, around 28% of deaths from CVD as a whole, 32% of deaths from CHD and 24% of deaths from stroke would have been avoided in 2002. This translates to over 3,400 CVD deaths, which includes 2,300 CHD deaths and 430 stroke deaths. Put another way, these excess deaths can be regarded as being due to socioeconomic inequality. • In 2003–04, adults living in the most disadvantaged areas of Australia also had significantly higher hospitalisation rates — a marker for more serious disease — for all CVD, as well as for CHD emergencies and stroke, compared with those living in the least disadvantaged areas. The comparison of the rates of the most and least disadvantaged areas — relative inequality measured as the rate ratio — ranged between 1.3 and 2.4. 	Institutional report ¹¹¹
<p>As noted earlier, ⁸⁸ Australia was ranked in the bottom 3rd of OECD nations (27 out of 35), p8 League Table 3, on inequality on the child wellbeing health domain.</p>	
<p>In 2008, WHO launched the final report of the Commission on Social Determinants of Health (CSDH) that concluded “social injustice is killing people on a grand scale”. ¹¹³ A commentary by Kumanan Rasanathan reports, disappointingly, that “Social injustice is still killing on a grand scale” ¹¹² and that the Commission has failed to realise the promise that was engendered at the time of its publication. He suggests the need for health equity advocates to revisit the CSDH analyses and recommendations, and act together to overcome the challenges and interests stacked against action on social determinants. Specific actions recommended were (comments in quotes added here for emphasis):</p> <ul style="list-style-type: none"> • Reconsider the language and framing of social determinants and develop simple messaging that resonates beyond public health and academic communities “Get out of our silos and into the real world” • Redirect energy from diagnosis and pathways towards designing, advocating, and testing solutions “Give the power to the people who matter” • Prioritise actions towards health equity, tailored to specific contexts, and consider sequencing of required actions to avoid charges of “selective social determinants” “On the basis of need, where it is needed” • Broaden the coalition for action by engaging with the wider health sector, including vertical programmes, and with other sectors on their own terms, framing interventions in terms of their language, targets, and interests and by linking with mature social justice movements globally and in countries to support advocacy for action on health equity “A stitch in time saves nine — problems fixed at source avert greater problems later” • Capitalise on the Sustainable Development Goals (SDG) platform for integrated action for development across sectors to embed work on social determinants and reconsider the global governance needed to support countries to do so, including funding support “A fairer, sustainable world to share”. 	Expert Comment ¹¹² World Health Organization Special Commission ¹¹³

1.7 Value of active travel/physical activity to developing children

Findings

Physical activity is vital to children's physical, social and emotional development. Average life expectancy at birth in Australia (as of 2015) is 82.45 years. Thus, early life opportunities provided to our children should allow them to develop: a heart and circulatory system; a muscular strength and neuromuscular control system; the skeletal structure and integrity; the social, emotional and mental capacities that will allow them to function well for at least that length of time.

Activities in the early years should focus on slowly developing the muscles, movement patterns, hand-eye coordination, throwing, catching and jumping skills that will be built upon in the later years.

With growth, maturation, and experience, basic movements are integrated and coordinated into more specialized and complex movement skills and behaviours that characterize free play, games, sports, and other activities of school-age youth either as individuals or as members of a team.

A seminal publication in 2005,¹¹⁴ reviewed the evidence on the effects of physical activity on health and behaviour outcomes and developed evidence-based recommendations for physical activity in school-age youth. The main effects highlighted in the context of this review are summarised below:

Percentage body fat: Regular moderate intensity physical activity of 30 to 60 minutes, 3 to 7 days per week leads to a reduction in total body and visceral fat in overweight children and adolescents.¹¹⁵⁻¹¹⁷

Cardio-metabolic risk factors: These have already been reviewed and updated in parts 1, 3 and 5 of this Table. Small beneficial effects on: blood lipids, blood pressure and cardiovascular fitness have been reported. Fitness improvements generally require vigorous activity for improvement (~ 80% of maximal heart rate) for >30 minutes at least 3 days per week. The expected benefit with systematic training averages approximately 10% or 3-4 ml/kg/min.

Mental health: Mental health effects in youth were limited to anxiety, depression, and self-concept — academic and non-academic, social and emotional, and physical (sport competence, strength or endurance, appearance). Weak to strong beneficial associations have been noted for both anxiety and depression, with higher quality research designs favouring the former i.e. weak as opposed to strong effects. Moderate to strong associations between physical activity and self-concept have been reported.

Musculoskeletal Health and Fitness: Longitudinal studies of adolescents indicate a positive influence of habitual physical activity on upper body muscular endurance. Experimental studies of resistance training 2 or 3 times per week (with at least a day of rest between training sessions) show improvements in muscular strength and endurance during childhood and adolescence. Most studies that have considered the effects of physical activity on bone health indicate a beneficial effect on skeletal health. The osteogenic influence of physical activity is generally site specific and related to local mechanical strains. The benefits are reflected in greater bone mineral content and greater bone mineral density.

The Expert Panel also made the following recommendations on the amount of physical activity that would be needed to obtain these benefits for children.

Recommendations:

- School-age youth should participate every day in 60 minutes or more of moderate to vigorous physical activity that is enjoyable and developmentally appropriate.
- Guided instruction and supervised practice, specifically by qualified teachers, coaches, and others who work with children, are important in learning movement skills. Types and contexts of activities are variable and change with age.
- For children and adolescents who have been physically inactive for a long period, an incremental approach to the 60-minute goal is recommended, say, adding ~10 minutes per week. Attempting to achieve too much too rapidly is often counterproductive and may lead to injury.

Evidence type

Expert Panel
Recommendations¹¹⁴
Peer-review papers¹¹⁵⁻¹¹⁷

This longitudinal study by Moore *et al.*¹¹⁸ adds strong support for the hypothesis that higher levels of physical activity during childhood lead to the acquisition of less body fat by the time of early adolescence.

Peer-review paper¹¹⁸

TABLE 1 Evidence supporting the need for change in policy for children’s development, health and well-being (continued)

1.7 Value of active travel/physical activity to developing children	
Findings	Evidence type
<p>A systematic review by Chillon <i>et al.</i>¹¹⁹ assessed 14 interventions designed to promote active transport to school. Ten of the interventions reported small to medium effect sizes (9 positive, 1 negative) and two reported large effect sizes. Effect sizes could not be calculated for the remaining two studies. The two intervention designs reporting large effect sizes are of particular interest. One¹²⁰ used essentially a walking school bus approach with interested parent volunteers supporting the initiative. It was a very small pilot study only so, perhaps, it is not surprising that a large effect size was observed. However, this approach is unlikely to be generalizable or scale-able across the whole community. On the other hand, the second intervention demonstrating a large effect size¹²¹ incorporated a number of attractive features that offer considerable promise with regard to generalizability and scale-ability.</p> <p>Firstly, active travel was integrated into the school curriculum and was delivered by the class teacher using resources developed by Sustrans (https://www.sustrans.org.uk/), a sustainable transport charity in the UK. This resource was designed to support teachers to deliver active travel projects through the primary/middle school curriculum across a variety of topic areas and to educate children about the importance of active travel to health. Secondly, participating families used pre-prepared ‘<i>children and family</i>’ resources that provided practical guidance on how to plan a safe active journey to school, including mapping safe routes and using familiar landmarks as navigation aids. Importantly, parent’s and children’s motivations for and barriers to using active travel to school were considered prior to running the intervention to assist with study design and the evaluation of effectiveness in terms of impact on “stage of behaviour change”.</p>	<p>Systematic Review¹¹⁹ Peer-review papers^{120,121}</p>
<p>Larouche <i>et al.</i>¹²² updated the review by Chillon <i>et al.</i> to include references up to October 2016. Twenty-seven articles reporting 30 interventions were reviewed. Thirteen interventions resulted in an increase in active school travel (AST), 8 found no change, 4 reported inconsistent results, and 5 did not report inferential statistics. The intervention reporting the largest effect size in this review, 0.75,¹²³ evaluated the impact of using drop-off zones within reasonable active travel distance of schools. This may be an attractive option in the ACT or Australian context, where distance of residence is often far from the school attended.</p> <p>Overall, these findings indicate modest support for the effectiveness of AST interventions but this mode of travel remains far from the norm choice in Australia.</p>	<p>Systematic Review¹²² Peer-review paper¹²³</p>

TABLE 2 Interventions to improve use of safe active travel to school

2.1 Stand alone events and competitions	
Findings	Evidence type
Significant increases are seen on the day of the event and remain higher than previous levels for a short period of time before falling off	Systematic Review ^{1,2} Peer review paper ³
Greater increases were seen in walking and riding to school when a walk and ride to school day was combined with another form of intervention, for example, an educational program	Systematic Review ¹ Peer review paper ⁴
Walk and ride to school days create excitement, raise awareness of the importance of active travel to school and improve parent's and children's motivation to use active travel to school. Even walking or riding to school just once has the ability to teach children important road safety skills	Peer review papers ^{3,4}
Weather can have a significant effect on the success of a walk and ride to school day. If the event happens to be held on a day and the weather is unfavourable there will be lower participation	Peer review papers ³⁻⁵
Offered incentives (retail vouchers, money for the school and charity donations) and use of swipe card technology (children scanned their card at electronic sensors along the route) to implement an international competition between schools in England and Canada. Using incentives improved the participation rates (95% participation) and new and interesting technology increased appeal	Peer review paper ⁶
There is conflicting evidence on the costs of these events to run and whether the costs outweigh the benefits. More research is needed to determine the costs of walk and ride to school days, as they can be resource intensive to run and appear to have limited long term return. On the other hand, there could also be direct savings to the health care system by reducing overweight and obesity if greater uptake of AST could be achieved	Peer review papers ^{4,7}
2.2 Walking school buses (WSB)	
Findings	Evidence type
Children and parents reported that they enjoyed travelling to school via a WSB, particularly due to the aspect of socialisation. WSBs improve social connectedness and build a sense of community	Institutional website ⁸ Review paper ⁹
Children who used a WSB stated that they enjoyed the interaction with the environment and being outdoors, which they are not exposed to when driven. Interaction with the environment is beneficial for both cognitive development and academic performance	Peer review paper ⁹
WSBs have many safety benefits. Parents know their children are with supervising adults and other children and so will get to school safely; children learn important and practical road safety skills while walking	Peer review papers ^{9,10}
Because children walk to school with an adult and are in a group, they do not need to focus on their surroundings as much as they would need to if travelling alone or with peers or siblings. They also do not need to make decisions about the route they take or road safety (for example when to cross the road). This can mimic car travel and does not improve children's independent mobility in the way that walking or riding to school without an adult does	Peer review paper ¹¹

TABLE 2 Interventions to improve use of safe active travel to school (continued)

2.3 Bicycle training programs	
Findings	Evidence type
Bicycle training programs make lessons exciting, which improves learning. Children's confidence and enjoyment of cycling increases and children want to cycle more as a result. Bicycle training programs can be integrated within the curriculum	Government of South Australia publication ¹²
Some children may not have access to a bicycle at home. Bicycle education programs give all children of all socioeconomic status the opportunity to learn how to ride a bicycle, and they teach important safety skills	Peer review papers ^{12,13}
Children who participated in a bicycle-training program increased their cycling skills and maintained these skills over a five-month follow up period	Peer review paper ¹⁵
While children's cycling skills improved significantly, levels of AST did not increase. This could be because this program only focused on basic cycling skills and did not cover road safety skills. The authors also suggest that because bicycle training programs are implemented during school hours there is insufficient parent involvement and the parents are the ones making the final decision on how their child/children travel to school	Peer review paper ¹⁴
There is a significant difference between improving cycling skills and changing cycling behaviour. Multiple strategies using multiple interventions including bicycle training programs may be needed to have a larger impact on changing cycling behaviour and attitudes. Bicycle education programs with a larger focus on AST and road safety skills could also improve their impact on children travelling by bicycle to school	Peer review papers ^{13,14}
Teachers really enjoyed teaching the Bicycle education program and reported that children thoroughly enjoyed the program	Peer review paper ¹²
2.4 School travel plans	
Findings	Evidence type
There are many factors that influence AST. Targeting multiple factors in an AST intervention will produce best results. Hinckson <i>et al.</i> ¹⁵ found that school travel plans were successful in New Zealand schools after three years of intervention and targeting multiple factors such as engineering, education, enforcement, encouragement, and policy strategies	Peer review paper ¹⁵
Implementing a school travel plan (or any intervention) for an extended period of time improves results. It takes time for people to change their travel behaviour and adopt new routines. It may also take time for an intervention to be fully implemented. For example, if changes to the built environment need to be made, this may take many months or years to complete	Peer review paper ¹⁵
Physical changes made to the built environment in and around the school improve perceived safety within the community and parents are more likely to let their children travel alone to and from school	Peer review paper ¹⁵
School travel plans use co-design, which means they consult the entire community (children, parents, teachers and the local community) on what should be included in the plan. Many parents reported that their involvement in the program meant they were more willing to participate and engage with the program. Parents also reported they drove less as a result of the program. School travel plans also give the wider community the opportunity to have their say, and extends the responsibility to the community to keep children safe while using AST	Peer review papers ^{15,16}
The resources and people needed to develop a school travel plan are quite significant despite the available resources. In a study ¹⁶ on school travel plans of 106 schools, 33 did not submit a school travel plan and 20 did not provide follow up data for various reasons. This suggests that schools may not have the time or resources to undertake such comprehensive school travel plans	Peer review paper ¹⁶
Some schools may be better suited to a school travel plan than others and individual plans can be difficult to evaluate or compare because they differ between locations	Peer review paper ¹⁶

COMMUNITY NAMED AND OWNED



COMMUNITY-DESIGNED AND TESTED SAFE ROUTES



Use natural features to way-mark routes



Community can create their own landmarks to navigate by

PROMOTING COMMUNITY AWARENESS



IMAGES © ROWAN MARSH-GROFT

FIGURE 8

Examples of outcomes from the co-design process with a primary school community.

Illustrations included here are: the identity chosen for the school community-owned project; an example of a natural feature re-designed by children to help them navigate their way from designated drop-off zones to and from their school; media used to promote the project in the local community.

TABLE 3 Resources to support road safety education and active travel to school

3.1 Effects of educational resources in schools	
Findings	Evidence type
Children who had received an educational intervention were less likely to be affected by a seasonal decrease in active school travel (AST) in the colder months compared to children at comparison schools	Peer review paper ¹
McMinn <i>et al.</i> ¹ found that children’s AST did not increase as a result of an educational program. They speculated that a reason for this might be the delivery of the program. As it was taught by the normal classroom teacher and not members of the research team, there may have been aspects of the program that were not delivered as intended	Peer review paper ¹
It is important to educate parents and the wider community as well as children. Parents, families and the community need to support the initiative and value their important contribution to its success. AST is influenced by home environment, parent attitudes and parents’ mode of transport. It can be a challenge for AST interventions to reach all parents and the wider community	Peer review papers ^{1,2}
After an educational program, children were more likely to change their commuting mode from car travel to walking or cycling. It also significantly improved children’s and parents’ knowledge of healthy behaviours. At six-month follow up, children were still participating in AST more than the control group ³ . AST was measured by student reported frequency out of 10 (to and from school 5 days a week = 10 trips) – this increased from around 4 trips per week pre-intervention to 6 trips per week at follow-up. The control group remained the same at 4 reported trips as the pre-week ²	Peer review papers ^{3,2}
School support for an educational program is crucial. The school and teachers need to value the program and realise its importance in children’s lives	Peer review papers ^{1,3}
Classroom lessons were more successful when accompanied with fun activities and games. This improves engagement and participation and increases learning	Peer review paper ²
There are many AST interventions that use education within their strategy but very few use it as the basis of their program/intervention	Systematic review ⁴
As mentioned earlier, changing travel behaviours and attitudes can take a prolonged period of time. Educational programs that run for significant periods of time (six-months or longer) have a greater potential to succeed	Peer review paper ⁵

3.2 Further benefits of active travel to school (education points for parents/schools)

Findings	Evidence type
<p>Active school travel has been shown to provide a number of important benefits to children's development. These are summarised briefly below together with the supporting evidence.</p> <p>Health</p> <ul style="list-style-type: none"> Increases physical activity levels ⁶⁻⁸ Improves: <ul style="list-style-type: none"> Cardiovascular health ^{9,10} Cardiorespiratory health ⁵ Musculoskeletal health ^{11,12} Body composition ¹³ Emotional and psychological health ¹⁴ Decreased risk of disease in adulthood ¹⁵ Increases children's independence and decision making ^{4,8,16} Less air pollution leads to less respiratory stress for conditions such as asthma ^{4,15} 	<p>Peer review papers ⁶⁻⁸</p> <p>Peer review papers ^{3,4,8-16}</p>
<p>Academic</p> <ul style="list-style-type: none"> Greater success in school ⁴ Students arrive alert and ready to learn ¹⁷ Complements curriculum ³ 	<p>Systematic review ⁴</p> <p>Institutional report ¹⁷</p> <p>Peer review paper ³</p>
<p>Safety</p> <ul style="list-style-type: none"> Improves safety for children ^{18,19} Increases traffic awareness and skills ³ Less traffic around the school during pick-up and drop-off times ¹⁹⁻²¹ 	<p>Peer review papers ^{18,19,3,19-21}</p>
<p>Environmental</p> <ul style="list-style-type: none"> Reduced noise and pollution ^{4,19} Reduced greenhouse gas emissions ^{9,15,10,21} Improves air quality ⁹ Reduces petrol consumption ¹⁹ 	<p>Systematic review ⁴</p> <p>Peer review paper ¹⁹</p> <p>Peer review papers ^{9,15,10,21,19}</p>
<p>Community</p> <ul style="list-style-type: none"> New or stronger relationships ⁹ Greater sense of community and belonging ⁹ Children get to know more about their neighbourhood ⁸ 	<p>Peer review papers ^{9,8}</p>

TABLE 3 Resources to support road safety education and active travel to school (continued)

3.3 Making way for active children – infrastructure, programs and policies to increase active travel to school	
Findings	Evidence type
<p>A comprehensive approach has a much greater impact on walking and cycling levels than even several individual measures that are not coordinated.²² An international review by Pucher <i>et al</i> concluded that substantial increases in bicycling require an integrated package of many different, complementary interventions, including infrastructure provision and pro-bicycle programs, supportive land use planning and restrictions on car use.</p>	<p>Peer review paper²² International review²³</p>
<p>The modal share of daily trips by walking and cycling varies greatly from country to country. In car-dominated countries such as Australia and the US, walking and cycling trips make up only around 1 in 10 of all trips whereas in the Netherlands the proportion of such trips is greater than 50%.²⁴ Active travel, particularly walking, has declined steadily in most nations except the Netherlands and Denmark, where it has remained relatively stable, at about 64% of trips for young people (aged 0–17) in the Netherlands and 51% for 10–19 year olds in Denmark.²⁴ Importantly, walking and cycling injuries and fatalities were much less in Denmark and the Netherlands than in comparator countries (Germany, UK, US) despite the increased proportion of trips using these active modes. The successful promotion of active travel in some northern European cities has been attributed to the introduction of a well-planned and fully integrated package of policies and local measures including: prioritising walking and cycling, particularly at busy intersections or ‘pedestrian priority’ zones; traffic calming and traffic separation; integration with transit; compact development (as opposed to the urban sprawl policies of the late 20th century); driver training, road safety education and training (especially for children and parents) and regulation; complementary pro-active travel policies such as restricted parking, higher registration and licensing fees and fuel pricing; establishing a culture of active travel.^{23,24}</p>	<p>Transport Research Body Publication²⁴</p>
<p>The US Community Preventive Services Task Force published a summary of the findings from a systematic review of interventions to promote active travel to school. The review concluded that interventions can facilitate ATS by targeting the physical or social safety of common routes to school or by promoting safe pedestrian behaviours. Similar recommendations about good planning and well-integrated, individual locality appropriate, policies and measures were made i.e. interventions must include one or more of the following components (the 6 Es):</p> <ul style="list-style-type: none"> • Engineering — operational and physical improvements to the built environment infrastructure • Education — materials and activities to teach the importance of active transportation; walking and cycling safety training sessions • Encouragement — events and activities to promote active transportation • Enforcement — partnerships with local law enforcement to ensure traffic laws are obeyed in school neighbourhoods; crossing guard programs • Evaluation — data collection and program monitoring to inform future intervention components • Equity — efforts to ensure that intervention components reach everyone within a school community and address potential barriers to participation for certain groups (e.g., low-income, people from different ethnic groups).²⁵ 	<p>Systematic review²⁵</p>

3.4 Examples of educational resources to support road safety education and behaviour development in children

Findings	Evidence type
<p>There is an almost overwhelming amount of well-produced material to support road safety education and safe active travel behaviour development in children. We are able only to include a representative sample in this review. Most of this material has had little or no impact in shifting physical activity norms in Australia, especially the use of active travel to and from school. For example, the Active Healthy Kids Progress Report Card for 2015 on Active Transport for Children and Young People²⁶ graded Active Transport as C, about 50% of children using active transport at least once per week or D, 21–40% using active transport on most days i.e. as the norm behaviour. The equivalent rating for the Netherlands in 2016 was A, 81–100% using active transport on 3 or more days/week.²⁷ Both countries, however, were graded D, 21–40% of children, with regard to meeting the recommended amount of physical activity for children of 60 minutes daily, indicating a need to promote daily physical activity for children more widely.</p>	<p>National Report Card for Physical Activity for Children and Youth. Australia²⁶, Netherlands²⁷</p>
<p>The National Report Card for Physical Activity for Children and Youth — Australia for 2015²⁶ also contains a useful overview summary of the approaches adopted to support active travel to school in Australia's eight States and Territories. Collectively these embody many of the components that are required to reset social norms for active travel for school children (see Table 3.3). Individually, however, they all fall short of being able to achieve significant sustained change in population levels of active travel for children within their own jurisdictions. In general, four of the 6 Es — Engineering (shaping the built environment for purpose), Education, Encouragement and Enforcement — are addressed at least partially. These could be strengthened by combining initiatives across jurisdictions. Two of the 6Es — Evaluation and Equity — are addressed poorly or not at all. We believe that a further E — Enabling — needs to be added to the essential components for success.</p> <p>Current neighbourhood environments are designed to support fast easy transit by car. Traffic lights are phased to support this at the expense and increased risk at peak times to all other modes of transport. There is no doubt, from traffic accident data, that busy intersections are dangerous places and not suitable for children, as a rule, to negotiate. Thus, until this status quo changes many parents, if not most parents, will be unwilling to allow their children to walk, bike or scooter to and from school on their own or with their peers or siblings. This is where the 7th E — Enabling comes in. There is a need to engage with children and their parents, involve them in the co-design of the solution/s if you like, to enable changes to school environments to make safe active travel at least part of the way to and from school the mode of choice.</p> <p>It is well established that physical activity is vital to children's physical, social and emotional development. The established international guideline is that children should undertake a minimum of 60 minutes of moderate physical activity daily²⁸, preferably socially mixed, to achieve optimum development. The task for society, then, should be to provide children with opportunities in their daily lives that allow this recommendation to be attained by all children, should they choose to do so. Active travel to and from school, assuming safe, enjoyable conditions can be achieved, could provide approximately half of this daily amount at little added cost to society. As discussed earlier (Table 1.4) better policy through co-investment in education and health alongside co-design with the rest of the community could reap a high return for Australia's future.</p>	<p>National Report Card for Physical Activity for Children and Youth. Australia²⁶</p> <p>Expert Panel Recommendations²⁸</p> <p>Review^{29,30}</p> <p>Lancet Commission³¹</p>

TABLE 3 Resources to support road safety education and active travel to school (continued)

3.4 Examples of educational resources to support road safety education and behaviour development in children	
Findings	Evidence type
<p>In reviewing resources to support safe active school travel in an Australian context, two initiatives are worthy of special mention as exemplars that provide a good basis that others could follow, each covering complementary aspects of the overall challenge. First, we highlight the Darwin Safe Active Routes to School Toolkit developed by the City of Darwin, Northern Territory (NT). This resource is a good example of a coordinated collective planning approach to support active school travel. A key principle in developing the toolkit was that each individual school community travel plan should be owned by the school and its local community, with a clear understanding of the importance of safe active travel to children and to the school environment and culture. Key partners in the community and within different areas of government are then identified to play their part in delivering the plan. The Toolkit resource is structured into clear sections that facilitate role identification and action planning:</p> <ul style="list-style-type: none"> • Governance — identify champions and roles • Catchment — get to know the school and its neighbourhood • Activities — get the right people involved and design activities that best fit the school’s resources and target specific issues • Travel plan — assess current travel patterns, develop objectives and future actions to achieve travel change • Local environment — take action to make the changes needed in the local environment to support the Travel Plan. <p>In the NT, the active travel participation rate for all children is around 50%, which is above the national average for Australia.²⁶</p> <p>The second initiative we highlight is the <i>Kids on the Move: primary school road safety education resources</i> developed by VicRoads, Victorian Transport Services.³³ This is essentially an educational resource providing core road safety education materials for primary schools. The resources are aligned with the Victorian primary school educational curriculum and focus on children at levels Prep to 2, when children are starting school and establishing learning patterns, and at levels 3 to 6, when children are becoming more independent and beginning their transition to secondary school. The resources are available at the Transport Accident Commission website.³⁴ Conceptually this approach is a good idea but fails to deliver significant change to behaviour for four main reasons: 1) it is not owned by and driven by the school community, 2) it focuses on safety education only, giving insufficient attention to the reasons why active travel is important to children’s development, 3) it does not include adequate consideration of the practice activities (and resource) that would be needed to establish the change behaviours and, perhaps most important of all, 4) there is competition for curriculum space with the established role of primary education to deliver numeracy and literacy subjects. In addition, it is fundamentally a reactive response to the car-dominated status quo rather than a proactive response to what is needed in the best interests of children, families and school communities.</p> <p>Despite the limitations discussed here, we believe that the further development of these two approaches in combination has the potential to reset behavioural norms that have proven difficult to change for decades.</p>	<p>City of Darwin Community Services³² Victorian Transport Services³³ Transport Accident Commission, Victoria³⁴</p>

3.4 Examples of educational resources to support road safety education and behaviour development in children

Findings	Evidence type
<p>Looking at initiatives to support active travel in other countries, we highlight four examples that appear promising and contain aspects that might be of value in the Australian context. The Ontario, Canada, Active School Travel program operated by Green Communities Canada, Peterborough, ON offers an online <i>School Travel Planning Toolkit</i>³⁵ that is supported by an online <i>Steps to Success</i> resource³⁶ built around the 5Es — Education, Encouragement, Engineering, Enforcement and Evaluation. This resource contains a wide range of accessible walking and cycling education materials, lesson plans for teachers and promotional activities for communities.</p>	<p><i>School Travel Planning Toolkit</i>³⁵ <i>Steps to success</i>³⁶ New Zealand Transport Agency Education Portal³⁷</p>
<p>The New Zealand Transport Agency, based in Wellington, offers an online Primary Education portal³⁷ that provides a road and rail safety education website for teachers and also contains resources to help teachers with students in Years 1–8 to plan teaching and learning aligned to the New Zealand Curriculum.³⁸ The latter includes examples of lesson plans containing learning materials and activities across the whole curriculum. Children undertaking these lessons should be well educated about the individual, social and environmental value of active travel as well as understanding how to negotiate their environments safely.</p>	<p><i>Feet First</i> primary education resources³⁸ Sustrans, UK Active School Travel resources^{39,40}</p>
<p>In the UK, the situation with regard to promoting active travel to school is similar to that in Australia. There are lots of examples of good local initiatives but overall effectiveness in increasing the proportion of children using active travel to school has been limited. That said, Sustrans (https://www.sustrans.org.uk/our-services/case-studies/active-travel-school), a sustainable transport charity that has been operating in the UK for over 40 years, has achieved a number of significant changes to walking and cycling infrastructure and has partnered with many school communities across the UK to develop and deliver local success stories and educational resources to promote active school travel.^{39,40} The Sustrans approach of lobbying Government on the need for change and working directly with communities to deliver that change has turned what looked a gloomy prospect in the late 1970s when they began their work into a future with a much brighter outlook.</p>	<p>SafeRoutes: National Center for Safe Routes to School⁴¹ <i>Vision Zero for Youth</i> initiative⁴² Safe routes to school data system website⁴³</p>
<p>In the US, the major support for active school travel is coordinated through the National Center for Safe Routes to School⁴¹, based at the Highway Safety Research Center, University of North Carolina (http://www.saferoutesinfo.org/). This initiative is in the early stages of its role as the National Center (since 2016) and has evolved from a former function as the Federal Highway Administration's Safe Routes to School Clearinghouse. The primary driver for this initiative has been to reduce the high level of injuries and fatalities on US roads, in particular the <i>Vision Zero for Youth</i> initiative⁴² (http://visionzeroforyouth.org/), but it is beginning to function as a lead national body for safe travel to school, linking more effectively with other bodies across the US that cover other aspects of promoting active travel to school. We highlight this initiative here not because of its demonstrable success in achieving a significant upturn in the proportion of children using active travel to school (which has gone from ~14% to ~17% in the period of its tenure as the National Clearinghouse between 2007 and 2016) but because this move at the national level offers a number of attractive features that should be worth considering across Australia. Firstly, the Safe Routes to School program attracts considerable Federal funding. Secondly, a nationally standardized means of gathering, benchmarking and evaluating safe travel to school practice, trends and analysis of program reach has been developed.⁴³ Thirdly, better coordination and collaboration between people and organisations with the requisite skills should lead to more effective and equitable targeting of the funding available.</p>	

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PART 1

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