

Physical activity measures for children and adolescents – recommendations on population surveillance: a rapid review

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EXECUTIVE SUMMARY

The measurement of physical activity among children and adolescents in populations is a challenging task made more complex because the measures or modes of administration might be different for children of different ages. This review focused on identifying measures used in surveillance in Australian jurisdictions, with the purpose of identifying those that could be used to meet the surveillance needs of the National Prevention Partnership Agreements. The specific performance benchmark required is to assess the proportion of children 5–17 years that meet the current recommended levels of physical activity [“participate in at least 60 minutes daily of moderate-vigorous physical activity”] and secondarily meet the electronic media use guideline¹ [“watch less than 2 hours of non-educational screen time daily”].

The format of this review was to identify the parameters of measurement of children’s physical activity in populations, review the existing surveillance measures used in Australian jurisdictions, and make specific recommendations for surveillance tasks that allow a baseline estimate close to 2009, and allow for follow up surveillance in 2013–2014 surveys, against which change in the performance benchmark can be assessed. The review of measures identified categories of assessing physical activity, including objective assessment, self-report measures, diaries or inventories of activity and proxy report [reported by parents, carers or teachers for younger children]. Of these, objective measures are most accurate, with population data available using pedometers [step counters] from several jurisdictions, and internationally, population data are available using accelerometers which are a more accurate objective assessment.

Self-report measures vary in length and mode of administration but most have similar reliability and validity properties. Diaries are reliable records of for example the previous day’s activity but may not be suitable for 7 day recording for assessing the recommended physical activity levels for children. Parental proxy are useful for children aged less than 11 years and show acceptable measurement properties; these should be similar to the self-completed measures used for older children and ideally combined with objective assessment in subsamples.

There are a diverse set of current surveillance instruments and methods used for surveillance across all Australian jurisdictions; these are discussed in detail, and the differences in prevalence in the recommended levels of physical activity compared. Two new national surveys are also discussed, and their approach to surveillance identified.

This information is integrated into final conclusions that provide specific recommendations to achieving the surveillance tasks necessary for the Prevention Partnership Agreements. A three-tiered approach is proposed, with a ‘common core’ short physical activity question where most jurisdictions have baseline data close to 2009. This short measure can provide information on the ‘performance benchmark’ prevalence. The measure is currently in self-completed mode and should be developed further for parental proxy use. Then the current longer measures unique to different jurisdictions may well be continued in their own surveillance systems, but the retention of this core short question is recommended for surveillance at jurisdictional levels to the 2013–2015 data collections to assess change in the performance benchmark indicator. Additionally a short screen time question is also recommended for both baseline and follow up surveillance. The addition of subsample objective measurement is strongly recommended; this will increase the

¹This is an important contributor to overall ‘sedentary behaviour’, but is strictly only the electronic media consumption part of children’s total sedentary time. [see Adolescent Sedentary Activity Questionnaire (ASAQ) Hardy, Booth et al 2007]

scientific validity and corroborate any observed changes in the self-completed or parental proxy short measure performance benchmark. This three-tiered approach is feasible, achievable where jurisdictions have the short question data, and are prepared to monitor it to 2013–2015 in order to report trend data against the benchmark '*proportion of children aged 5–17 years achieving at least 60 minutes of moderate-vigorous physical activity daily*'.

Overview

This document reviews physical activity (PA) measurement among children and adolescents for the purpose of population surveillance. For this report PA measures used in interventions or in correlate studies are not considered unless they have the potential for use in large-scale behavioural surveillance at the state or national level.

The need to identify and utilise comparable measures of children and adolescent's PA for surveillance was established through discussions in the Population Health Information Measurement Group, and its successor committees including the National Health Information and Statistics Committee and PHDIG. This issue has been of concern to the Computer Assisted Telephone Interviews (CATI) [population surveillance] measurement and surveillance working groups across the Australian state and territory jurisdictions for some time. These groups noted the lack of identifiable standard questions regarding PA measurement among children and adolescents aged 5–17 years. Previous children's PA measures have relied on different questions and modes of data collection, so that the determination of children's PA levels remained a challenging area for surveillance.

This review therefore addresses the need identified through the Prevention Partnership discussions on achieving specific improvements in preventable risk factors. Performance indicators were established for child and adult healthy weight, nutrition, PA and tobacco use. As part of this agreement jurisdictions will be funded in response to achieving specific performance benchmarks or targets which are the established public health guidelines in these areas. For example, the public health guideline for PA among children and adolescents in Australia is "the proportion participating in at least 60 minutes of moderate-vigorous physical activity" every day. The Prevention Partnership defined benchmarks are to increase this in each state/territory from 2009 levels, by 5% by 2014 and 15% by 2015.

Since no standardised benchmark questions exist for use in current and future CATI and related surveillance systems in 2009, or for future use in 2013 and 2014/2015, this review examines existing surveillance practice with respect to children and adolescent's PA, in order to move forward the surveillance tasks of achieving the Prevention Partnership goals.

The purposes of this report are defined by the following specific questions:

1. To review the principles of measurement, appropriateness, reliability and validity of measures of child and adolescent physical activity
2. To review the literature on the appropriateness, reliability and validity of proxy [parent, carer, or other person derived] measures of child and adolescent physical activity
3. Perform a review of the current physical activity measures used for self-report surveillance across jurisdictions in Australia, to identify what indicators can be extracted from existing data to provide a baseline rate of child and adolescent physical activity for each jurisdiction, and to identify which are the most accurate indicators that could be extracted for 2013 and 2014
4. To suggest ways in which these indicators might be readily augmented to provide a more accurate baseline estimate of physical activity
5. Based on the evidence about measures of children and adolescent's physical activity, provide expert opinion on the most accurate measure of children and adolescent's physical activity or a proxy measure that may be available for future data collections [what measure is recommended for future use in surveillance?], and what are the

6. recommended indicators that could be extracted from existing and planned data collections in 2013–2015?
7. What overall recommendation can be made about the accuracy of existing measures for children and adolescent's physical activity rates? What would be recommended to be included in current data collection exercises or would be recommended for any new specific-purpose surveys?

There is some overlap among these questions, but in the report details that follow, they will be referred to as 'Review Question 1', 'Review Question 2' etc.

The sections of this report are developed into a logical sequence for discussion of children and adolescent's physical activity measurement, and a focus on the surveillance 'review questions' above will be the primary orientation. The report is divided into the following sections: [a] Review of PA measurement, [b] Methods of measuring PA among children and adolescents, [c] Current PA measures for surveillance across jurisdictions in Australia in meeting the performance benchmark, [d] Providing suggestions for optimising data collection for surveillance to meet the performance benchmarks.

Section A: The principles of physical activity measurement among children and adolescents, relevant to population surveillance

Physical activity measurement in children and adolescents

At the population level, accurate physical activity (PA) measurement is important to monitor trends in PA over time and assess improvement or deterioration in population PA levels (Bauman, Phongsavan et al. 2006). This is the same need that jurisdictions require for meeting their defined performance benchmarks, and this requires identification of reliable and valid measures of PA (and of the domains, contexts, frequency/intensity/volume) that are needed to assess total PA levels. Particularly for children and adolescents, the additional issues of measurement appropriateness, feasibility and respondent burden are important measurement attributes to consider. The target age range for this performance benchmark report is changes among 5–17 year old children and adolescents. This extends beyond the measurement of PA in infancy and early childhood, but several principles of PA measurement in the early years are relevant to the first few years of primary school. ²

Principles of surveillance of physical activity in childhood and adolescence

Any surveillance measure for children should have known measurement properties [reliability, validity, and responsiveness (Nutbeam and Bauman 2006)] should be simple, feasible and affordable to implement with large representative samples, and should pose an acceptable respondent burden. The challenge for PA measurement for children is that there is no clear consensus on the domains or contexts for PA to be assessed. ³

Rather than a review of PA measurement simply extracted from the literature, key issues were identified for the purposes of improving surveillance, and are discussed below:

- The focus of measurement is on public health surveillance systems, not on measures used in interventions, clinical studies or correlates studies. Surveillance systems imply large representative samples, serial (repeat) surveys at defined intervals, and measures that can classify individuals into meeting PA recommended levels.
- For Australian children and adolescents, there are specific PA guidelines, established as population-specific recommended levels of PA (Department of Health and Ageing (DOHA) 2004; DOHA 2004)
 - i. For 5–18 year olds ⁴:
 - At least 60 minutes of moderate-vigorous PA each day

² Pre schoolers – assessing physical activity – a short note: PA in pre-school age children (ages 2–5 years) is beyond the scope of the age range in this review, but is instructive because the choice of measures includes parental report (proxy measures), objective measures, or direct observation. These measures have been systematically reviewed [Lewicka & Farrell 2007], and are later discussed under parental proxy assessment.

³ For example, leisure time sport and recreation; domestic domain; active transport [active travel] domain; and the school setting [that includes class and curriculum time, but also may provide opportunities before and after school]. In addition, a recent research development focuses on not only on summing across all domains to assess ‘total physical activity’, but also measures sedentary behaviour in the various settings where it occurs [school; home based TV, internet, other screen time, other sedentary time; total sitting time].

⁴ For younger children 2–5 years, the recommendation is 1 hour /day of television, and 3 hours of active movement, with ideally, no more than an hour of continuous sitting through the day.

- <2 hours of electronic media [television and screen time] per day for entertainment.⁵

As mentioned, the Prevention Partnership Agreement indicator is the proportion of children meeting the recommended '60 minutes of at least moderate-vigorous intensity PA' every day', from a baseline around 2009 for each state, and to increase by 5% by 2014; and by 15% by 2015.

⁵ Note this latter measure of 'less than 2 hours of screen time' for younger children assesses one indicator of sedentary time; the challenge is that the epidemiological evidence does not yet clearly identify the relationships between inactivity and health among young people, apart from obesity, where screen time shows a clear and consistent cross sectional and longitudinal relationship to obesogenesis [Hardy L et al 2007].

Section B: Measuring physical activity among children and adolescents

Identifying the parameters for measurement of physical activity

The range of domains and settings where PA might be measured needs to be considered in any surveillance system. For the purposes of this report, the central indicator for performance benchmarking is the 60 minutes per day recommendation, and other measures, of sedentary behaviour, and of the sub-domains and settings for PA are of subsidiary importance. Measures of the '60 minutes per day' indicator could be assembled through:

- Measurements of all domains – estimates of 'total PA' (of relevance to energy expenditure, and as part of obesity prevention); this could apply to detailed and intensive PA measures, that asked about each domain separately, including sport and recreation/play for children, active travel and active chores and tasks at home
- Measures confined to leisure time physical activity [LTPA], which could include recreation and sport participation (further categorised into organised or non-organised settings); this comprises a large part of the total PA among children, and has been suggested as an indicator to monitor of the recommended level
- Other domains contribute less to the total PA, and hence to the achievement of the indicator. These include the transport domain (active commuting, particularly to/from school by walking or cycling), domestic active chores or walking the dog; PA during school time (include PE classes, activity in recess and lunch breaks), PA in the before and after school periods (for example, at "after school programs")
- Other measures that apply to only a few in the 5–17 age group include PA through part time work (for adolescents) such as paper delivery, part-time jobs
- Measures of inactivity, sedentary time, school sitting time, other educational (non-recreational) screen time, homework time, and non-educational sedentary sitting time (screen time, other inactive recreations). These measures may be useful for the secondary performance indicator, "achieving less than 2 hours of non-educational screen time daily".

Methods of measuring physical activity in children and adolescents

Objective measures

Objective measures provide a direct and objective method of assessing PA, which is usually highly reproducible, and attempts to provide a valid representation of PA. These kinds of objective measurement include doubly-labelled water (criterion method for assessing energy expenditure, but very expensive); indirect calorimetry (measuring EE from oxygen consumption and CO₂ production), and heart rate (HR) monitoring (and HR response to activity assessment). These objective measures are beyond the scope of this review (see Sirard and Pate 2001; Trost 2007). Validation studies are shown in more detail in Appendix 1, but are beyond the scope of this report.

Of more relevance to population surveillance is the use of motion sensors. There are two types in use for PA surveillance among children, adolescents and adults:

- Accelerometers (measure all movement in defined planes, report data as activity counts per unit of time), provide valid and reliable measures of walking, running but less reliable

- for cycling and some sports. Accelerometers are superior to pedometers, as they provide more accurate and detailed PA as well as sedentary time data. These are expensive (approximately \$400 per unit), but they have been used as an objective measure of movement in large scale population PA surveillance of children and adolescents in the USA, UK and Sweden
- Pedometers are small devices worn on the hip that measure total steps per day, as an estimate of total PA. These have been used for annual school-based population national surveillance in Canada through the CAN PLAY Project, [Craig et al. 2010]⁶ and population samples of adolescents have provided pedometer data in some Australian jurisdictions (Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) 2008 study in Western Australia (WA); Healthy Kids Queensland 2006, and subsamples of the 2007 National Physical Activity and Nutrition Survey) using reliable pedometers.

Direct observation of physical activity is used in specific settings where patterns, types and intensity of PA are directly observed and coded for defined and generally short periods of time (Dollman, Okely et al. 2009). These measures show good validity but are limited to observations in discrete settings (such as observing a playground, SOPLAY; McKenzie, Marshall et al. 2000) or for defined periods (e.g. A PE lesson, sports training or Active After School period in an Active After School Program), rather than population surveillance (Dollman, Okely et al. 2009). They are beyond the scope of the measurement needs in this report (see Appendix 1).

Self-report (subjective) methods of physical activity measurement

Self-report is the cornerstone of surveillance for measuring this performance benchmark. There are four categories of subjective measurements for use in populations. The categories of self-report measures include:

- i. Self-report (self-completed) questionnaires
- ii. Interviewer administered (face to face, via telephone)
- iii. Diaries, PA logs (recording of all activities)
- iv. Proxy reports of PA among (younger – i.e. < 10/11 years old) children by parents, carers or teachers.

[i]. **Self-report physical activity measures** are widely used in population surveillance of children and adolescents. They vary in the length of the instrument, and in the domains of PA covered. There are many examples of recall and self-report PA instruments for children and adolescents, some of which are regularly used for surveillance. These vary by length (from 1–2 questions through to detailed inventories). A detailed listing of instruments is provided in Table 1 below, with population estimates of meeting the PA and sedentary guidelines shown for each jurisdiction. There is additional information and examples of actual questions asked are presented in the appendices. Candidate self-report instruments that have acceptable to good reliability and validity and could be considered for meeting this performance benchmark include:

- Very short self-complete instruments, such as the European-wide surveillance tool [Health Behaviour in School Children (HBSC)] which comprises two PA questions [that has been compared in Australia to the Australian Physical Activity Recall Questionnaire (APARQ); Booth et al. 2001]. The more recent single item new HBSC question also has acceptable

⁶ The CAN PLAY project identified ambitious step-count targets for Canadian children, as well as the self-report indicators of the recommended levels of PA. The pedometer guidelines were high in Canada [around 15-16,000 steps per day were recommended, and the prevalence of sufficiently active, based on step counts was around 10-12% of students, which was much lower than the 40-50% meeting the 60 minute guideline in self-reported questionnaires (see Craig CL et al 2010).

- measurement properties, and has been used in the Australian ASSAD surveys [see details in Table 1].⁷
- Other more lengthy and detailed measures of self-report PA include :
 - The Australian Physical Activity Recall Questionnaire (APARQ), which asks separately by season, focusing on sport and recreational activity [Table 1]
 - The Youth Risk Behaviour survey, a school based survey series across the USA, asked about the past week PA; established reliability (Brener, Kann et al. 2002; Troped, Wiecha et al. 2007)
 - The HBSC measures [see above, asked in the ASSAD survey, Table 1]
 - The Children's Leisure Activity Study (CLASS) measure asking about a typical week, showed acceptable reliability and validity (Telford, Salmon et al. 2004), in both self-complete and proxy parent formats; mostly used in intervention studies, but adapted in CAPANS in WA [Table 1].

Self-completed [self-report] questionnaires require consideration of several important principles and challenges among children aged 5–17 years:

- Children under 10 or 11 years do not reliably recall PA behaviours (Trost et al. 2000), and self-report of all forms should not be used for children under 10 or 11 years (Baranowski et al. 1984; Trost 2000).⁸
- The shorter the time period (1 day recall), the better the reliability and validity of measurement compared to longer periods recalled (7 day recall, 1 month recall).
- Reliability and validity of reported PA increases through adolescence, with 15–17 year olds reporting PA more accurately than younger adolescents (Trost 2007).
- Length and complexity of the activity behaviours recalled will vary by age, language proficiency and questionnaire familiarity.

[ii]. Interviewer administered questions are less often used for PA surveillance among children, except for household based Australian Bureau of Statistics (ABS) surveys. However, the method of measurement is usually parental proxy discussed below. Since there is limited experience with direct interviewer administered interview PA measures of children, these approaches have little relevance to collecting the performance benchmark data for the Prevention Partnerships.

[iii]. Physical activity diaries are self-completed records of a recalled time period (usually the previous day) where the adolescent records their specific behaviour (in terms of pre-defined categories, and for designed time segments, such as every 15 minutes); these include measures such as the PDPAR (previous day PA recall) which is reliable and valid (Trost 2007) It is mostly used with older adolescents in the USA, so is not considered further in this review.

An Australian example is the Multimedia Activity Recall for Children and Adolescents (MARCA) measure, a one day diary recording of PA that was used in the 2007 National Physical Activity

⁷ The indicator 'achieving 60 minutes per day', has been expressed as a single reliable self-complete survey question – see Prochaska JJ et al 2001, in both self-complete and parental proxy modes; or the current HBSC PA self-complete question [www.hbsc.org], now used for adolescent surveillance for school students aged 11 years and older in 40 countries in European region; the HBSC 2006 PA question was asked as one of two variants: "Over the past 7 days [or in a usual week], on how many days were you physically active for a total of at least 60 minutes per day?"

⁸ There are different views on whether the lower age range for cognitive comparability among children occurs such that self-report can be reliably used; many researchers suggest 10 years as a lower limit, and some suggest 11 years as the lowest age group for self-completion questionnaires

and Nutrition Survey (Ridley, Olds et al. 2006; Kids Eat, Kids Play survey 2007). This measure is a one-day recalled instrument; it has good reliability and validity, but because it is only a one day recall, it cannot be easily adapted to assess the habitual 'daily' part of the 60 minutes recommendation, without the burdensome task of seven daily MARCA records being collected. Although useful to characterise populations, these diary recall based measures may not be suitable for collecting data against the 'daily 60 minutes' recommendation, as the information of the previous day may not be typical of the pattern of behaviour for that individual child.

[iv]. **Proxy measures** are used for children aged 10 years or less, where self-report may be inaccurate and unreliable. Proxy measures included parental reports of their children's overall PA or occasionally using teacher's report of children's activity during school time. These measures are most accurate for capturing structured or organised PA participation (for example, in a sporting team a PE class, a structured program or other organised setting based PA). These proxy reports are less useful at capturing the continuous moment to moment unstructured activities of children, including unstructured play, sudden short periods of high activity or other incidental movement.

Reviews recommend proxy measures (parent or teacher) as appropriate for use in large population samples, particularly with younger children, provided the instruments have acceptable measurement properties. A study from Canada showed grade 5 parents had moderate agreement with their children's reported PA (Sithole and Veugelers 2008). Purslow et al. 2009 used 428 twin children participating in a longitudinal study in the UK, and showed significant correlations between maternal rating of their child's PA with other children of the same age on a 5 point scale, and with accelerometry. The Australian CLASS measure has good measurement properties in proxy parental reports of PA among 5–6 year old children (Telford, Salmon et al. 2004).

The Sirard and Pate (2001) review concluded that proxy reports might be "suitable for studies involving large populations of young children as it circumvents recall errors due to younger children's cognitive abilities, provided valid and reliable instruments are developed". A more recent review recommended that proxy measures of children's PA are "suitable for use in large population samples", low in cost and relatively easy to administer (Dollman, Okely et al. 2009).

There are some Australian surveys where proxy measures have been used for assessing primary school-aged children's PA, using the similar measures to the self-report instruments, but adapted for proxy administration [Table 1, NSW Child health surveys; Victorian Child Health surveys; Healthy Kids Queensland; South Australian Child Health surveillance system; Tasmanian Child Health survey]. Proxy methods are also used in the Sport and Recreation sector surveys and in ABS Surveys via household interviews in the National Health and other ABS Surveys.

In conclusion, there are few studies that have examined the reliability and validity of proxy reporting methods. Studies have used small samples, and reported a mixed range of associations with HR, accelerometers or directly observed behaviour (Sirard and Pate 2001). However, the potential for proxy assessment is often quoted (Sirard and Pate 2001; Hussey, Bell et al. 2007), and has a reasonable evidence base from the studies conducted. As these are likely to be superior to the (poor) self-recalled measurement among younger children, it is reasonable to recommend them for PA surveillance for children <10 years old, and they could be used to assess the performance benchmark.

Section C: Current physical activity surveillance measures for children and adolescents used in Australia

This section reviews measures identified in Australian population surveillance studies that measured childhood PA. These are shown in Table 1, and the major state and national surveys are included. For each survey, the jurisdiction is identified, the survey methods used and age group assessed and the PA measurement methods. Finally [in the far right hand column], the proportion meeting the 60 minutes 'recommended' level of daily PA is shown. These data in the table are all population estimates derived from large, representative samples.⁹ For most surveys, boys were more likely to meet the PA recommended level than girls, and rates of reported PA declined through secondary school.

The sedentary area is asked using questions regarding screen time, ranging from single item questions through to more detailed instrument such as the Adolescent Sedentary Activity Questionnaire (ASAQ), a validated inventory of sedentary behaviour questions across weekdays and weekends (Hardy, Booth et al. 2007). It is recommended as a longer measure of sedentary behaviours. A short version of this question is asked in the NSW School Students Health Behaviours Survey SSHBS [Table 1]¹⁰; this can be used to ascertain the prevalence of the 'less than 2 hours per day' recommended indicator of screen time.

The estimates in Table 1 and Figure 1 were derived from as systematic a review as possible, using published sources, grey literature, state and government reports, and other data from Australian jurisdictions. The table might be further added to by the inclusion of other possible community-level surveys not identified here, but the overall conclusions [Text Box 1] would remain the same.

Overall, the field of self-report measures for children is similar to other areas of behavioural surveillance, in that "there is a lack of consistency or standardisation of measures used" (Trost 2007). The variation in estimates of achieving the '60 minutes daily' recommendation is noted in Table 1, despite all these surveys using representative samples and established measures. The question differences result in large differences in achieving the guideline. Details of these surveys, their questionnaires and questions asked, and some details of further results are described in Appendix 2.

Additional note and update February 2010 – national surveys in the planning process in 2010

This supplementary note reflects current planning for two national physical activity and nutrition surveys; current progress with these tasks is worth mentioning in this report. The first is the National Nutrition and Physical Activity Survey [NNPAS, planned for 2011, by DOHA and ABS, concomitant with the next National Health Survey]. A panel of expert advisers¹¹ met with DOHA and ABS (Feb 3rd 2010); this is early in the development of the instruments for adults and children, but the principles are quite relevant to this report. For children, the same tiered model proposed in this report was accepted. This comprised a 'core short measure' [the same HBSC derived measure as is recommended in this report], an intermediate measure derived from APARQ and MARCA [to

⁹ And most of the estimates provided in the table are weighted to the age/sex distribution of the state or region.

¹⁰ On an average school day, about how many hours a day do you do the following when you are not at school: watch television or DVDs or videos; use the internet or play computer games (not including for homework)?

¹¹ Academic experts comprised Adrian Bauman, Wendy Brown, David Dunstan, Tim Olds, Jo Salmon; senior managers from relevant sections of DOHA, ACS, ABS and related jurisdictional groups represent Government and the survey delivery team [this advisory group has met since December 2009, and will meet until mid to late 2010].

be piloted and tested] with additional active transport and sedentary behaviour questions, and the final tiers of measurement are objective, with pedometers for all school aged children, and accelerometers in a smaller subsample. Although this process is in early stages of development and may change, the relevance for this report is that similar principles of measurement for surveillance were adopted for children in this National Nutrition and Physical Activity Survey.

The second proposed national survey is further advanced. It is the National Survey of Secondary Students Diet and Activity (NaSSDA), established by a group of experts through the Cancer Council Australia and National Heart Foundation to conduct a secondary schools national survey which is coordinated by the Cancer Council Victoria (CCV). This group is outside the jurisdictions directly related to this report or the performance benchmarks, but the existence of parallel national surveys is of relevance to the surveillance field. This measure is comprised of an adapted version of APARQ [organised and non-organised sport in a typical week, by season], with supplementary questions on active travel, and sedentary questions similar to ASAQ. The measure has been piloted nationally with around 400 secondary students.

These two surveys demonstrate the choices in PA measurement in children and adolescents. For the national survey, parental proxy reporting is used for primary aged students under 11 years, but self-complete or interviewer-assisted completion are used for both surveys, and it appears likely that adaptations of APARQ with supplementary activity questions on other domains and sedentary time are the likely final choices for longer PA instruments in both of these national surveys.

Text Box 1: Summary of children's PA measurements in population surveys in Australia

There is great variability in these jurisdictional estimates of recommended lower limit levels of physical activity [achieving more than 60 minutes per day is the suggested guideline], and recommended upper limits of 2 hours of TV watching [as a screen time measure which captures important dimensions of sedentary behaviour].

This variability in meeting physical activity recommendations is shown in Figure 1, where the data from Table 1 are portrayed. These are all population based surveys, all with careful choices of measures used, and good attention to population sampling, question administration and data analysis. The variability in these different questions makes it difficult to choose one as first among equals, as they were designed differently, and show the sensitivity of physical activity question differences on reaching a public health threshold. Similarly, the measures of sedentary behaviour also provide different estimates of the proportions of children and adolescents who watch less than 2 hours of TV per day, in the different states and jurisdictions.

Further, there is no clear consistency within survey method – school based surveys that ask different questions give different prevalence results, as do the several CATI survey estimates. This poses challenges to instrument choice and the decisions about mode of administration. Most importantly, it is unlikely that algorithms could be developed to harmonise the estimates derived from these diverse population measures.

The decision regarding which measure to use is now discussed. Measurement selection will be based on consensus agreement in the field, feasibility, existing measures, and the existence of a baseline performance indicator that could be compared with subsequent data collections to 2015. The proposed measures include a 'tiered' approach, with a 'short core measure' with an existing history across jurisdictions proposed as an indicator in 2009 and for 2013-2015. Jurisdictions will mostly retain their usual intermediate length measures, such as APARQ or MARCA or CAPANS. In addition, subsample objective measurement with preferably accelerometers [or failing that, pedometers] is strongly recommended. Baseline pedometer data in recent years are available from several jurisdictions.

Table 1. Recent surveys of child physical activity – national and state level¹²

Survey, year, auspice	Method	Target group/sample frame	Physical activity measures/ indicators	Percent meeting recommendations
				>60 minutes moderate-vigorous physical activity [MVPA] every day; <2 hrs per day of sedentary behaviour [SB] or small screen time during their leisure time
National survey of children's nutrition and physical activity survey 2007	Household (CAPI) + CATI	Australian children 2–16 years (yrs) N= 4,487	Self-reported PA using Multimedia Activity Recall for Children and Adolescents (MARCA, Ridley et al. 2006), a computer-delivered time-use instrument – child is asked to recall previous day's activities and duration of those activities in periods of five minutes or more Pedometers worn for six days	PA (>60 mins MVPA on all four days sampled) 9–13 yrs 40% 14–16 yrs 19% 9–16 yrs 32% SB (<two hrs screen time on all four days sampled) 9–13 yrs 7% 14–16 yrs 6% 9–16 yrs 7%
NSW Schools Physical Activity and Nutrition Survey (SPANS) 2004, 2010	School-based	NSW school students Year (Yr) K,2,4,6,8,10	Self-reported PA using Adolescent Physical Activity Recall Questionnaire (APARQ, Booth et al. 2002) – organised/non-organised, summer/winter, frequency, duration	PA Summer Yr 6 boys 88.8%, girls 80.0% Yr 8 boys 87.3%, girls 76.8% Yr 10 boys 77.9%, girls 59.8% PA Winter Yr 6 boys 83.8%, girls 72.4% Yr 8 boys 79.9%, girls 66.2% Yr 10 boys 76.7%, girls 54.5%
NSW Department of Health			Self-reported sedentary behaviours using Adolescent Sedentary Activity Questionnaire (ASAQ, Hardy et al. 2007) – types, frequency, duration	SB [screen time- % meeting <2hrs guideline] Yr 6 boys 38.8%, girls 55.1% Yr 8 boys 23.8%, girls 33.9% Yr 10 boys 21.6%, girls 33.5%

¹² Note, for additional and detailed explanatory text for this table, see Appendix 2, section A.2.1

Recent surveys of child physical activity – national and state level

Survey, year, auspice	Method	Target group/sample frame	Physical activity measures/ indicators	Percent meeting recommendations
				>60 minutes moderate-vigorous physical activity [MVPA] every day; <2 hrs per day of sedentary behaviour [SB] or small screen time during their leisure time
NSW School Students Health Behaviours Survey (SSHBS) 2002, 2004, 2008	School-based	NSW secondary school students in Yr 7-12	Self-reported PA questions based on Australian Government Department of Health and Ageing recommendations for 5–12 and 12–18 yr olds - frequency, duration, intensity	2008 survey PA 12–17yrs 13.3% 12–15 yrs 14.6% 16–17 yrs 10.2%
[data collected for incorporation into Australian Secondary School Student Alcohol and Drug Survey (ASSAD)]			Self-reported sedentary behaviours – types, frequency, duration	SB 12–17 yrs 8.3% 12–15 yrs 9.2% 16–17 yrs 6.2%
NSW Population Health Survey – Child Health (Biennially since 2001)	CATI	NSW Child population <=16 yrs	Parent or carer-proxy report of child’s PA and sedentary behaviours – frequency, duration, types of activities	2005-06 Survey ¹³ PA 5–15 yrs 25.6% 5–8 yrs 34.3% 9–15 yrs 21.2%
NSW Department of Health				SB 5–15 yrs 15.6%
Victorian Child Health and Wellbeing Survey 2006, 2009	CATI	Victorian children aged 0–12 yrs old; N=5000	Parent or carer-proxy report of child PA –time spent in exercise and outdoor play, active transport to school, time spent in small-screen recreation	2006 Survey PA 5–13 yrs 71.2%
Victorian Department of Health				

¹³ Note – since this report was completed, more estimates have been released; the NSW Child Health survey data 2007/8 was released in March 2010, and the latest PA estimates were for 5-8 yrs, 34.3% met the PA guideline, for 9–15 yrs, it was 20.2%, and for overall 5-15yrs, 25.0% met the PA guideline. Also they changed the sedentary behaviour indicator in NSW to ‘use of electronic media for entertainment at home’ (>2 hrs per day). The estimates for the last 2 surveys for 5–15yr olds are 58.9% (2005-06) and 47.2% (2007–08).

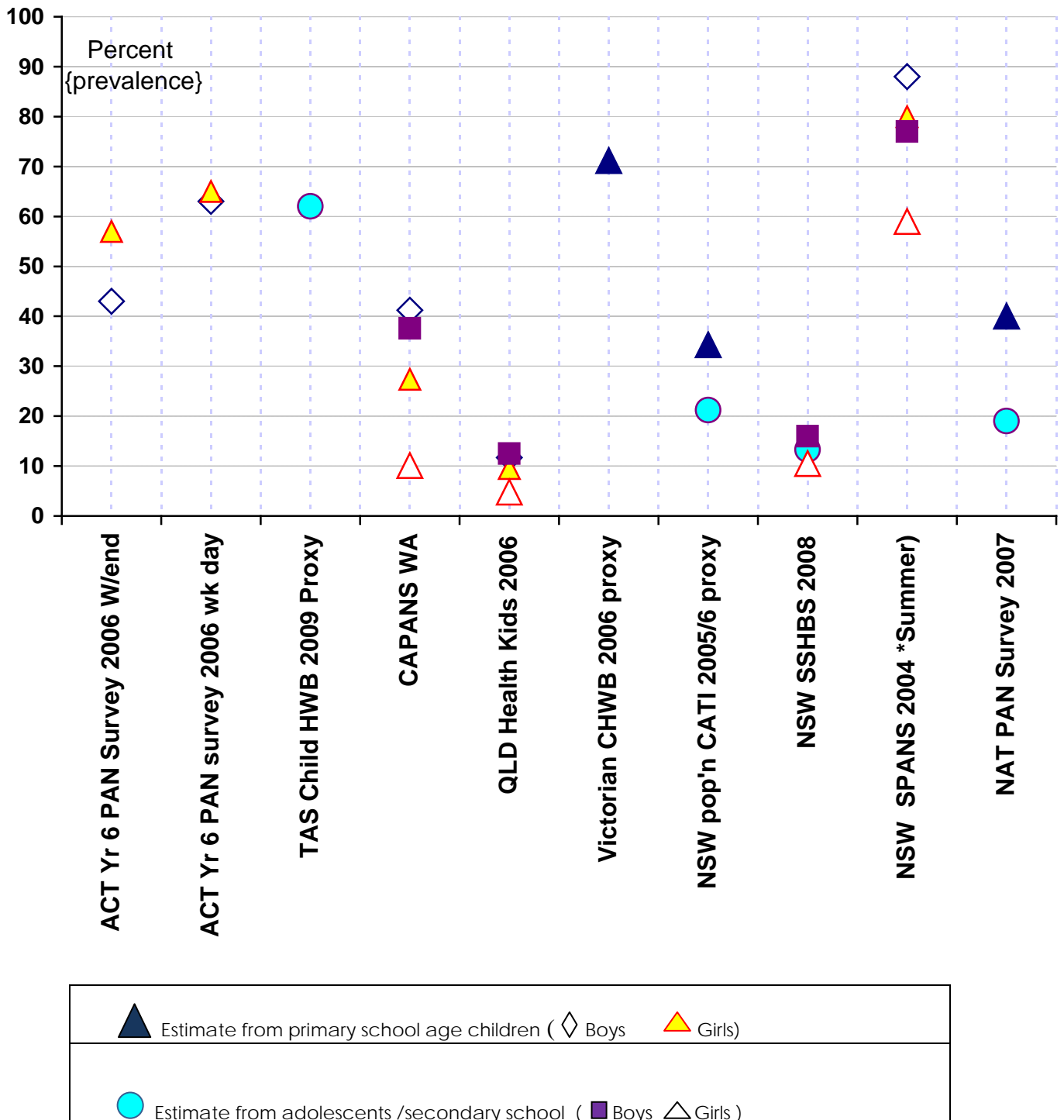
Survey, year, auspice	Method	Target group/sample frame	Physical activity measures/ indicators	Percent meeting recommendations
				>60 minutes moderate-vigorous physical activity [MVPA] every day; <2 hrs per day of sedentary behaviour [SB] or small screen time during their leisure time
Victorian Adolescent Health & Wellbeing Survey 2009 Victorian Dept of Health	Online survey	Victorian secondary school students; N= 10,000	Information not yet available	--
Healthy kids Queensland Physical Activity and Nutrition Survey 2006 ¹⁴ Queensland Health	School-based	Queensland school students, grades 1,5,10 (N=3691); aged 5–17 yrs	Self-reported or parent-proxy (for children in grade 1) PA– number of days that child engaged in mod-to-vigorous pa or active play in the past week; 2) Pedometer worn for five consecutive days + daily step log	PA Yr 1 boys:16.5%, girls: 6.3% Yr 5 boys:1.7%, girls 9.5% Yr 10 boys 12.5%, girls 4.8% SB (<2 hrs, previous day only) Yr 1 boys 84.0%, girls 82.5% Yr 5 boys 73.4%, girls 80.8% Yr 10 boys 60.7%,girls73.0%
Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) 2003, 2008 Premier’s PA Taskforce Healthway and Dept of Health, WA	School-based	Western Australian children and adolescents; primary school years 3, 5, 7 (aged 7–12yrs), high school years 8, 10, 11 (aged 13–16yrs).	Self-reported PA– frequency, duration of PA past 7 days, average school/weekend day, types of activities, active play, active transport; attitudes about PA And Pedometers + pedometer diary	2008 CAPANS Survey PA Primary school: boys 41.2%, girls 27.4% Secondary school: boys 37.6%, girls 10.1% SB Primary school: boys 29.1%, girls 24.8% Secondary school: boys 21.3%, girls 17.0%

¹⁴ Note that one reason for the lower prevalence rates of meeting the 60 minute threshold among Queensland children is a slight difference in the indicator [it was activities for 60mins+ that caused children to increase their heart rate or ‘huff and puff’, which may have been a more stringent criterion for inclusion of activities]

Recent surveys of child physical activity – national and state level

Survey, year, auspice	Method	Target group/sample frame	Physical activity measures/ indicators	Percent meeting recommendations >60 minutes moderate-vigorous physical activity [MVPA] every day; <2 hrs per day of sedentary behaviour [SB] or small screen time during their leisure time
South Australian Monitoring and Surveillance System – Child health (since 2002) South Australian Department of Human Services	CATI	South Australian children less than 16 yrs old	Parent/carer-proxy report of child PA – time spent in organised sport, time spent studying or doing homework, time spent reading for pleasure, time spent in screen-based activities. Parental perceptions of child’s level of PA	--
Tasmanian Child Health and Wellbeing Survey (2009) Tasmanian Department of Health and Human Services	CATI	Children aged 5–12 yrs (PA) Children aged 1–12 yrs (sedentary behaviour) N=1228 primary care-givers	Parent/carer proxy reported PA - estimate of number of days per week child was physically active for at least 60 minutes; mode of travel to and from school; access to parks Parent/carer proxy reported sedentary behaviour – child’s time spent in leisure time sedentary behaviours (TV or computer)	PA 5–12 yrs 62% 5–10 yrs 67% 11–12 yrs 51% SB 1–12 yrs 52% 1–4 yrs 77% 5–12 yrs 41%
ACT Year 6 Physical Activity Nutrition Survey 2006 ACT Health	School-based	Children enrolled in Year 6 in ACT primary schools. N=1172 students from 35 schools.	Self-reported PA, sedentary behaviour – frequency, duration , intensity, types of activities, active transport	PA All 19%, boys 24.9%, girls 13.6% SB Nearly 2/3 of children met guidelines on weekdays, boys 64.7%, girls 65.5%. Less than half of children met guidelines on weekend days, boys 42.6%, girls 54.8% .

Figure 1. Prevalence estimate (percentage of children) of meeting 60 minutes per day PA recommendations in different population surveys of children and adolescents in Australia¹⁵



Section D: Suggestions for optimising current data collections, making better use of existing data, and recommendation for meeting the Prevention Partnership performance benchmarks

This section provides a way forward, using the existing data in existing surveillance systems, to meet the Prevention Partnership benchmarks. First, the areas of agreement on measurement are highlighted, and then areas that more work remains to be done are described. Next a framework of specific guidance is provided to advance the discussion, using existing indicators.

First, the areas of agreement and areas where there is not consensus are described. Then the strengths and weaknesses of existing measures are outlined. Finally a three-tiered model is proposed as a way forward to monitor PA against the performance benchmarks.

Areas of measurement and methods that are decided [and require no further action]:

- The recommended amount of physical activity and sedentary behaviour are agreed
- The age range is 5–17 years
- The preferred mode of administration seems to be CATI or school-based surveys
- There is a preference and reasonable scientific support for self-administered instruments for children 11 years and older, and proxy parent completed questions for younger children
- The need for corroborative subsamples with objective measurements is mostly accepted¹⁶
- The performance benchmarks require a standardised comparable baseline, ideally close to 2009, and follow up administrations in 2013–2015.

Areas of measurement and methods that are not yet clearly established:

- There is no standardisation of self-report PA measures across jurisdictions, so there is no 'clear single measure' that would immediately get widespread acceptance, as there are substantial differences in primary measures of PA surveys across jurisdictional surveillance systems (Table 1)
- Most self-report data are of moderate reliability and validity, but no instrument in current use is markedly better than the other existing tools¹⁷

¹⁶ As mentioned earlier, Canada is the only country to have adopted pedometer based steps, at the FPT levels [Federal and Provincial and Territorial inter-governmental level, in other words, as standard for annual PA surveillance of children in Canada]; however, for Australia, no national recommended levels appear to exist for sufficient PA based on step counts from pedometers [whereas, for accelerometry, the exact '60 minutes of moderate-vigorous activity' can be objectively verified].

¹⁷ This is a debate or discussion that may already be resolved. The only arguments from the literature to support the choice is that more recently recalled measures tend to have better measurement properties, and as such, the one day PA diary types of measures [such as MARCA] may be more strongly correlated with objective measurements, than the longer period based recall measures. The short form measures [such as HBSC, YRBSS internationally, and the ASSAD measure in Australia] offer the potential for adding these to whatever existing measures are used routinely by a particular jurisdiction.

- There is no consensus on which domains of PA are sought, but this is a lesser consideration, as the primary purpose of this report is to define measures to address the PA performance benchmark levels for 60 minutes of PA, and secondarily, to assess < 2 hours of non-educational screen time daily.

Strengths and weaknesses of different types of measures:

- Self-report questionnaires are least expensive, feasible for large samples, can be used in school based completion formats for self completion by children older than 11 years
- Interviews are more expensive than self-completed data, but otherwise have similar attributes; these may be suitable for slightly younger children, and may have slightly better measurement properties, as questions can be explained; interviews are also the best method of parental proxy measurement for younger children
- Objective measures are the most valid way of capturing PA among young children and adolescents¹⁸
- Note that harmonisation of the self-report and proxy measures would be difficult, given the differences in prevalence in Figure 1. It would be unlikely that an analytic algorithm could be developed to harmonise these estimates of meeting the 60 minutes per day recommendation.

A framework for moving forwards – a three-tier model for monitoring against the performance benchmarks

The conclusion from this review of PA measurement in children is that there is no obvious single candidate measure that can be recommended ahead of all others. The data on measurement properties do not allow for discrimination between existing measures, as they all have specified purposes and objectives, and most demonstrated utility and feasibility in population surveys. The decision may then be made based on existence of comparable data that fulfil the criteria required by the Prevention Partnerships, and do not disrupt existing data collections within jurisdictions.

For this reason, a three-tiered solution is proposed.

TIER 1 – A COMMON CORE: A brief core measure that is agreed and asked across jurisdictions [and asked in an age appropriate mode, with proxy reporting for younger primary school children]. This would be the “minimal data set” for surveillance, and would have cross sectional comparability and monitor trends over time [most useful for self-report school based surveys, and therefore mostly for grade 6 and the secondary school age groups] (Need to note that this would get data for 2013 and 2014 but would not provide a baseline).

The candidate core measure proposed for this purpose is the ASSAD short question, used in NSW in the serial SSHBS surveys, and derived from the current HBSC questions in Europe (Prochaska 2001). The NSW SSHBS asks a single question for the 60 minute guideline [shown below, PA Question in blue and underlined], and three questions for the sedentary behaviour [shown below

¹⁸ Pedometer based surveys are easier and cheaper than accelerometers, but are limited to walking/running movements, and do not provide intensity or duration of activities. However, pedometer surveillance been used in some jurisdictions in Australia already, and in a national surveillance system for children’s PA in Canada. This is a policy debate within Australia; the National Nutrition and Physical Activity Survey for 2011 from DOHA/ABS will use pedometers for all school aged children 5–17 years. Accelerometers are the best method for assessing PA, but are more expensive. They are the most valid estimate of meeting the ‘60 minute’ guideline; they have limitations for measurement of some activities, for example, swimming and cycling, so ideally are supplemented by some self-report system. The feasibility of using accelerometers for population surveillance among children may need to be tested in Australia, and pilots may be warranted to assess costs, methods and acceptability of this ‘gold standard’ method, if this is preferred to pedometers.

in green in italics].¹⁹ The triennial ASSAD surveys were national, but had a drug and alcohol focus; however in recent years, several jurisdictions have asked these PA questions in 2005 and 2008.²⁰ The exception appears to be WA, but other jurisdictions could provide comparable data. The only missing part is the proxy data for younger children, as ASSAD was a secondary school survey.

TIER TWO – USUAL MEASURES: The jurisdictions are likely to want to continue to use their existing lengthier measures, for example, MARCA in South Australia (SA), APARQ in the SPANS series in NSW; these may differ, but harmonisation may be difficult as discussed earlier. This tier of data collection will not influence or be used in the comparable assessment of the performance benchmarks.

TIER THREE – OBJECTIVE MEASURES: A subsample of objective PA measurement is recommended to corroborate the self-reported trends in the core measure [using a smaller sample of accelerometers, or a larger sample if pedometers are used]. This is discussed earlier and requires a standardised approach.

Specific rapid research and investigation that could inform the process further

There are some tasks that are required rapidly to test the three-tier model, explore alternatives, and identify if this proposed solution is feasible.

- First, the core question from the ASSAD data across jurisdictions would need to be pooled for analysis and compared; only NSW publish these data readily, so combined analyses of all jurisdictional data for 2005 and 2008 data would further inform this process; prevalence estimates should be very similar across jurisdictions, as the questions were the same, and ASSAD survey methods are standardised. The pooled analysis would also examine the secondary measure, sedentary behaviours, across these jurisdictions. This analytic task is small, but would require jurisdictional permissions, and could provide useful information to further progress with the core tier one measure.
- The core questions in ‘proxy format’ are not available for current years to 2009, so there is no baseline. The core short question(s) could be developed in a proxy format.²¹ Either a baseline should be collected, or alternative proxy measures sought. This latter course is difficult, as the proxy questions asked of parents are not comparable across jurisdictions, and if this cannot be resolved, then a “tier 3” approach might be considered, using pedometer based estimates for the primary school aged 5–12 children, for those jurisdictions with that information. An alternative, and less desirable option is to attempt to compare ‘60 minutes per day’ estimates across different proxy surveys; this could require concurrent validity research [making sure inter-method comparisons were valid]

¹⁹ PA Q: [How many days in the past week have you done any vigorous or moderate physical activity for a total of at least 60 minutes? \(This could be made up of different activities during the day like cycling or walking to and from school, playing sport at lunchtime or after school, doing an exercise class, doing housework etc.\): Responses: 1 day, 2 days 3 days ... 7 days, no days](#)

Sedentary Q: On an average school day, about how many hours a day do you do the following when you are not at school: [separate questions] for [a] homework, [b] watch tv/videos/dvds, [c] use the internet/ play computer games? (Don't include computer use for homework), with response categories: None, 1 hr or less, 2 hrs, 3 hrs, 4 hrs, 5 or more hrs

²⁰ SA, Victoria, Queensland, Northern Territory (NT) and Tasmania asked the physical activity core question in 2005, and the three sedentary questions, and in 2008, SA, Queensland and Tasmania repeated the physical activity questions they asked in 2005.

²¹ For example, the CLASS measure was validated in 10–12 year olds by self-complete, and similar metrics were seen in the proxy report format, reported by parents for 5–6 year old children

- Exploration of other existing national data might be warranted; for example, in the National survey of Children's Nutrition and Physical Activity 2007, there are moderate sample sizes in all jurisdictions.²² However, a concern is that the MARCA measure is only a one day recall, and not translatable into the benchmark measure required.
- The pedometer data in various surveys in Australia could be compared, to establish step count per day 'norms' for children. Such data are potentially available at least from the National Children's Nutrition and Physical Activity Survey 2007, the Healthy Kids Queensland survey 2006 and the CAPANS survey in WA. This might be a useful secondary analysis to establish norms, assess methods and protocol comparability, with a view to considering pedometers as a way of implementing an objectively measured surveillance system.
- Decisions would be needed around tier three measures as several but not all states have pedometer estimates. The decision regarding this objective measure would need to consider the costs and feasibility, and sample sizes for future pedometer study estimates, and compare those with the additional benefits of accelerometer use. A partial solution [or later benchmark baseline] would be to use the 2011 National Nutrition and Physical Activity Survey by DOHA/ABS, as this will have pedometer data nationally, with sufficient sample size for jurisdictional comparisons, but will be collected in 2011 and not a 2009 baseline as is required.

²² We reanalysed these data [January 2010] to identify the sample sizes available, and jurisdictional sample sizes range from the smallest sample [187 children in the ACT], to the largest sample, n=1203 from NSW; four jurisdictions have samples >800, and these are acceptable for a MARCA-derived PA estimates at the state level.

Conclusion and summary of responses to key questions asked

Physical activity surveillance among children and adolescents is a complex process, and jurisdictions have assessed it differently in population surveys. Most self-report instruments measures have moderate reliability and validity characteristics, but none is a standout candidate [Review Questions 1 and 5]. Proxy measures, reporting by parents or carers, is often used for children aged less than 11 years, and is more appropriate than self-report, although additional objective assessment is warranted [Review Question 2].

There is substantial variation in the measures used for current PA surveillance for children [Review Question 3]. Baseline data can be extracted from few instruments that are comparable, but one such instrument is the short question in the ASSAD survey, that could be collected as a baseline, and followed up to 2013–2015 [Review Questions 3 and 5]. This measure has acceptable measurement properties, and has baseline data for secondary school students in most jurisdictions, but does not have a ‘proxy’ administered format [Review Question 3]. Additional analysis and proxy measurement development could augment the decision to use this measure as a performance benchmark [Review Questions 4 and 6].

A three-tiered approach is proposed, with tier one collecting short core questions for PA and sedentary behaviours. Tier two will report on the usual PA measure in each jurisdiction but not contribute to pooled comparisons on the performance benchmark, and tier three will provide objective data to corroborate the self-reported and proxy assessed change [Review Question 6]. The next steps are to review these recommendations, assess the relatively small research and measurement tasks required, in order to establish the surveillance system against which the performance benchmarks can be monitored.

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Appendices

Appendix 1 Table showing the validity of direct observation techniques to assess young people's physical activity

(from Sirard & Pate 2001)

Instrument	Technique	Participants	Reliability	Criterion measure	Validity
Children's activity rating scale (CARS) Puhl et al. 1990	1 minute partial time sampling with 5 categories during various conditions	12 boys, 13 girls; 5–6 yrs	84 ±10% agreement between observers; n = 192, 3–4 yrs	VO2, HR	VO2 and HR differed between treadmill speeds designed to represent the 5 categories of exercise intensity (p < 0.05)
Modified fargo activity time sampling survey (FATS) Bailey et al. 1995	3 second continuous time sampling with 30 categories during freelifving conditions	2 boys, 2 girls; 7–10 yrs	91% agreement between observers; n = 15, 6–10 yrs	VO2	Categories separated by intensity as measured by VO2
Activity patterns and energy expenditure (APEE) Epstein et al. 1984	15 second momentary time sampling with 5 categories during freeplay	19 girls; 5–8 yrs	86–99% agreement between observers	HR	r = 0.72-0.91
Children's physical activity form (CPAF) O'Hara et al. 1989	1 minute partial time sampling with 4 categories during PE	18 boys, 18 girls; 8–10 yrs	96–98% agreement between observers	HR	r = 0.61-0.72
Behaviours of eating and activity for children's health evaluation system (BEACHES) McKenzie et al. 1991	1 minute momentary time sampling with 5 categories during various conditions	19; 4–9 yrs	94–99% agreement among observers; Kappa = 0.71–1.0; n = 17 boys, 25 girls; 4–8 yrs	HR	HR increased for each of the 5 categories

Table showing the validity of direct observation techniques to assess young people's physical activity

Instrument	Technique	Participants	Reliability	Criterion measure	Validity
System for observing fitness instruction time (SOFIT) Rowe et al. 1997	10 second momentary time sampling with 5 categories during PE class	173; Grades 1–8	N/A	HR	HR increased for each of the 5 categories except lying versus sitting categories
System for observing fitness instruction time (SOFIT) McKenzie et al. 1992	10 second momentary time sampling with 8 categories during various conditions	7 boys, 7 girls; 2–4 yrs	91–98% agreement among observers	lesson context (fitness)	r = -0.65 w/ standing; r = 0.49 w/ walking; r = 0.36 w/ very active; r = 0.69 w/ MVPA
Fargo activity time sampling survey (FATS) Klesges et al. 1984	10 second momentary time sampling with 8 categories during various conditions	7 boys, 7 girls; 2–4 yrs	91–98% agreement among observers	Large scale integrated PA monitor, LSI®	r = 0.78-0.90

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Appendix 2 Additional information on child and adolescent physical activity self-report surveillance instruments

Appendix 2.1 Results of the jurisdictional surveys [additional explanatory text for Table 1 in this report]

The first survey shown is the National survey of children's Physical Activity and Nutrition [this survey is also known as 'Kids Eat, Kids Play', 2007]. This survey used the one-day diary recall method, using the Multimedia activity recall for children and adolescents measure [MARCA, Ridley, 2006]. The prevalence rates for 'sufficiently active' were around 19% for 14–16 year olds, and 40% for younger children aged 9–13 years.

Next is the NSW Health Department SPANS survey, a representative sample school-based approach to surveillance in NSW, with self-reported PA using the APARQ questionnaire among grades 6, 8 and 10. This self-report measure was completed in class, and asked students about their organised and non-organised PA during summer and winter; in addition, the sedentary behaviour instrument, ASAQ, was also administered, and in addition, an objective criterion measure, the 20 metre shuttle test was used to assess fitness. Using the APARQ, over two-thirds of students met the '60 minutes daily recommended level' for PA.

The next measure is the SSHBS [the Secondary School Health Behaviour Survey, also known previously as the ASSAD survey series]. This is a national school based survey collecting self-report information of tobacco, alcohol and other drug use, sun protection behaviours, and in an additional module, information of diet and PA. The additional module has been asked in NSW over at least three survey series [2002, 2005 and 2008], and the full PA questions are shown in the appendix. This was administered only to 12–17 year old students, and produced low rates of reaching the recommended PA threshold [around 10–15%].

Another NSW measure is the Child Health Survey, as part of the NSW Health Survey CATI program, where biennial child health surveys are carried out; this survey asks parents to report on the health status and other attributes of their children aged 2–16 years. This parental-proxy reporting method resulted in around a third of early primary school, and a fifth of upper primary and lower secondary school aged students achieving the 'recommended PA level'.

The Victorian Child and Wellbeing Survey, another CATI system, also asked parents to report on time spent in exercise and active play for their children; for primary school aged children, 71% achieved the recommended level, much higher than the parental proxy questions asked in the NSW Health Survey program. A more recent survey, the Victorian Adolescent Health and Wellbeing survey was collected from sampled school students, using an online mode of data collection in 2009, but data are not yet released from this study.

Healthy Kids Queensland collected information in 2006 from students in school grades 1, 5 and 10, and asked for self-report information on the number of days they engaged in moderate to vigorous PA; in addition, a pedometer subsample was collected. Rates of reaching the recommended level of PA were low, with fewer than one sixth in any age or gender group reaching the threshold of 60 minutes daily PA.

The CAPANS survey in WA was carried out in 2003 and 2008 from three grades of students in primary school and three grades in high school. A self-reported measure was supplemented by pedometer and diaries. The 2003 survey set some norms for step counts using pedometers, with boys taking 12–13,000 steps per day and girls around 1–2,000 fewer steps per day on average. The 2008 survey indicated that just over a third of boys and fewer girls reached the PA threshold, with secondary school girls showing the lowest rate [10%] of sufficiently active.

The South Australian monitoring and surveillance system used a CATI method to obtain parental proxy measures of PA among children and adolescents, but the questions were not asked in a way that could provide data on children reaching the recommended PA level.

The Tasmanian Child Health and Wellbeing Survey in 2009 asked parents of primary school students to report their children's PA levels, and over half reported that their children met the recommended levels.

The ACT Physical Activity and Nutrition Survey in 2006 asked grade 6 children to self-report their activity levels, and only a fifth met the recommended PA level.

Note that some PA questions and instruments were not included in this regional surveillance review. The National Health Survey does have a parental proxy for the exercise questions, but a two week period is recalled, and they are not suitable for assessing the current children's PA guidelines. Similarly, NT proxy questions that asked about vigorous activity episodes for at least 20 minutes and moderate activity for at least 30 minutes were not included, as the indicator of an hour per day cannot be estimated from these questions. Data from cohort studies or intervention studies were also not included, even where these studies were of large magnitude, as the samples and the PA questions were not designed for surveillance.

In addition to PA estimates, several of the surveys across jurisdictions asked about sedentary behaviour, but did not report on this in a consistent way. Using the 2 hours of screen time indicator, the National survey of Children's Physical Activity and Nutrition 2007 estimated that fewer than 10% achieved this on all four days of sampling. This estimate was similar to that obtained from the NSW SSHBS survey in 2008. The NSW SPANS survey indicated greater rates, with between a quarter and just over half of students met this guideline [less than two hours TV daily]. This estimate was slightly less than the WA CAPANS study, where a fifth to a quarter of students met the guideline. Over half of Tasmanian adolescents in 2009 met this sedentary guideline. The Healthy Kids Queensland survey found that around three-quarters or more of students met this two hours TV guideline, but were only asked about the previous day. This was similar to estimates from the ACT grade 6 PAN survey.

Appendix 2.2 Additional notes and the questions asked

NSW Child Health Survey

How often has this survey been conducted?

- Conducted biennially since 2001
- Reports are available for 2001, 2003-04 and 2005-06
- Physical activity and sedentary behaviour data available for 2001 and 2005-06, but the questions were different and age range different. See below.

What were the questions asked?

Health indicators by year of survey

Survey year	Indicator	Description
2001	Physical Activity	Child reported to participate in sports or physical activities
	Physical Inactivity	Child reported to watch an average of two or more hours of TV per day.
2005-06	Adequate physical activity	Child reported to meet recommendations >60 mins per day
	Sedentary behaviour	Child reported as not meeting recommendations of <2hrs per day

NSW School Students Health Behaviours Survey (SSHBS)

Trend data available for physical activity and sedentary behaviour

Indicator	Year	Males % (95% CI)	Females % (95% CI)	12-15 yrs % (95% CI)	16-17 yrs % (95% CI)	All % (95% CI)
Adequate physical activity*	2005	15.4 (13.7-17.0)	11.1 (9.7-12.4)	14.3 (13.0-15.6)	10.3 (8.7-12.0)	13.2 (12.1-14.4)
	2008	16.2 (14.6-17.7)	10.5 (9.3-11.6)	14.6 (13.4-15.7)	10.2 (8.5-11.8)	13.3 (12.3-14.3)
Sedentary behaviour (≥2hrs when not at school)	2002	91.4 (90.0-92.9)	86.4 (84.6-88.0)	89.0 (87.7-90.3)	88.6 (86.3-90.9)	88.9 (87.8-90.0)
	2005	91.1 (89.5-92.7)	88.9 (87.3-90.5)	89.9 (88.6-91.2)	90.2 (87.8-92.5)	90.0 (88.8-91.1)
	2008	91.8 (90.3-93.2)	91.6 (90.6-92.5)	90.8 (89.6-92.0)	93.8 (92.8-94.9)	91.7 (90.7-92.6)

*Adequate PA: >60 mins of MVPA per day

Survey questions asked by jurisdiction

NSW Child Health Survey

1. On about how many days during the school week does child usually do physical activity outside of school hours?
[number of days]
2. On those days, about how many hours does child usually do physical activity?
[hours, minutes]
3. On about how many weekend days does child usually do physical activity?
[number of days]

4. On a typical weekend day, about how many hours does child usually do physical activity?
[number of hours]
5. In the last 12 months, what types of sports and outdoor activities did child play?
 - Basketball
 - Cricket
 - Cycling or mountain biking or bike riding
 - Dancing or ballet
 - Jogging or athletics or running
 - Martial arts
 - Netball
 - Rugby league
 - Rugby union
 - Skateboarding or rollerblading
 - Soccer
 - Swimming
 - Other (specify) _____
 - Did not play any sport
6. On about how many days during the school week does child usually watch TV, videos or DVDs at home?
[number of days]
7. On those days, about how many hours does child usually spend watching TV, videos or DVDs?
[number of hours]
8. On about how many weekend days does child usually watch TV, videos or DVDs at home?
[number of days]
9. On a typical weekend day, about how many hours does child usually spend watching TV, videos or DVDs?
[number of hours]
10. On about how many days during the school week does child usually play video or computer games?
[number of days]
11. On those days, about how many hours does child usually spend playing video or computer games?
[number of hours]
12. On about how many weekend days does child usually play video or computer games? [number of days]
13. On a typical weekend day, about how many hours does child usually spend playing video or computer games?
[number of hours]

NSW School Students Health Behaviours Survey (SSHBS)

1. How many times in the last week did you do any vigorous physical activity for at least 30 minutes that you sweat and breathe hard? (e.g. basketball, netball, soccer, football, running, fast bike riding, aerobics)
[None, once, twice, 3 times, 4 times, 5 times, 6 or more times]
2. How many times in the last week did you do any moderate physical activity for at least 30 minutes that you sweat and breathe hard? (e.g. slow bike riding, housework, brisk walking, pushing a lawnmower)
[None, once, twice, 3 times, 4 times, 5 times, 6 or more times]
3. How many days in the past week have you done any vigorous or moderate physical activity for a total of at least 60 minutes? (This could be made up of different activities during the day like cycling or walking to and from school, playing sport at lunchtime or after school, doing an exercise class, doing housework etc.) [1 day, 2 days 3 days ... 7 days, no days in the week]
4. On an average school day, about how many hours a day do you do the following when you are not at school:
 - homework
 - watch TV/videos/dvds
 - use the internet/ play computer games? (Don't include computer use for homework)
 - None, 1 hr or less, 2 hrs, 3 hrs, 4 hrs, 5 or more hrs
5. Outside school time, how many hours a day on average do you usually watch TV, videos or DVDs?
 - on Monday to Friday

- on Saturday and Sunday
 - Not at all, 1hr or less a day, 2 hrs a day, ... 5 hrs or more a day
6. Outside school time, how many hours a day on average do you usually use computers for entertainment or to play video games (e.g. surfing the net, Playstation, Nintendo)?
- on Monday to Friday
 - on Saturday and Sunday
 - Not at all, 1hr or less a day, 2 hrs a day, ... 5 hrs or more a day
7. Outside school time, how many hours a day on average do you usually use computers for study or school work?
- on Monday to Friday
 - on Saturday and Sunday
 - Not at all, 1hr or less a day, 2 hrs a day, ... 5 hrs or more a day

Victorian Child Health and Wellbeing Survey

Parent or carer was asked how often child is active for at least one hour a day.
[Everyday, 5 or 6 days, 4 days, 3 days, 2 days, 1 day, no days, don't know]

Victorian Adolescent Health & Wellbeing Survey

Not available

Healthy kids Queensland Physical Activity and Nutrition Survey

1. Children were asked how many days of the past seven days had they engaged in physical activity or active play that raised their heart rate or caused them to 'huff and puff' for a total of 60 minutes per day.
2. Children were also asked to record how long they had spent on the previous day (or most recent school day) 'watching television, videos, DVDs or playing video or computer games for entertainment' in daylight hours.
3. Children were asked about the type of physical activities that they had participated in over the previous week and also to indicate what physical activities they usually participated in the previous year.
4. Children were asked to record the number of times they had walked and the number of times they had cycled to or from school in the previous week.

WA Child and Adolescent Physical Activity and Nutrition Survey (CAPANS)

1. Children were asked to report their physical activity participation (>60mins per day) in the last week. [0, 1-2, 3-4, 5-6, 7 days]
2. Children asked to report the types of physical activities they participated in over the last 7 days.
3. Secondary school-aged children were asked to report the time they spent in 1) sport, exercise and dance, 2) active play, 3) school sport and PE, and 4) active transport [mins per day based on 5 day school week]
4. Children were asked to report their method of transport to school and home from school.

SA Monitoring and Surveillance System – Child Health Survey

Not available

Tasmanian Child Health and Wellbeing Survey

1. Over a typical week, on how many days is (child) physically active for a total of at least 60 minutes per day. Would you say.....
[Everyday, 5 to 6 days, 4 days, 3 days, 2 days, 1 day, No days]

2. (For child aged 5-12yrs) Over a typical week, about how many hours per day does (child) usually watch television (including videos and DVD's) in their free time but NOT for homework? We ask you to choose one answer for Monday to Friday and one answer for during the weekend. For Monday to Friday usually how many hours a day? (does (child) usually watch television (including videos and DVD's) in their free time but NOT for homework)?

(For children aged less than 5yrs) Over a typical week, about how many hours per day does (child) usually watch television (including videos and DVD's)? We ask you to choose one answer for Monday to Friday and one answer for during the weekend. For Monday to Friday usually how many hours a day? (does (child) usually watch television (including videos and DVD's)?

[none at all, less than an hr a day, about 1 hr a day, about 2 hrs, a day, ..., about 6-7 hrs a day, more than 7 hrs a day]

3. (For child aged 5-12yrs) During the weekend, that is Saturday and Sunday, usually how many hours a day? (does (child) usually watch television (including videos and DVD's) in their free time but NOT for homework)?

(For children aged less than 5yrs) During the weekend, that is Saturday and Sunday, usually how many hours a day? (does (child) usually watch television (including videos and DVD's)?

[none at all, less than an hr a day, about 1 hr a day, about 2 hrs, a day, ..., about 6-7 hrs a day, more than 7 hrs a day]

4. (For child aged 5-12yrs) Over a typical week, about how many hours a day does (child) usually use a computer (for playing games, emailing, chatting or surfing the internet but NOT including homework)? We ask you to choose one answer for Monday to Friday and one answer for during the weekend. For Monday to Friday usually how many hours a day does (child) usually use a computer? (for playing games, emailing, chatting or surfing the internet but NOT including homework)

(For children aged less than 5yrs) Over a typical week, about how many hours a day does (child) usually use a computer? We ask you to choose one answer for Monday to Friday and one answer for during the weekend. For Monday to Friday usually how many hours a day does (child) usually use a computer?

[none at all, less than an hr a day, about 1 hr a day, about 2 hrs, a day, ..., about 6-7 hrs a day, more than 7 hrs a day]

5. (For child aged 5-12yrs) During the weekend, that is Saturday and Sunday, usually how many hours a day? (does (child) usually use a computer (for playing games, emailing, chatting or surfing the internet but NOT including homework)

(For children aged less than 5yrs) During the weekend, that is Saturday and Sunday, usually how many hours a day does (child) usually use a computer?

[none at all, less than an hr a day, about 1 hr a day, about 2 hrs, a day, ..., about 6-7 hrs a day, more than 7 hrs a day]

6. During the current school term, in a typical week, where there are 10 trips to and from school, how many trips would (child) usually make....

Please count each trip separately. If child uses more than one form of transport on each journey, the main form of transport is the form that takes the child the furthest.

- By car (record number between 0-10)
- By walking (record number between 0-10)
- By bus or public transport (record number between 0-10)
- By cycling (record number between 0-10)
- Some other way (Specify) (record number between 0-10)

ACT Year 6 Physical Activity Nutrition Survey

- Over the past 7 days on how many days were you physically active for a total of at least 60 minutes per day?
[0 days, 1 day, ..., 7 days]
- Over a typical week on how many days are you physically active for a total of at least 60 minutes per day?
[0 days, 1 day, ..., 7 days]
- When you are AT SCHOOL, how OFTEN do you usually exercise so much that you get out of breath or sweat? (Including physical activity during PE classes, recess and lunchtime, NOT before or after school)

[every day, 4–5 times a week, 2–3 times a week, once a week, once a month, less than once a month, never]

4. When you are AT SCHOOL, how many HOURS A WEEK do you usually exercise so much that you get out of breath or sweat? (Including physical activity during PE classes, recess and lunchtime, NOT before or after school)
[none, about half an hour a week, about 1 hr a week, about 2–3 hrs a week, about 4–5 hrs a week, 7 hrs or more a week]
5. About how many times a week do you participate in a PE class at school?
[number of times per week]
6. OUTSIDE SCHOOL HOURS: Over a typical week in the current school term which of the following ORGANISED sporting activities – including training, games and matches – do you usually do?

Activity/sport

- Australian Rules Football ____times per week
- Baseball ____times per week
- Basketball ____times per week
- Cricket ____times per week
- Cycling ____times per week
- Dancing (ballet/jazz)/Calisthenics ____times per week
- Golf ____times per week
- Gymnastics ____times per week
- Hockey ____times per week
- Horse-riding /equestrian events ____times per week
- Ice or snow sports ____times per week
- Little athletics ____times per week
- Martial arts ____times per week
- Netball ____times per week
- Sailing ____times per week
- Soccer ____times per week
- Softball ____times per week
- Squash ____times per week
- Swimming ____times per week
- Rowing ____times per week
- Rollersports ____times per week
- Rugby league ____times per week
- Rugby union ____times per week
- Running or jogging ____times per week
- Ten-pin bowling ____times per week
- Volleyball ____times per week
- Waterpolo ____times per week
- Other sport classes (Please specify below)
- _____ ____times per week
- _____ ____times per week

7. OUTSIDE SCHOOL HOURS: How OFTEN do you usually exercise so much that you get out of breath or sweat?
[every day, 4–6 times a week, 2–3 times a week, once a week, once a month, less than once a month, never]
8. OUTSIDE SCHOOL HOURS: How many HOURS A WEEK do you usually exercise so much that you get out of breath or sweat?
[none, about half an hour a week, about 1 hr a week, about 2–3 hrs a week, about 4–6 hrs a week, 7 hrs or more a week]
9. Over a typical week in the current school term, how many times do you go to school in the following ways?
[number of times per week for walk to school, bicycle to school, catch bus to school, ride in car with mum or dad to school, ride in a car with someone else to school]
10. Over a typical week in the current school term, how many times do you go from school in the following ways?
[number of times per week for walk to school, bicycle to school, catch bus to school, ride in car with mum or dad to school, ride in a car with someone else to school]
11. About how many hours a day do you usually watch television (including videos and DVD's) in your free time? (separate for weekdays and weekend)
[none at all, about half an hr a day, about 1 hr a day, ..., about 7 hrs or more a day]

12. About how many hours a day do you usually spend doing school homework out of school hours?
(separate for weekdays and weekend)
[none at all, about half an hr a day, about 1 hr a day, ..., about 7 hrs or more a day]

13. About how many hours a day do you usually use a computer (for playing games, emailing, chatting or surfing the internet) in your free time? excluding school related work) (separate for weekdays and weekend)
[none at all, about half an hr a day, about 1 hr a day, ..., about 7 hrs or more a day]