GAAIII

The Australian Prevention Partnership Centre
Systems and solutions for better health

Getting Australia Active III

A systems approach to physical activity for policy makers

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CONFIDENTIAL

1.2 Are Australians active? Prevalence, trends and correlates of meeting physical activity guidelines

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1.2.1 Introduction

The purpose of this chapter is to describe the prevalence of physical activity (PA) among Australians. This involves understanding current PA guidelines and using population data to identify the proportion of people that meet those guidelines. If repeat population surveys are carried out in an identical fashion, then trends in PA can be monitored.

1.2.2 Purpose of monitoring and physical activity guidelines

Measures of population levels of PA are usually conducted through representative cross-sectional surveys that assess the prevalence of meeting PA guidelines. These are discussed, and the guidelines are also presented as part of a PA surveillance system (Chapter 5).

PA guidelines for Australian adults recommend a minimum of 150 minutes per week of at least moderate intensity activity[1,2], with recent updates to the evidence suggesting that benefits accrue across the range of 150 and 300 minutes per week. In addition, the adult guidelines recommend at least twice weekly strength training, and PA to improve balance, particularly among older adults where falls prevention is an important component of PA promotion. The guidelines for school aged children and adolescents are 60 minutes a day of at least moderate intensity activity, with guidelines also for the 0–5 age group.[3]

There are several challenges in monitoring population levels of PA. The first is changes to the way PA is measured, with changes to the questions asked to assess PA. Even small changes to these questions result in large differences in the prevalence of meeting PA guidelines in the population[4], much larger than changes attributable to implementing optimal policy. As questionnaires evolve (e.g. by assessing new dimensions and domains of PA and adding measures of sedentary time and sleep to summate to a '24-hour movement continuum') there is substantial pressure to include these 'improved questions' in population surveys. This may preclude assessment of trends, and 'starting again with a new series using these better questions' has been unhelpful in assessing PA policy translation.[5] This area has become more complicated with the advent of device based measures for assessing PA including accelerometers, other fitness trackers, step counters and motion sensing devices, integrated devices including heart rate responsiveness, GPS and smart phones, and even measures of

Challenges to PA monitoring in Australia:

- Variations in questions between and within jurisdictions over time
- Changes to PA guidelines (e.g. amount of recommended PA; addition of new dimensions such as strength)
- Variability in interpretation of PA guidelines (i.e. what amounts to 'sufficient PA' and how that is determined).

direct observation or laboratory assessment of direct energy expenditures.[6,7]

The second challenge is that our scientific knowledge has not remained static and neither has our science-based PA guidelines. Initial guidelines in the 1980s recommended aerobic activities (vigorous PA) three times a week for at least 20 minutes on each occasion. These were updated following the US Surgeon General's report on PA in 1996 to include consideration of moderate intensity activity, and the recommendation to accumulate 30 minutes a day of total daily PA. This was expressed slightly differently in different countries, but one Australian interpretation was "*5 times a week for at least 30 minutes on each occasion*". Included in this guideline was the concept of a minimum threshold, thought to be at least 10 minutes of continuous activity in order to derive a health benefit. Updated 2018 PA evidence reviews have removed this minimum threshold.[8] Recent reviews have revised the PA guidelines to recommend "*at least 150 minutes a week*" (without the need for the number of sessions or number of days) and in some countries including an optimal range for adults, namely 150–300 minutes per week of at least moderate intensity activity. These differences have created confusion across jurisdictions in Australia, with different estimates based on using different guidelines (see box below for possible variants). Guidelines have become more complicated including dimensions of strength training and balance training, also thought to contribute to health in adults, but particularly difficult to measure in populations.

Possible variants of the adult PA guidelines in current use in Australia

i. **Meeting the current WHO aerobic PA guideline of 150 minutes/week of at least moderate PA (or 75 minutes of vigorous, or combinations thereof)**

ii. **Meeting the 2014 Australian interpretation of the WHO aerobic PA guideline – range between 150 – 300 minutes of at least moderate intensity PA (with increased benefits at the upper end of this range)**

iii. **Meeting the previous aerobic PA guideline – at least 150 mins of moderate PA 5x/week (or its variant, 5x30 mins)**

iv. **Meeting the strength-based guideline (resistance activities) – training 2x/week**

v. **Meeting the 150 mins aerobic guideline (or variant) and the strength-based guideline**

vi. **Meeting a combination of:**

- **the 150 mins aerobic and the strength-based guideline**
- **the sedentary behaviour guideline**
- **balance guideline.**

[NB. Sedentary behaviour and balance are seldom reported; the threshold for sedentary behaviour is not clear for adults, and measurement problems limit the balance guideline]

Thus, the choice of guidelines poses challenges to prevalence estimation, which in turn contributes to different rates reported in different jurisdictions. Furthermore, estimates of the burden of disease attributable to physical inactivity are dependent on the prevalence of inactivity in population, which will be quite different given different ways of assessing it, which in turn will influence the relative importance of physical inactivity as a risk factor for poor health outcomes.

The above challenges are fundamental to policy makers, as they result from different population surveys that monitor PA. The speed of population change may be overestimated; for example, it would be of little use to have five year time frames for a particular measure if one considers that it would take 10 to 20 years to influence PA with optimal policy focused initiatives. Therefore, several recommendations underpin this section:

1. Maintain consistent PA monitoring measures over a prolonged period, the length of the period being determined by the time in which change is considered plausible and feasible (for example, up to the WHO target of a 15% reduction in inactivity by 2030)
2. Use consistent measures and survey methods that can be compared across jurisdictions over time
3. Report which PA guideline is being used as the primary indicator of 'sufficiently active' and if necessary, report other secondary guideline-derived thresholds in order to monitor trends.

1.2.3 Measures used in monitoring the proportion achieving 'physical activity guidelines' with a focus on Australia

Self-report measures have been developed in different decades, and typically reflect the measurement needs of that period. For example, in the 1980s when there was an aerobic 3x20 recommendation for health, questions were asked about 'exercise and sport' typically of a vigorous nature. These questions were used in the Australian Bureau of Statistics' (ABS) National Health Surveys (NHS) from 1989 until 2011, with almost exact comparability in questions over this timeframe. Careful analysis adjusting for population and demographic changes during this period enabled trend assessment among adult Australians meeting PA recommendations, or trends in doing very little PA (less than 30 minutes per week).[9] Subsequent surveys made changes to the NHS questions including the addition of new questions to measure walking and other dimensions of active travel (AT), strength training and sedentary/sitting time, leading to a range of diverse ABS estimates of the proportion meeting PA recommendations. It is recommended that the original 1989 PA questions be used continuously in future National Health Surveys, and are asked first, such that estimates can be compared over longer timeframes.

The history of PA population measurement in Australia started following the 1996 US Surgeon General's report on PA and health. The Australian Institute of Health and Welfare (AIHW) commissioned the development of a new measure for self-report PA that took account of these new guidelines; this became known as the Active Australia survey.[10] The Active Australia survey asked about the number of sessions and total time in the past week that people did (a) vigorous PA (b) walking and (c) moderate PA. At about the same time, international measures for population PA were being developed – the IPAQ and GPAQ (International and Global PA questionnaires respectively). The short IPAQ was generic, included occupational PA, and provided higher estimates of PA prevalence than previous measures. GPAQ provided domain specific estimates, for both moderate and vigorous activity, which could be used to estimate AT, exercise recreation and sport, and domestic/occupational PA, but it was substantially longer than the short IPAQ. At the state and territory level in Australia, different interpretations of the Active Australia (AA) survey and IPAQ/GPAQ measures were made and sometimes changed over time as improvements to the questions were suggested. This has made comparability difficult and suggest the need for standardisation and harmonisation of PA monitoring at the state and territory level.

The indicators for PA population surveys are based on the PA guidelines, revised in Australia in 2014. Note that there are still different ways of expressing these indicators. The purpose of Tables 1–3 is to illustrate the range of ways that meeting recommendations can be characterised, as described by the different ways in which questions are asked in existing population surveys.

Table 1. Adult physical activity (PA) guidelines and how they are operationalised in Australia

Descriptor from the PA adult guidelines for ages 18–64 years	How this is measured in Australian population surveys
"Be active on most, preferably all, days every week"	This cannot be operationalised as the PA questions in Australia typically ask about the number of sessions, not the number of days that activity was reported. Using GPAQ or IPAQ could estimate this. Sometimes, "five *sessions* and 150 minutes per week" is used to characterise this indicator.

Descriptor from the PA adult guidelines for ages 18–64 years	How this is measured in Australian population surveys
Accumulate 150 to 300 minutes of moderate intensity physical activity or 75 to 150 minutes of vigorous intensity physical activity, or an equivalent combination of moderate and vigorous activities, each week	The lower limit here, 150 minutes per week is the WHO 2010 guideline. The upper limit of 300 minutes/week, and incorporation of vigorous minutes can be easily computed. By convention, and consistent with physiology, vigorous minutes are multiplied by two and then added to moderate minutes and walking minutes. Note that some surveys, the ABS NHS 1989–2011, asked only about moderate and vigorous exercise. State based surveys often ask about walking as well (from the Active Australia survey), and sometimes include walking for recreation or leisure, and separately walking to get to or from places (AT).
"Do muscle-strengthening activities on at least 2 days each week"	Specific NHS questions have been introduced since 2014 asking about this indicator, but the validity of self-report is not known.
Minimise the amount of time spent in prolonged sedentary time/sitting (or break up sitting)	This is an overall general guideline for adults. Note that the epidemiological evidence is not yet clear enough to produce a highly specific threshold or cut point for adults.

Table 2. Children and adolescent physical activity (PA) guidelines and how they are operationalised in Australia

Descriptor from the PA guidelines for children and adolescents 5–17 years	How this is measured in Australian population surveys
Accumulate at least 60 minutes of moderate to vigorous physical activity every day	This is measured through a range of different questions in the national health survey and in state based surveys. The prevalence of NOT meeting this guideline is generally high for adolescents, typically ranging from 70 to 85% not meeting this guideline.[11]
Limit sedentary recreational screen time to no more than 2 hours per day	In some jurisdictions there are efforts to measure the screen time guideline, which is less than two hours a day for adolescents.

Table 3. Preschool aged children physical activity (PA) guidelines and how they are operationalised in Australia

Descriptor from the PA guidelines for preschool aged children	How this is measured in Australian population surveys
At least 180 mins/day of PA [1–2 and 3–5 year olds]	This is described as 180 minutes of total daily activity, with at least 60 minutes being "*energetic*".
Sedentary screen time should be ≤ 1 hour total through each 24-hour period	Screen time should be in bouts of no more than an hour. Recent guidelines also added sleep recommendations [which differ by age], to summate to total 24-hour movement guidelines [activity + sedentary time + sleep time]

1.2.4 Population data and trends in adult physical activity participation in Australia

National health surveys (1989–2017/18)

The NHS conducted by the ABS are conducted every few years on a sample of households that are representative of the Australian population. Data over the past four surveys are shown in Figure 1, indicating the proportion of

adults aged 18 to 64 years old who met PA guidelines (referred to as PAG in this Figure). The reference to meeting PA guidelines in Figure 1 refers to those who achieved at least 150 minutes of moderate to vigorous PA on five or more days per week. The definition of PA here included walking for fitness, recreation, or sport; walking to get to or from places; moderate exercise; and vigorous exercise (multiplied by 2) reported for the week prior to interview. Rates were age standardised to the 2001 Australian population.

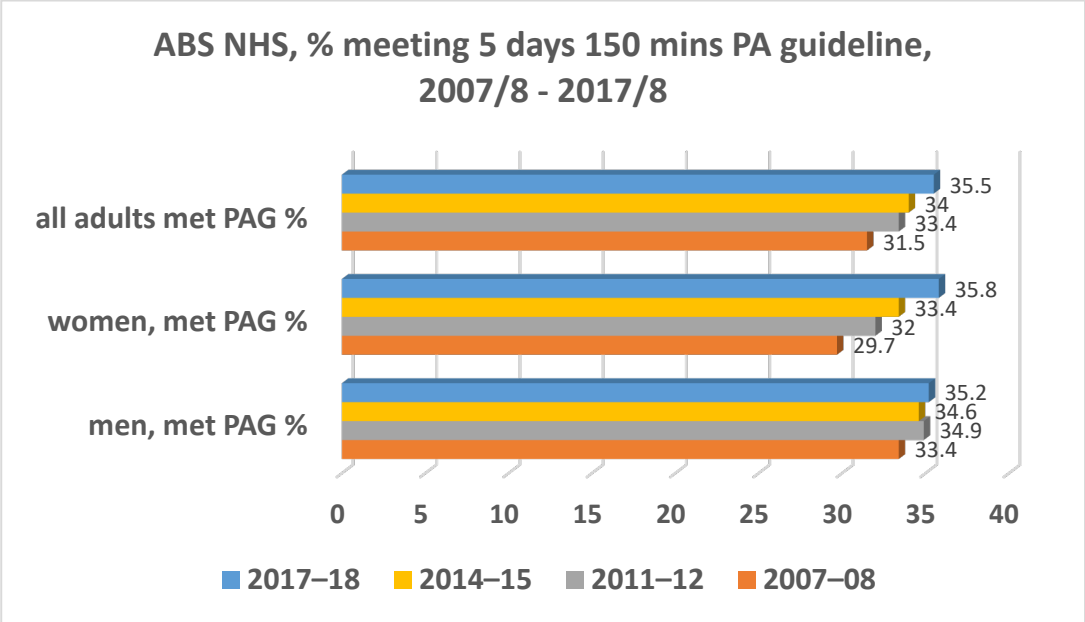


Figure 1. How active are Australians over time [5x150 PA guidelines]

Source: AIHW analysis of ABS 2019; ABS 2016; ABS 2014 and ABS 2010

Figure 2 shows a more fine-grained analysis by demographic subgroups and gender, based on the 2014/15 NHS. Here, the method used is different to Figure 1, because the analysis by the ABS used a definition of '*insufficient physical activity*' as <150 minutes of at least moderate activity, with no mention of sessions or days. Overall, 47.8% of working age adults met this definition of the PA guidelines (green in Figure 2), with 43.6% if all adults are included (i.e. including those aged over 65 years) (blue).

Here, it is clear that meeting the PA guidelines decreases with age, especially over the age of 65 years. There is also a lower rate of meeting PA guidelines in rural and remote areas, compared to cities, and a strong relationship with measures of social disadvantage. Those in the most advantaged regions are much more likely to meet the PA guidelines (60%), compared to 37.4% in the most disadvantaged regions. The data in red show trends over time, comparing 2007/8 with 2014/15, and reveals an overall 5% increase in meeting PA guidelines.

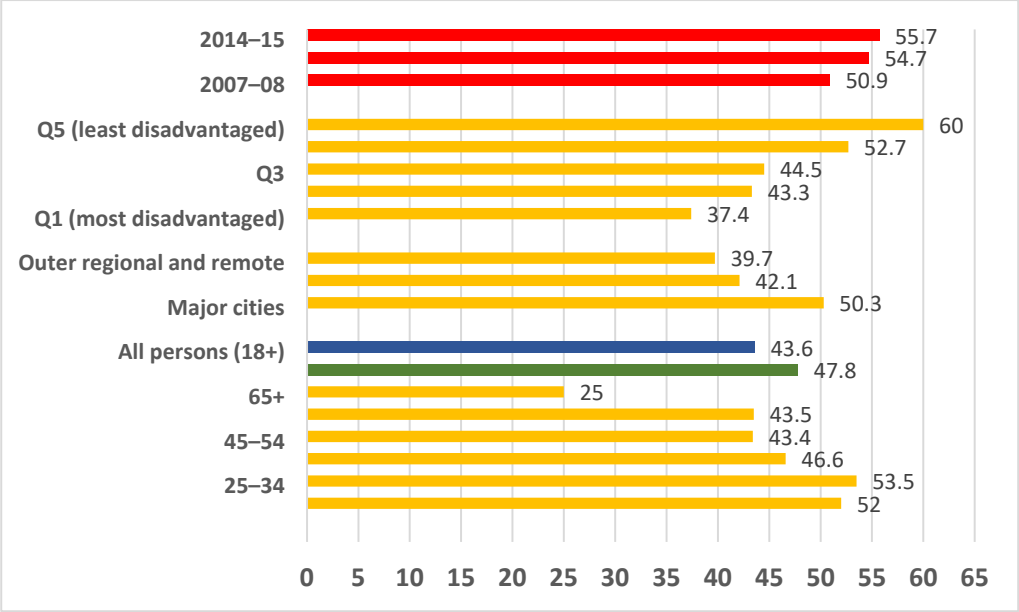


Figure 2. Variation in physical activity by subgroups, NHS 2014/15

Figure 3 shows the gender difference by age group; these differences between men and women are similar across different surveys and different definitions of meeting PA guidelines. Except for middle-aged adults, 3-6% more men achieve the PA guidelines compared to women.

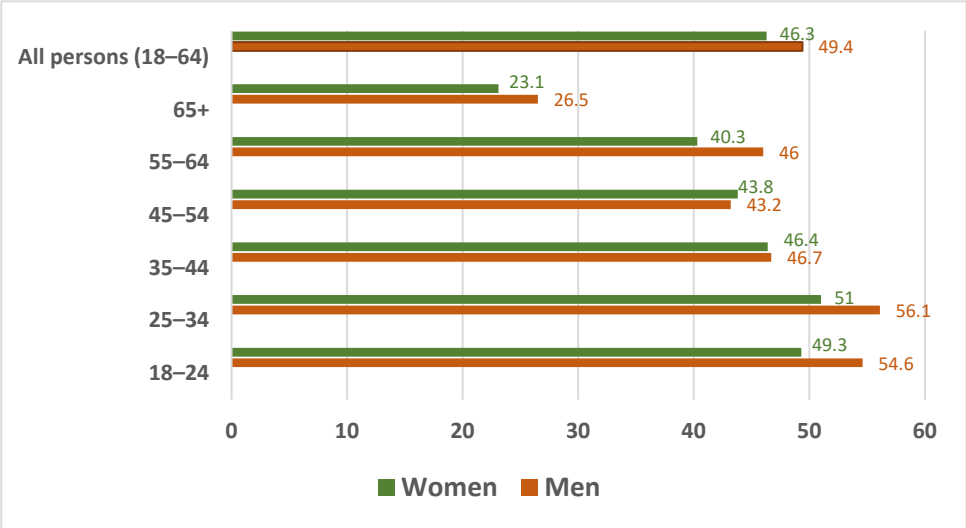


Figure 3. NHS 2014/15 Meeting physical activity guidelines by gender and age

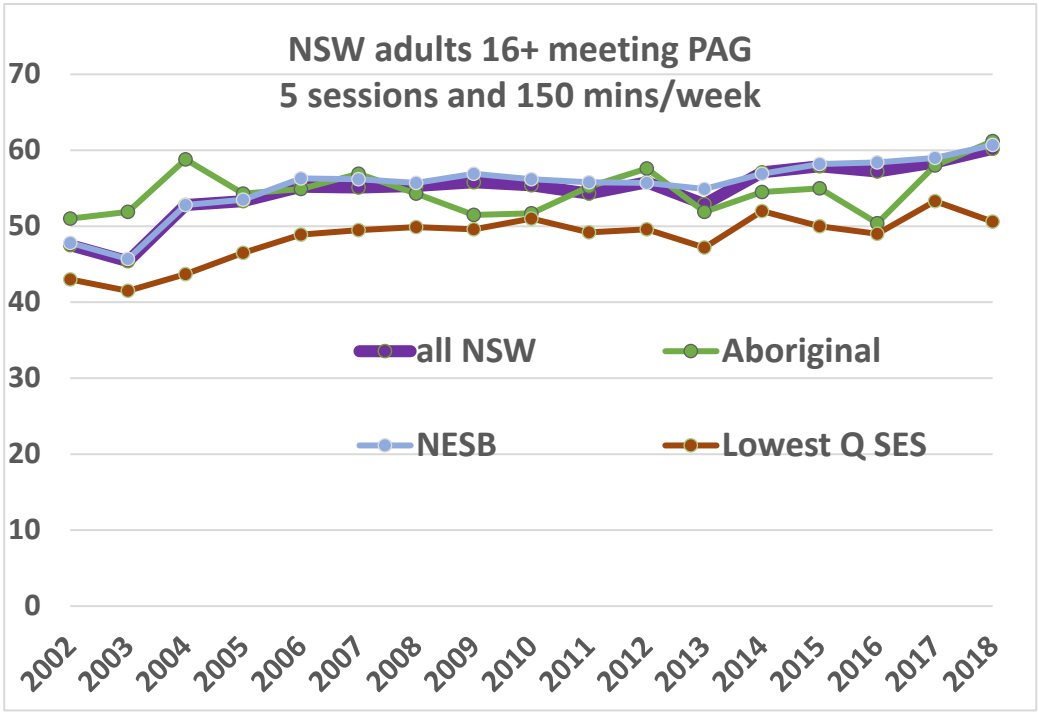
Source: AIHW analysis of ABS microdata, Australian National health survey (NHS) 2014/15

NSW state-level trends using Population Health Surveys (2002–2018)

Data from NSW are presented because that state has since 2002, collected annual telephone-based population data from representative samples of the NSW population using the same questions across survey years, as taken from AA. These surveys use a continuous rolling sampling schedule across the year, and since about 2015 included mobile phones in the sampling frame. 'Sufficient PA' is defined as ≥150 minutes/week over 5 separate occasions. There are some differences in the approaches used by NSW and the ABS NHS. For example, the NSW survey analysis includes all people aged at least 16 years, so it is a slightly broader age range than the NHS which report on data from adults 18 years and over. The NSW survey uses the exact AA questions, so their walking question incorporates walking for exercise and AT, whereas the NHS survey asks about walking for AT separately from

walking for exercise. Both surveys do not count gardening or household activity towards their calculation of sufficient PA, consistent with the surveillance approach recommended by AA. However, whereas walking is specifically excluded from the NHS questions for moderate and vigorous PA (along with gardening and household activity), only gardening and household activity are specifically excluded from the moderate and vigorous PA questions in the NSW survey. Possibly, some of these variations account for the difference in prevalence estimates for meeting PA recommendations, which for example in 2014/15 were around 5% higher under the NSW survey than the same period using the ABS NHS. One of the most likely reasons though, is that the samples are obtained through different modes of survey administration, with telephone-based surveys in NSW, and the ABS NHS employing a random household-based sample.

Examining the trends in PA in different groups has facilitated state-level population targeting of policy and programs. NSW data trends in meeting guidelines are shown in Figure 4, with the overall NSW rate described by the thicker purple line. The upper panel shows the trends at the appropriate scale; the lower panel zooms in on the trends by using a smaller range on the y-axis so that variation can be more easily seen. Notably, people from a non-English speaking background showed similar rates of meeting PA guidelines to NSW as a whole. Aboriginal adults, shown in the green line, showed substantial variability because of the smaller sample sizes each year, but were not substantively different to non-Aboriginal adults. The most socially disadvantaged group, shown in the brown line reported consistently lower rates of meeting the PA guideline. Of note, all groups showed an increase in meeting guidelines between 2002 and 2018, with the relative increase similar in high and low socioeconomic areas. Much of this increase appears attributable to increases in reported walking across all sociodemographic groups.[12] There seem to be two probable periods of increase, between 2003 and 2006, and then again in the period since 2013/14, attributable to changes in reported walking behaviour with no substantive changes in reported moderate or vigorous activity.



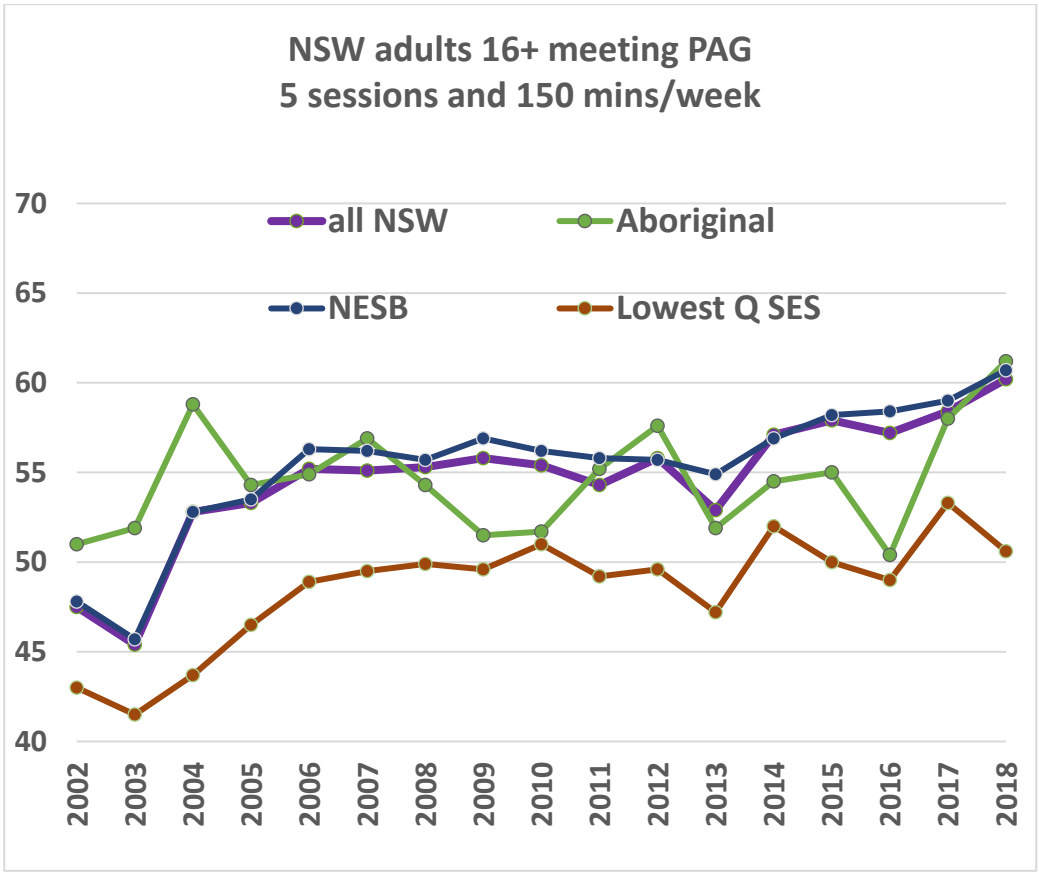


Figure 4. NSW trends, Active Australia survey, 5 x 150mins/week [usual Y axis scale, upper panel; smaller y axis scale lower panel]

1.2.5 Children and adolescents' physical activity in Australia

There are several different monitoring systems for assessing PA among children and adolescents (Table 2). The national PA guidelines recommend 60 minutes daily of moderate to vigorous PA for school aged children 5–17 years old, and less than two hours/day of non-essential screen time.[3] In addition, the guidelines suggest muscle and bone strengthening activity three times per week, and recommend healthy guidelines for sleep. Summary guidelines across the whole day are described as '24-hour movement guidelines' and have been released for preschool age groups.[13] These reflect all activity, sedentary/sitting time and sleep across a 24-hour continuum. There are specific guidelines for younger infants and children aged 0–5 year[13]; for example, among children aged 3–5 years, these guidelines suggest three hours of total movement per day (of which 60 mins should be "*energetic*"), limiting sedentary time to periods up to an hour, and 10–13 hours per day of good quality sleep.

The situation is more complex than among adults, with different questions used to assess children's and adolescents' PA in diverse population surveys across Australia. These different questions, although all were asked in representative surveys, provide different estimates of the prevalence of children and adolescents meeting guidelines.[14] There are no regular population data collected on infants and young children as part of surveillance systems to date.

ABS NHS data asked for parental report of their children's PA.[15] The NHS 2011–12 indicated that around 39% of children aged 2–5 years did less than the recommended three hours/day of activity. Three-quarters children aged 5–12 years, and 92% of adolescents aged 13–17 years did not meet the recommended 60 minutes of PA every day. Further, two-thirds of children exceeded the recommended limit of two hours of screen time.[15,16] These data are shown in Figure 5 below. The Guidelines further recommend children and adolescents undertake muscle strengthening activities at least three times a week; this was only asked of 15–17 year old adolescents of whom

22% of boys and 8% of girls met this guideline (16% overall in this age group). Boys were more active than girls, but the socioeconomic differentials in PA seen in adults in the NHS and in AusPlay data were not present in these NHS data. Aboriginal children were more physically active than non-Indigenous children at both primary school ages (60% meeting guidelines) and adolescents (45% met guidelines).

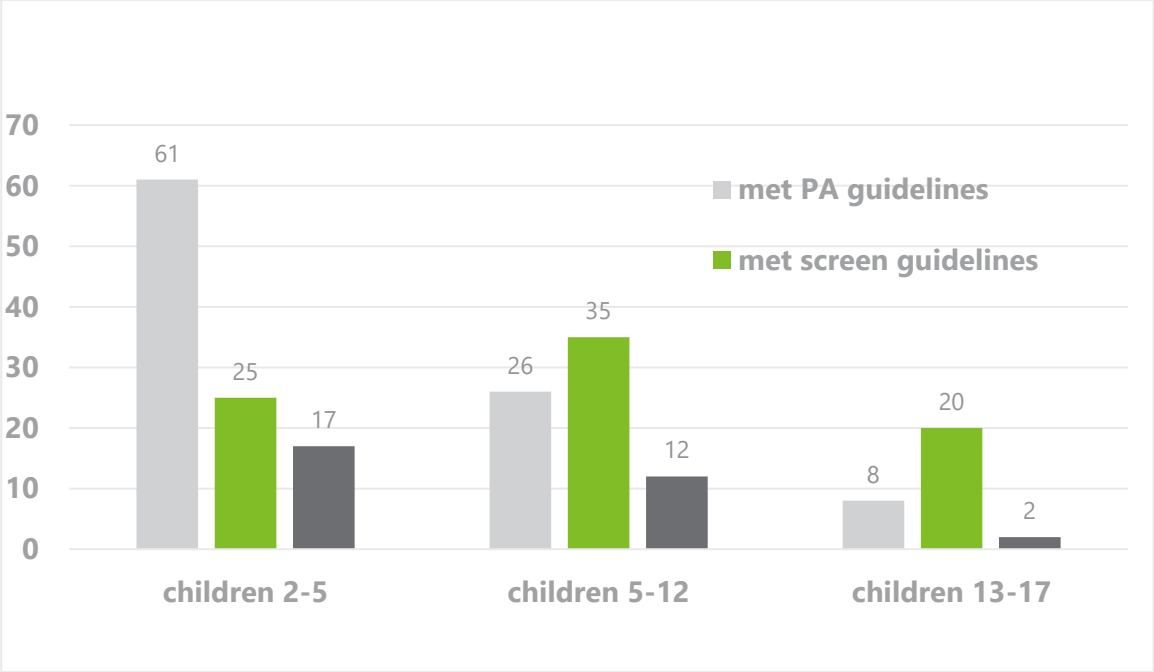


Figure 5. NHS 2011/12 Percent meeting age-specific physical activity guidelines Australian children and adolescents

Another large-scale population survey is the representative AusPlay surveys, carried out by Sport Australia.[17] Data obtained in 2016 and 2017 comprised 7,000 parents reporting on their children's participation in PA and sport outside of school in the previous 12 months.[18] Between 70 and 74% in 2016 and 2017 respectively participated in any activities in the previous year. Although not a health-specific indicator, the AusPlay survey reported "*regular participation of three times a week or more*" as an indicator for sport, and this was reported by 20% in 2016 and 25% in 2017. Boys were slightly more active than girls in all ages in childhood and adolescence, except for preschool-aged children (0–4 years). Organised PA were more commonly reported by more advantaged socioeconomic families, and by urban residents (compared to remote residents). Children from non-English speaking cultural backgrounds were less active than those from English speaking backgrounds. An important limitation is that AusPlay describes organised PA, which is a subset of all PA in children and adolescents, as the AusPlay survey excludes some incidental activities including AT, active play and non-organised informal activity.

A worldwide comparative research project has monitored policy and prevalence of PA among children and adolescents.[19] This project, the Active Kids Healthy Kids (AKHK) Global Matrix project, has collected data from 49 countries and provided ratings from 'A' to 'F' for indicators of policy and progress supporting children and adolescent PA. Overall, the AKHA report (2018) [20] rated Australian PA levels as a D-, indicating a low level of children and adolescents meeting PA guidelines, compared to other countries. This was unchanged from the ratings awarded in the earlier 2016 report card, where sedentary behaviour was also awarded a D- grade (AKHK 2016)[21] and a D- in 2014[22]. This was further confirmed in an updated worldwide scan of adolescent PA, which positioned Australian adolescents as among the least active in the world.[11] For screen time, Australian children and adolescents scored a D- rating, which was also awarded for AT to/from school. Access to a PE teacher scored a B+ rating, and having access to parks, playgrounds and living in safe neighbourhoods scored an A- rating. Investment and policy initiatives scored a D but were released before Sport Australia released the *National Sport Plan* in 2018. Australian children typically rated a B score for sport participation, which indicates reasonably good rates of sport participation, but sport alone may be insufficient to drive overall proportions meeting PA guidelines.[22]

Other data systems exist [references available on request]. These include state based systems, which sometimes collect children's PA data by parental report. Other population surveys, such as the triennial Australian Secondary

Students' Alcohol and Drug Survey, have additional modules for PA and other health behaviour. In NSW, there were serial Schools Physical Activity and Nutrition surveys (SPANS) up to 2015 which measured PA objectively, tracking measures of fitness and fundamental movement skills over time. There are also several cohort studies (such as LSAC) that are assessing PA over time in large samples of children from birth to adolescence and beyond. These different systems measure PA in different ways, so produce different prevalence estimates, and occasionally change questions to 'improve the validity of measures used', but at the expense of losing information on trends over time.

1.2.6 Physical activity prevalence in special populations

Special populations and variations in physical activity within subgroups

Numerous population studies have suggested that men are more active than women, and although this is consistent in self-report measures, data from the pedometer-based NHS of ABS in 2011/12 showed less gender variation among middle-aged adults in mean step counts by gender.[23] From self-report surveys, this is likely due to underestimation of household and incidental PA among women, or omission of these domains in mainstream studies. The gender divide starts in childhood, and by early adolescence, objective studies suggest that girls are less active than boys throughout adolescence.[23] This highlights the importance of gender specific strategies in this period, as they also are in cultural groupings through adolescence where activity is different for girls and boys. PA decreases with age, initially after young adulthood, leading to the middle aged 'slump' in activity as a result of work and family responsibilities that take up more of their available time. Subsequent declines occur especially after late middle age, with all dimensions of PA declining substantially in the late 60s and 70s, whether measured by self-report or objectively. A few international exceptions exist, but in Australian populations this is the usual pattern. PA is also distributed by other parameters, including rurality (overall, remote rural adults are less active), language spoken at home (people from diverse cultural backgrounds may be less active, especially those from South Asia, East Asia and the Middle East), and socioeconomic gradients occur in most PA measures, with the lowest activity and lowest organised sport participation among the most disadvantaged. Other factors associated with low PA at the population level include aspects of the built environment and transportation systems, social isolation, and those with chronic health problems including mental health.

Specific details below relate to two important groups for chronic disease prevention, namely Aboriginal and Torres Strait Islander people, and people with disabilities.

Indigenous Australians

PA prevalence among Aboriginal and Torres Strait Islanders has been collected by special ABS surveys in 2012/2013[24] (with the only example of trend data that is publicly available shown from NSW earlier). These results focused on non-remote Indigenous populations. Adults aged 18 years and over reported an average of 39 minutes/day of PA, with 38% meeting the 5x150 mins PA guideline in 2012/13. Among the special sample of remote living residents, 55% met the PA guideline, especially through walking, but also through traditional activities. A subsample of the non-remote residents participated in the objective pedometer assessment, and an average of ~7000 steps/day was recorded. These data were compared by ABS with non-Indigenous adults, and showed that age-adjusted, non-remote resident Aboriginal and Torres Strait Islander adults were slightly less likely to meet PA guidelines (rate ratio 0.8), and slightly less likely report any PA (rate ratio 0.9).

Indigenous children and adolescents aged 5–17 years in non-remote areas reported around 2 hours per day on PA, substantially more than non-Indigenous children and adolescents. Around 48% met the 60mins/day PA guideline, compared to 35% among non-Indigenous children. Among Indigenous children from remote areas, even more (82%) reported meeting the PA guideline. The Indigenous children and adolescents in the objectively measured pedometer study averaged 9500 steps/day. Indigenous toddlers and preschoolers (aged 2–4 years) in non-remote areas were reported to spend around 6.6 hours/day being active, with more outdoor time than non-Indigenous children.

Australians with disabilities

Rates of PA participation are substantially lower among people with disabilities compared to people without disabilities.[25] Meeting PA guidelines was lower among working aged adults with disabilities (34.6% compared to 50% of non-disabled people). People who were classified as having severe disabilities had even lower rates (typically less than half as active as the non-disabled population). Among older adults aged 65 and over with disabilities, 17.2% met the PA guidelines compared to 37.8% of those without disabilities.

1.2.7 Policy implications of prevalence data for adults and children

There are challenges to assessing the proportion of Australians that are physically active, among both adults and children. It seems that somewhere between 30 and 55% of adults achieve the minimum PA guideline recommended by the WHO and by the Australian Department of Health, but this variation is determined by different interpretations of the guidelines, and by different survey questions used. Most survey systems use the most recent '150 mins/week' of moderate-vigorous activity as in the current WHO recommendation, others use the slightly older '5daysx150 mins' criterion. Some surveys ask about strength training 2x/week and include that in the proportion 'meeting recommendations', resulting in fewer than 20% achieving the 'total PA recommendation'.

It is important to maintain consistent survey methods and measures over a prolonged time period to determine trends in the proportion of those meeting guidelines. The timeframe for consistent monitoring should be determined by the estimated period that optimum policy implementation will take to produce the required increases in PA.

Australia is a signatory to the WHO global monitoring framework, which targets a 15% reduction in physical inactivity by 2030[a], suggesting exactly comparable, consistent measures to 2030 should be sought. Survey reports should identify exactly which interpretation or combination of PA guidelines are being measured by the indicator chosen, so the differences in prevalence can be understood more easily.

An example of PA measurement consistency occurs in the USA, through the Behavioral Risk Factor Surveillance System (BRFSS). Identical questions are asked to collect data at state level, with the measures and methods overseen by the national Centers for Disease Control. This provides agreed national data collection, which can be compared across jurisdictions, as well as providing detailed state-level estimates. Changes to the PA are agreed nationally [and have occurred once since 1986]. Overall, the system has enabled clear assessment of trends, regional gaps, and national correlates to be established and monitored.

This approach to standardisation of measures will require substantial cross jurisdictional effort, policy congruence and methodological convergence. Such harmonisation would be possible given a national PA plan, as this would inform the monitoring component.

Key recommendations:

- **Maintain consistent PA monitoring measures over a suitably long period (e.g. to 2030)**
- **Use consistent and identical measures and survey methods to enable comparability across and within jurisdictions over time**
- **Report which guideline is being used to derive the 'sufficiently active' indicator.**

[a] This was described as a 10% reduction by 2025 (see www.who.int/nmh/global_monitoring_framework/en/) but has been updated to coincide with the Sustainable Development goals with the target adjusted to a 15% relative reduction in physical inactivity by 2030 [see the WHO Global Action Plan on Physical Activity (WHO 2018)[2]]

References

1. World Health Organization (WHO). Global recommendations on physical activity for health [Internet]. Geneva: WHO; 2010 [cited 2020 Mar 10]. Available from: apps.who.int/iris/bitstream/10665/44399/1/9789241599979_eng.pdf
2. Australian Government Department of Health. Australia's Physical Activity and Sedentary Behaviour Guidelines [Internet]. Canberra: Australian Government Department of Health; 2014 [last updated 2019 Apr 12; cited 2020 Mar 10]. Available from: www1.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines
3. Australian Government Department of Health. Australian 24-Hour Movement Guidelines for Children and Young People (5–17 years) – An Integration of Physical Activity, Sedentary Behaviour and Sleep [Internet]. Canberra: Australian Government Department of Health; 2014 [last updated 2019 Apr 12; cited 2020 Mar 10]. Available from: www1.health.gov.au/internet/main/publishing.nsf/Content/health-24-hours-phys-act-guidelines
4. Bauman A. Trends in exercise prevalence in Australia. Community Health Stud [Internet] 1987;11(3):190–196. doi: 10.1111/j.1753–6405.1987.tb00005.x
5. Milton K, Bauman A. A critical analysis of the cycles of physical activity policy in England. Int J Behav Nutr Phys Act [Internet] 2015;12:8–8. doi: 10.1186/s12966-015-0169-5
6. Pedišić Ž, Bauman A. Accelerometer-based measures in physical activity surveillance: current practices and issues. Br J Sports Med [Internet] 2015;49(4):219. doi: 10.1136/bjsports-2013-093407
7. Bauman A, Pedišić Ž, Bragg K. Objective Measurement in Physical Activity Surveillance: Present Role and Future Potential. In: Shephard RJ, Tudor-Locke C, eds. The Objective Monitoring of Physical Activity: Contributions of Accelerometry to Epidemiology, Exercise Science and Rehabilitation [Internet]. Cham: Springer International Publishing; 2016:347–367. Available from: link.springer.com/chapter/10.1007%2F978-3-319-29577-0_13
8. Powell KE, King AC, Buchner DM, Campbell WW, DiPietro L, Erickson KI, et al. The Scientific Foundation for the Physical Activity Guidelines for Americans, 2nd Edition. J Phys Act Health [Internet] 2019:1–11. doi: 10.1123/jpah.2018-0618
9. Chau J, Chey T, Burks-Young S, Engelen L, Bauman A. Trends in prevalence of leisure time physical activity and inactivity: results from Australian National Health Surveys 1989 to 2011. A [Article]. Aust N Z J Public Health [Internet] 2017;41(6):617–624. doi: 10.1111/1753-6405.12699
10. Australian Institute of Health and Welfare (AIHW). The Active Australia Survey: a guide and manual for implementation, analysis and reporting [Internet]. Canberra: AIHW; 2003 [cited 2020 Mar 10]. Available from: www.aihw.gov.au/reports/physical-activity/active-australia-survey/contents/table-of-contents
11. Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants. Lancet Glob Health [Internet] 2018;6(10):e1077–e1086. doi: 10.1016/S2214-109X(18)30357-7
12. Merom D, Ding D, Corpuz G, Bauman A. Walking in Sydney: trends in prevalence by geographic areas using information from transport and health surveillance systems. J Transp Health [Internet] 2015;2(3):350-9. doi: 10.1016/j.jth.2015.04.006
13. Australian Government Department of Health. Australian 24-Hour Movement Guidelines for the Early Years (Birth to 5 years): An Integration of Physical Activity, Sedentary Behaviour, and Sleep [Internet]. Canberra: Australian Government Department of Health; 2014 [cited 2020 Mar 10]. Available from: www1.health.gov.au/internet/main/publishing.nsf/Content/npra-0-5yrs-brochure
14. Pedišić Ž, Zhong A, Hardy LL, et al. Physical activity prevalence in Australian children and adolescents: Why do different surveys provide so different estimates, and what can we do about it? Kinesiology [Internet] 2017;49(2):135–145. doi: 10.26582/k.49.2.14

15. Australian Institute of Health and Welfare (AIHW). Physical Activity across the Life Stages. [Internet] 2018 [cited 2020 Jan 24]. Cat. no: PHE 225. Available from: www.aihw.gov.au/reports/physical-activity/physical-activity-across-the-life-stages/contents/table-of-contents

16. Australian Institute of Health and Welfare (AIHW). Insufficient physical activity [Internet] 2019 [cited 2020 Mar 10]. Cat. no: PHE 248. Available from: www.aihw.gov.au/reports/risk-factors/insufficient-physical-activity

17. Sport Australia. AusPlay National results [Internet]. Canberra: Clearinghouse for Sport and Physical Activity. Updated 2019 Oct 31 [cited 2020 Mar 10]. Available from: www.clearinghouseforsport.gov.au/research/smi/ausplay/results/national

18. Sport Australia. AusPlay Focus: Children's Participation in Organised Physical Activity Outside of School Hours [Internet] 2018 [cited 2020 Mar 10]. Available from: www.clearinghouseforsport.gov.au/__data/assets/pdf_file/0012/796827/AusPlay_focus_Children_Participation.pdf

19. Active Healthy Kids Global Alliance. The Global Matrix 3.0 on physical activity for children and youth [Internet]. Ottawa: Active Healthy Kids Global Alliance; [updated 2020 Feb; cited 2020 Mar 10]. Available from: www.activehealthykids.org/

20. Active Healthy Kids Australia (AHKA). Muscular Fitness: It's Time for a Jump Start. The 2018 Active Healthy Kids Australia Report Card on Physical Activity for Children and Young People [Internet]. Adelaide: AHKA; 2018 [cited 2020 Mar 10]. Available from: www.activehealthykidsaustralia.com.au/report-cards/

21. Active Healthy Kids Australia (AHKA). Physical Literacy: Do Our Kids Have All the Tools? The 2016 Active Healthy Kids Australia Report Card on Physical Activity for Children and Young People [Internet]. Adelaide: AHKA; 2016 [cited 2020 Mar 10]. Available from: www.activehealthykidsaustralia.com.au/report-cards/

22. Active Healthy Kids Australia (AHKA). Is sport enough? 2014 Report Card on Physical Activity for Children and Young People [Internet]. Adelaide (AUST): AHKA; 2014 [cited 2020 Mar 10]. Available from: www.activehealthykidsaustralia.com.au/report-cards/

23. Australian Bureau of Statistics (ABS). Pedometer steps, in 4364.0.55.004 – Australian Health Survey: Physical Activity, 2011–12 [Internet] 2013 [cited 2020 Mar 9]. Available from: www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.004Chapter5002011-12

24. Australian Bureau of Statistics (ABS). 4727.0.55.004 – Australian Aboriginal and Torres Strait Islander Health Survey: Physical activity, 2012–13 [Internet] 2014 [cited 2020 Mar 10]. Available from: www.abs.gov.au/ausstats/abs@.nsf/mf/4727.0.55.004?OpenDocument

25. Australian Institute of Health and Welfare (AIHW). People with disability in Australia [Internet]. Canberra: AIHW; 2019 [cited 2020 Mar 10]. Cat. no: DIS 72. Available from: www.aihw.gov.au/reports/disability/people-with-disability-in-australia/summary

5. Physical activity surveillance

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5.1 Introduction – the role of surveillance

Surveillance systems grew out of infectious disease monitoring, to enable early detection and tracking progress of epidemic disease. Surveillance is defined as the "*(continuous) systematic collection, analysis, and interpretation of data for use in the planning, implementation, and evaluation of public health (programs and) practice*".[1] With the increase in noncommunicable disease (NCD) in recent decades, surveillance of NCD risk factors has become a routine part of public health monitoring.[2] Optimal physical activity (PA) surveillance needs to assess elements of the *PA system* as well as monitor the population prevalence of PA. This chapter is linked to Chapter 1.2 on the prevalence of PA and meeting PA guidelines among Australians, with common themes of measurement and monitoring. The focus of this chapter is to describe the measures of PA used in surveillance and elaborate on the broader measurement and monitoring required for an optimal PA surveillance system (PASS). A surveillance system is tied to the specific elements of a National or regional PA Plan and includes a range of indicators required to monitor the implementation and outcomes specified in that Plan.

5.2 Measures of PA

An optimal PASS needs to use standardised protocols and measures. The first step is to assess PA, usually expressed as the proportion of adults or children meeting PA recommendations (see Chapter 1.2). Traditionally, surveillance systems have used self-report measures, where people are asked to describe their PA participation in a recent period, usually in the past week, past two weeks, or past month.

In designing a PASS, the purpose and type of measurement of PA should be specified: (i) which measure will be used, (ii) has it been validated and used in surveillance systems, and (although rarely considered) (iii) is it sensitive enough to detect changes in population PA. PA is often categorised and assessed by (i) intensity (e.g. light, moderate, and vigorous), (ii) domain (e.g. work, transport, domestic, and leisure time), and (iii) type (e.g. walking, cycling, running, specific sports). Measurement can occur across the whole 24-hour spectrum, and can, in addition to measures of PA, also include sitting/sedentary time and sleep (see Figure 1). Establishing which among these measures are essential for surveillance needs careful consideration, based on the strategic outcomes proposed in the PA Plan. These should be monitored consistently for the duration of the PASS; typically, this should be at least 10–20 years (i.e. the time required to expect changes in endpoint PA behaviours at the population level). As described in Chapter 1.2, the PA measure should be identical over time to enable time-trends to be established, and should be identical between jurisdictions to enable geographical comparisons.

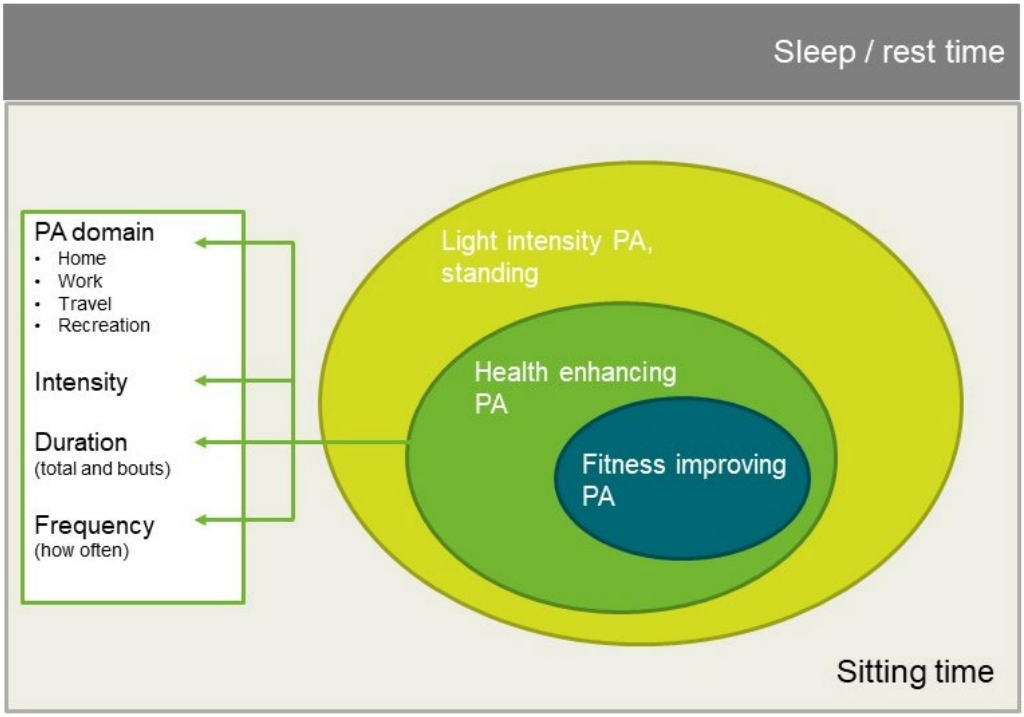


Figure 1. The spectrum of movement behaviours that might be measured

Measurement dimensions may include the frequency of PA, the intensity, the duration of activity, and the types of PA. In some generic brief PA instruments, such as the Active Australia survey[3], these elements are measured broadly, as brief instruments are only six items long. In some surveillance systems, it may be relevant to measure each of the domains or settings for PA in more detail. The mode of data collection should be considered carefully, as self-report measures may provide different estimates when completed by personal or telephone interview, or online.

One problem is that when PA guidelines or recommendations change, the measures to assess them also need to be changed, and this may have a substantial impact on prevalence estimates[4, 5] (see Chapter 1.2). In reality, even small changes to the wording of self-report questions may have a large impact on PA prevalence estimates, and if instruments are changed midcourse, this may obscure accurate trends in PA.[6] Careful attention to preserving identical PA questions over time is necessary for surveillance, even in the face of a plethora of research evidence continuously suggesting alternative and 'improved' measurements. Sometimes, the list of PA measures may need to be expanded, as new dimensions are recommended by updated PA guidelines. For example, in the past decade there has been increasing interest in specific measures of transport related PA, measures of sedentary behaviour/sitting time, and measures that reflect participation in muscle-strengthening activities and exercise to improve balance. Adding new indicators to an ongoing PASS should be done without affecting the existing set of PA measures.

There has been scientific 'pressure' in recent years suggesting that device based measures of PA (sometimes referred to as 'objective measures') are more reliable and valid than self-reported measures, and some countries have included accelerometer based measures in their surveillance systems (notably Norway, Sweden and the USA). Accelerometers measure different things to self-report PA, and although reliable, may show differential validity across accelerometer models and do not necessarily provide comparable estimates.[7] Future attempts to harmonise raw accelerometer data may solve this problem, but currently this remains a limitation of accelerometer use. Pedometers have been effectively used in surveillance systems in Canada, to monitor steps in school aged children over time (within Canadian Physical Activity Levels Among Youth – CANPLAY national PASS[8]), and adult pedometer surveillance has been used in Japan for several decades.[9] Pedometer measurement was used in several Australian national and state level surveys to provide a device based indicator of PA.[5]

PA estimates can also be derived from time-use surveys.[10] Such surveys have been conducted in more than 85 countries worldwide[11], and they inquire about the time spent in a range of daily activities, usually referring to the past day. Although PA estimates from time-use surveys show good reliability and validity[12], processing time-use survey data to obtain PA estimates may be challenging.[13]

Other possible ways of assessing population PA may be through monitoring of aggregated online data from PA apps, wearable devices such as Fitbits, smart phones and smart watches.[14] These are relatively unobtrusive methods for population measurement, but their measurement properties and data sharing and privacy protocols still need to be established.

Each of these different methods of PA measurement will be relevant in different settings, have different cost structures and have different implementation challenges. An informed decision to use a particular form of measurement will be made based on a number of factors and will require consideration and advice from a PA measurement specialist.

5.3 Examples of relevant physical activity surveys in Australia

The data in Table 1 demonstrate the diversity of measures used to assess population level PA in Australia. There is a need for standardisation and consensus processes, to define which measures form the essential components of any proposed integrated and comprehensive PA surveillance system. A survey based example that collected PA and fitness, but also environmental and organisational measures through serial population based surveys was the NSW Schools Physical Activity and Nutrition surveys, 1997-2015 (see ***Case study*** at the end of this chapter).

Table 1. Examples of population surveys of relevance to physical activity surveillance in Australia

Level of measurement, sector	Surveys	Requirements for a surveillance system
National health surveys, run by ABS, every 3-5 years	National health surveys; ABS NNPAS (2012)[15]	Routine, comparable PA questions over 30 years NNPAS included pedometer measures
State health surveys **Variable periodicity, some run continuously all year; surveys of adults and children**	State based health survey systems. These typically ask about PA participation, but sometimes include questions on strength training, sedentary time, screen time among children	Note that these surveys use slightly different questions across jurisdictions, so they are not always comparable, and questions sometimes change over time[5]
Routine adolescent health surveys, led by Cancer Council of Victoria	Regular NaSSDA surveys[16], provide sufficient samples for some state level prevalence estimates	Use validated single item PA question for adolescents
Various large health related cohort studies	Large sample cohort data, with repeated measurements on the same individuals; for example, HILDA and LSAC (children), 45&Up, AusDiab, ALSW, Raine (adults and older adults)	Follow same individuals with drop out occurring; but provide useful data on PA correlates and possibly impact evaluation data for assessing population intervention effects
Sport sector	Sport participation surveys (PSM 1990s, then ERASS in the 2000s, then a five year hiatus, and then AusPlay surveys	Population surveys of sport participation and its distribution; changes to surveys and sampling preclude long term trend

Level of measurement, sector	Surveys	Requirements for a surveillance system
	2015 onwards[17])	analysis
Economic and labour force statistics	Time-use surveys[12] – less frequent surveys, reflect total time used across the day	Can be used to estimate long term trends in PA and time spent in sedentary behaviours
Department of Transport [various jurisdictions]	Transport and travel surveys: describe trips and trip modes using a two-day diary in representative population samples (see ***Case study*** at the end of this chapter for indicators developed from state based transport surveys)	Allows estimates and establishing long term trends in active travel (AT); data access for PA surveillance purposes varies across jurisdictions, for data trend example, see Merom et al 2010[18]
Other/miscellaneous population surveys	Other surveys, such as the ABS General Social Survey, sometimes asked PA relevant questions; ABS Census is useful for trends in mode of travel to work on the Census day	Several non-health data sources could be considered for inclusion in any PA surveillance system

ABS NNPAS, Australian Bureau of Statistics National Nutrition and Physical Activity Survey; NaSSDA, National Secondary Students' Diet and Activity; HILDA, Household, Income and Labour Dynamics in Australia survey; LSAC, Longitudinal Study of Australian Children; 45&Up, surveys from the 45 and Up study; AusDiab, Australian Diabetes, Obesity and Lifestyle Study; ALSW, Australian Longitudinal Study on Women's Health; Raine, surveys from the Raine study; PSM, Population Survey Monitor; ERASS, Exercise, Recreation and Sport Survey

5.4 What kinds of physical activity questions exist in international surveillance systems?

Internationally, through the World Health Organization (WHO) STEPwise approach to surveillance (STEPS), the GPAQ (Global Physical Activity Questionnaire) is widely used in more than 100 countries for assessing domain specific population PA levels. Surveillance systems for adolescent PA have occurred internationally through the WHO Global School Health Survey, and through the European Health Behaviour in School-aged Children Survey (assessing health behaviour in school children in 49 countries). Within countries, long term monitoring of PA has occurred in the United States through, for example, the Behavioral Risk Factor Surveillance System (BRFSS), in Canada through the Physical Activity and Sport Monitor (PAM) surveys, and in Finland and Baltic countries through the Finbalt Health Monitor surveys, providing long term comparable questions to assess PA trends.

Note that some surveillance systems ask detailed questions about each of the activities that the respondent reported in the previous *12 months* (e.g. in the Canadian PAM), which provides a period prevalence estimate for PA as well as for sport participation. Most surveys ask shorter PA questions, usually recalling PA over the previous one to four weeks. These are typically 6 to 20 questions long and may provide data on domains of PA (work/domestic, transport activity, leisure time activity) or just generic total PA estimates, often characterised as the total time or relative energy expenditure in walking, moderate intensity activity and vigorous intensity activity.

5.5 Beyond individual behavioural measures: building a PASS

5.5.1 Overview of a PASS

Comprehensive surveillance requires assessment of the PA system, not just estimates of PA behaviours (See Table 2). A PASS is a modular structure, with components added as necessary in a particular setting or jurisdiction, or for particular purposes. For example, in Canada the PAM surveys[19] standardised data for both health and sport sectors, and for all thirteen provinces and territories. This system collected data from organisations, municipalities and several sectors, regarding policy and programs across Canada, as well as monitoring individual physical activity and sport behaviour.

As shown in the table below, there are routine survey indicators that need to form the long term components of PA surveillance (level 3 measures). Then, a PASS might collect routine organisation level and policy implementation indicators (shown as level 2 indicators in the table). Examples of ecological level indicators are shown in the ***Case studies*** at the end of this chapter, particularly the community-wide system level indicators developed to monitor the ***Victorian Health and Wellbeing*** initiative. More acute or short term implementation measures may be added as needed to a PASS to reflect more immediate indicators of a particular component of the overall PA strategy.

Planning and designing a PASS should be a part of developing any national or regional PA strategy, and the PASS should be integrated into the PA Plan. It is more difficult in situations where there is no specific PA plan, where elements of PA surveillance are embedded in general population health indicators, or in an Obesity or Chronic Disease strategy. It is difficult to measure the unique PA-related inter-agency components of a PASS in such 'embedded' situations, as the 'system' is broader and more diffuse if 'all NCD' or all population health indicators are included.

Table 2. Levels of indicators in a PASS

Measurement purpose and frequency of assessment	Measurement purpose	Examples
Level 1. Short term implementation Ad hoc process measures as needed No routine measurement	Implementation Indicators [process]	PA implementation policy and plan Mobilisation of resources and timeframe Delivery of programs as intended to reach targets (e.g. school physical education (PE) delivered; municipality builds of multi-use parks) Creation of infrastructure on time and budget
Level 2. Organisational and policy indicators Routine surveys or audits of key organisations, stakeholders and environments	Settings; system	Routine surveys of workplaces, schools, primary care, local government, transport and planning sectors Workplace policy implemented Audits to monitor the built environment Systems to monitor non-health indicators such as public transport or park usage Surveys or interviews of stakeholders
Level 3. Core survey based indicators Routine individual based surveys on PA behaviours and their correlates	Individual	Surveys among population-representative samples Measures of PA antecedents such as access to services, social norms and support, intention, self-confidence to be active, barriers Measures of other health indicators such as wellbeing, mental health, other health outcomes

5.5.2 Principles of a comprehensive PASS

A comprehensive PASS should be designed according to the principles set out in Table 3.

Table 3. Design principles for a PASS

Design principle	Description
1. Generalisability	It will provide population-generalisable estimates
2. Simplicity	It will cause minimal respondent and researcher burden
3. Data quality	It will provide reliable and responsive estimates of population-level PA
4. Comprehensiveness	It will collect data on all essential components of individual-level PA behaviour and the PA system
5. Between-jurisdictional comparability	It will use standardised measures, to allow for comparisons among jurisdictions and with other countries
6. Continuity and sustainability	It will retain comparable measurement methods over time, to identify trends
7. Adaptability	Its data collection protocols will be flexible enough to enable any essential adaptations to be made without affecting comparability of data over time
8. Affordability	It will require dedicated, secure funding, distributed across different components/measures

5.5.3 Measures for a PASS

Deciding on the choice of measures depends on whether the PASS is standalone and linked to a PA Plan, or whether it is to assess which components of a PASS can be included in existing NCD or Obesity monitoring frameworks, in which PA is often subsumed. There is no clear guidance on which elements are mandatory, as it depends on the jurisdictional definitions of 'meeting PA guidelines', the organisational change strategies that require monitoring, and the urban environmental / transport interventions that are included as part of prevention strategies. From existing strategic planning documents, a set of PASS-related components can be developed. Note that PASS measures should only be applied where actual change is feasible within the timeframe of the strategic policy; incomplete policy definitions or uncertain timeframes should preclude the use of PASS measures, as otherwise uncertain or incomplete conclusions may be drawn.

The types of measures that could be embedded in a PASS include those set out in Table 4.[20]

Table 4. Types of potential measures for a PASS

Type of measure	Description and examples
1. Individual level measures	These would be obtained from surveys for all age groups and possibly in any special population group or target group identified in the strategy. They may include: • Measures of PA participation; derived from health-enhancing PA measures; or from transport surveys, occupational surveys, sport participation surveys, or time-use surveys [level 3 measures] • Measures of muscle-strengthening activity and sedentary behaviour/sitting time [level 3 measures] • Community views and support for PA behaviour changes, support for public transportation, support for changes in the built environment, support for PA programs at the local level [level 1 measure, as needed]

Type of measure	Description and examples
	• Individual level antecedents and determinants of PA, which might include intention to be physically active, attitudes towards PA, perceived barriers to being active, and community awareness of the recommended amounts of PA [level 3 measures]
2. Organisational level measures	The following are possible examples [all level 2 measures]: • Engagement of municipalities or local councils • Engagement by childcare and preschool facilities • Engagement and changes in schools, PE, wider school/educational environments, AT to school, use of the school before and after class time for PA • Participation by workplaces in providing PA advice, programs, and opportunities • Engagement of the healthcare setting, activity recommendations in primary care, and PA recommendations for people with existing NCDs • Engagement of workplaces in implementing PA strategies and policies, activity facilities at work, and travel to work incentives
3. Macro level (policy/system) indicators	For example, including: • The existence of PA national plan • The existence and maintenance of cross-sectoral partnerships to promote PA, coalitions and support structures • Committed PA resources in strategic documents • Commitments by non-government organisations and other agencies to PA [this is qualitative, but is part of level 2 measurement]
4. Built environment and transport measures	Measures of the built environment and transport environment, walkability, related urban form and urban density measures [level 2 measurement; see ***Case study*** of the ***Australian Urban Observatory***, at the end of this chapter]
5. Monitoring of policies, practices, program implementation and reach	Monitoring of policies and practices around PA, monitoring of implementation of programs and their population reach [ongoing measure, level 2]
6. Monitoring of dissemination, reach and uptake of PA guidelines	Monitoring of the dissemination and reach of PA guidelines and their uptake by professional organisations and groups, in the general population, and [within communities [this is part of assessing the reach of the PA strategy, level 2 measure]
7. Additional indicators specific to certain types of PA and settings for PA	Additional indicators relevant to specific types and settings for PA that can be linked to any level of measurement. For example, a sport participation surveillance system may need details of specific sports and the extent, type, and costs of participation. A different setting, such as a transport, may need data on the nature and mode of reported trips, on car usage, and possibly air quality indicators, as well as behavioural measures of active or passive transportation

5.6 Conclusion: Guidance for policy makers

Developing a PASS is a major undertaking, but it is an essential part of PA strategic planning. It comprises a planned collection of information to understand and support the implementation and evaluation of a PA strategy.[21] It is part of the planning phase of a PA strategy, and provides information that should be used continuously to aid refinement and modification of the strategy implementation. Expert decisions need to be made about the measures used, and there needs to be long term commitment to maintain identical measures throughout the lifecycle of a PASS [especially level 2 and 3 measures]. If PA is embedded in other prevention-related activities, then elements of the PASS relevant to that system assessment should be used. In optimal

circumstances, a comprehensive PASS is a multilevel integrated set of indicators and measures that monitors implementation of a National PA Plan, and assesses individual level behaviours, organisations, settings and sectors, and their relationships in the PA system over time.

Further resources and examples

Refer to the links listed under 'Surveillance and monitoring' in Appendix 5 for other useful resources and guidance.

Refer to Appendix 3 for some illustrative examples of policies, programs and other initiatives in Australia that relate to this domain (particularly those described under GAPPA 4.2, 4.3).

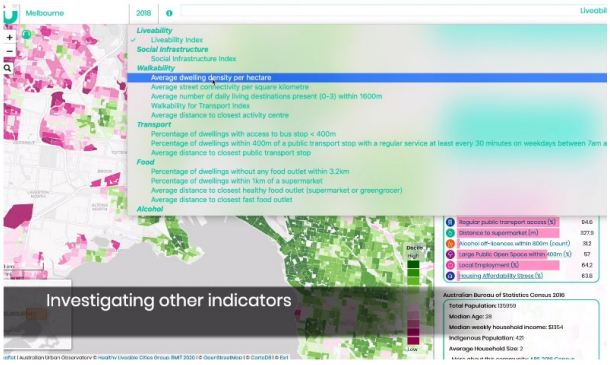
Some ***Case Studies*** are provided below as examples of cross-sectoral surveillance efforts that monitor a component of the PA system. These reflect indicators for urban form, measurement indicators from transport surveys for AT, a NSW survey system for school children and adolescents, and a set of indicators for a state based system to monitor health and wellbeing outcomes in Victoria.

Case study: Australian Urban Observatory

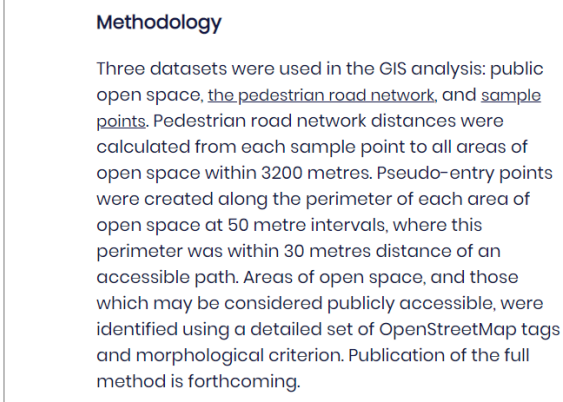
https://auo.org.au/

The ***Australian Urban Observatory*** is an online tool developed by RMIT health and urban researchers that policy makers can use to measure and compare the liveability of Australian cities, suburbs and neighbourhoods across the domains depicted to the right. The tool can therefore support decisions about resource allocation and policies and programs to create equitable, healthy and liveable places.

Users can access indicators for each of the domains, visualise the indicators within a specific area, and compare indicators across major capital cities for different areas.



Indicators have been chosen based on their association with health and wellbeing outcomes and connection to government policies. The Observatory website explains the rationale for each indicator, what the indicator measures, and how it is measured (see example to the right which describes the methodology behind measurement of the indicator 'Public open space').



Methodology

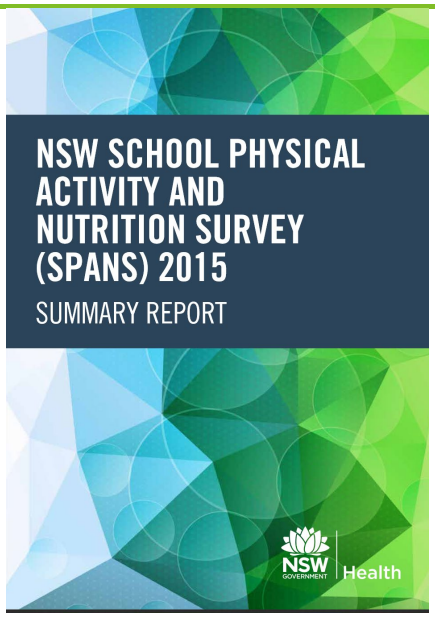
Three datasets were used in the GIS analysis: public open space, the pedestrian road network, and sample points. Pedestrian road network distances were calculated from each sample point to all areas of open space within 3200 metres. Pseudo-entry points were created along the perimeter of each area of open space at 50 metre intervals, where this perimeter was within 30 metres distance of an accessible path. Areas of open space, and those which may be considered publicly accessible, were identified using a detailed set of OpenStreetMap tags and morphological criterion. Publication of the full method is forthcoming.

There is a short video tutorial on the website which explains how to use and interact with the Observatory maps.

Case study: NSW Schools Physical Activity and Nutrition Surveys (SPANS) (1997-2015)

Weblink to the 2015 SPANS survey: www.health.nsw.gov.au/heal/Pages/spans-2015-full-report.aspx

The ***NSW SPANS*** *(Schools Physical Activity and Nutrition Survey(s))* were carried out every ~5 years between 1997 and 2015 on representative samples of NSW School students. These were sampled from primary school grades 2,4,6, and secondary schools grades 8 and 10, and collected data on PA and sport participation, the school environment, physical education policies, and in addition, objectively measured fitness using the 20 metre beep test, and measured fundamental movement skills, related to the capacity for sport and PA participation.



Examples of data summaries for primary school (upper row) and secondary school pupils (lower panel)

- Less than 1 in 4 (23%) children met the physical activity recommendation every day.
- Among children from Asian cultural backgrounds this was around 1 in 10 (11%).

- 63% of children were in the healthy fitness zone for cardiorespiratory fitness.
- 37% of children were in the healthy fitness zone for muscular fitness.

More than half of adolescents (59%) were in the healthy fitness zone for cardiorespiratory fitness.

Case study: Indicators of active transport (Victoria)

www2.health.vic.gov.au/about/publications/policiesandguidelines/victorian-public-health-and-wellbeing-outcomes-framework

The Victorian Public Health and Wellbeing Outcomes Framework embeds PA measures as part of a broader outcomes framework. The framework brings together indicators from multiple data sources, including for AT.

Example of the information provided by the Data Dictionary for the active transport measure

Domain 1: Victorians are healthy and well | Outcome 1.3: Victorians act to protect and promote health | **Indicator 1.3.1: Increase healthy eating and active living**

Measure	Proportion of journeys that use active transport	
Rationale	Active transport refers to unassisted travel (walking) or non-motorised (bicycle) transportation with an intended purpose or destination. Active transport has many demonstrated benefits – personal (health and fitness), social (community connectivity), environmental (reduced carbon footprint) and economic (infrastructure costs). Adults who walk for transport are more likely to achieve sufficient physical activity than those who do not. A significant proportion of public transport users report that they meet all their recommended levels of physical activity just from their active transport associated with public transport use.	
Measure detail	**1.3.1.7**	**Proportion of journeys that use active transport**
Target	Not set	
Definition	*Numerator:*	Number of trips recorded by household residents on their survey day made in part or fully by walking and/or bicycling
	Denominator:	Total number of trips in survey, weighted to mid-year population estimate (Source–ABS)
	Mode:	Proportion
Data source	*Baseline and future:*	Victorian Integrated Survey of Travel and Activity (VISTA) DEDJTR
	Alternatives:	VPHS (reported as indicators of adults cycling for transport and adults walking for transport)
Data availability	*Baseline year:*	2012–14
	Frequency:	Annual for Melbourne (based on rolling 2-year average); every 4–5 years for Geelong and regional centres
Breakdown	Data available for the survey area by age, sex, purpose of journey, day (all days, weekday, weekend), transport mode and household income, and by location (Melbourne inner/middle/outer, Geelong and Regional centres).	
Comparability	National, state and territory comparison unavailable.	
Linked to	Proportion of adults, adolescents and children who are sufficiently physically active (Measure detail 1.3.1.6.A–C) Proportion of adults, adolescents and children who are overweight and obese (Measure detail 1.3.2.1.A–F) Liveability (TBD) (Measure detail 5.1.1.1)	
Further information	Nil.	

Where data is available, the Outcomes framework also enables assessment of health and wellbeing inequalities.

Snapshot of available population groups and geographic breakdowns for PA measures in the framework

Measures (detailed)		State	Equalities and inequalities (state level)									Geographical		
			Age	Sex	Aboriginal and Torres Strait Islander	Cultural and linguistic diversity	Sexual orientation and gender identity (LGBTI)	Socioeconomic status	Disability / special healthcare needs	Mental health / psychological distress	Chronic / long-term condition	Metropolitan/rural	Regional	Local government area
1.3.1.5	Proportion of infants exclusively breastfed to three months of age	Y	Y	N/A	Y	P	N	P	N	N	N	P	Y	P
1.3.1.6.A	Proportion of adults who are sufficiently physically active	Y	Y	Y	P	Y	N	Y	N	Y	Y	Y	Y	Y
1.3.1.6.B	Proportion of adolescents 10–17 years who are sufficiently physically active	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	P
1.3.1.6.C	Proportion of children 5–12 years who are sufficiently physically active	Y	Y	Y	Y	N	N	Y	Y	N	N	Y	Y	P
1.3.1.7	Proportion of journeys that use active transport	Y	Y	Y	N	N	N	Y	N	N	N	N/A	Y	N/A
1.3.1.8	Proportion of people participating in organised sport (TBD)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

References

1. Fulton JE, Carlson SA, Ainsworth BE, Berrigan D, Carlson C, Dorn JM, et al. Strategic Priorities for Physical Activity Surveillance in the United States. Med Sci Sports Exerc [Internet] 2016;48(10):2057-69. doi: 10.1249/mss.0000000000000989
2. Macera CA, Pratt M. Public health surveillance of physical activity. Res Q Exerc Sport [Internet] 2000;71(2 Suppl):S97-S103. doi: 10.1080/02701367.2000.11082792
3. Australian Institute of Health and Welfare (AIHW). .The Active Australia Survey: a guide and manual for implementation, analysis and reporting [Internet] Canberra: AIHW; 2003 [cited 2020 Mar 19]. Cat. no: CVD 22 Available from: www.aihw.gov.au/reports/physical-activity/active-australia-survey
4. Bauman A. Trends in exercise prevalence in Australia. Community Health Stud [Internet] 1987;11(3):190-6. doi: 10.1111/j.1753-6405.1987.tb00005.x
5. Pedišić Ž, Zhong A, Hardy LL, Salmon J, Okely AD, Chau J, et al. Physical activity prevalence in Australian children and adolescents: Why do different surveys provide so different estimates, and what can we do about it? Kinesiology [Internet] 2017;49(2):135-45. doi: 10.26582/k.49.2.14
6. Milton K, Bauman A. A critical analysis of the cycles of physical activity policy in England. The international journal of behavioral nutrition and physical activity. 2015;12:8-8. doi: 10.1186/s12966-015-0169-5
7. Pedišić Ž, Bauman A. Accelerometer-based measures in physical activity surveillance: current practices and issues. Br J Sports Med [Internet] 2015;49(4):219. doi: 10.1136/bjsports-2013-093407
8. Cameron C, Craig CL, Bauman A, Tudor-Locke C. CANPLAY study: Secular trends in steps/day amongst 5–19year-old Canadians between 2005 and 2014. Prev Med [Internet] 2016;86:28-33. doi: 10.1016/j.ypmed.2015.12.020
9. Inoue S, Ohya Y, Tudor-Locke C, Tanaka S, Yoshiike N, Shimomitsu T. Time trends for step-determined physical activity among Japanese adults. Med Sci Sports Exerc [Internet] 2011;43(10):1913-9. doi: 10.1249/mss.0b013e31821a5225
10. Bauman A, Bittman M, Gershuny J. A short history of time use research; implications for public health. BMC Public Health. 2019;19(2):607. doi: 10.1186/s12889-019-6760-y
11. United Nations Statistics Division. Time Use Data Portal [Internet]. Geneva: United Nations; [updated 2020; cited 2020 Mar 19] Available from: unstats.un.org/unsd/gender/timeuse/index.html
12. van der Ploeg HP, Merom D, Chau JY, Bittman M, Trost SG, Bauman AE. Advances in population surveillance for physical activity and sedentary behavior: reliability and validity of time use surveys. Am J Epidemiol [Internet] 2010;172(10):1199-206. doi: 10.1093/aje/kwq265
13. Liangruenrom N, Craike M, Dumuid D, Biddle SJH, Tudor-Locke C, Ainsworth B, et al. Standardised criteria for classifying the International Classification of Activities for Time-use Statistics (ICATUS) activity groups into sleep, sedentary behaviour, and physical activity. Int J Behav Nutr Phys Act [Internet] 2019;16(1):106. doi: 10.1186/s12966-019-0875-5
14. Bauman A, Pedišić Ž, Bragg K. Objective Measurement in Physical Activity Surveillance: Present Role and Future Potential. In: Shephard RJ, Tudor-Locke C, eds. The Objective Monitoring of Physical Activity: Contributions of Accelerometry to Epidemiology, Exercise Science and Rehabilitation. Cham: Springer International Publishing; 2016. p. 347-67.
15. Australian Bureau of Statistics (ABS). 4364.0.55.004 - Australian Health Survey: Physical Activity, 2011-12 [Internet]. Canberra: ABS; 2013 [cited 2020 Mar 19]. Available from: www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4364.0.55.004Explanatory%20Notes12011-12?OpenDocument
16. Cancer Council Victoria. National Secondary Students' Diet and Activity (NaSSDA) survey [Internet]. Victoria: Cancer Council Victoria; [updated 2019 Nov 13; cited 2020 Mar 19]. Available from:

www.cancer.org.au/preventing-cancer/nutrition-and-physical-activity/national-secondary-students-diet-and-physical-activity-survey.html

17. Sport Australia. AusPlay [Internet]. Canberra: Sport Australia; [updated 2019 Oct; cited 2020 Mar 19]. Available from: www.clearinghouseforsport.gov.au/research/smi/ausplay
18. Merom D, van der Ploeg HP, Corpuz G, Bauman AE. Public health perspectives on household travel surveys active travel between 1997 and 2007. Am J Prev Med [Internet] 2010;39(2):113-21. doi: 10.1016/j.amepre.2010.04.007
19. Craig CL, Cameron CA, Bauman A. Utility of Surveillance Research to Inform Physical Activity Policy: An Exemplar From Canada. J Phys Act Health [Internet] 2017;14(3):229-39. doi: 10.1123/jpah.2015-0698
20. Pate RR, Berrigan D, Buchner DM, Carlson SA, Dunton G, Fulton JE, et al. Actions to improve physical activity surveillance in the United States [Internet]. National Academy of Sciences: Washington, DC, USA; 2018 [cited 2020 Mar 19]. doi: 10.31478/201809f
21. Lacy KE, Nichols MS, de Silva AM, Allender SE, Swinburn BA, Leslie ER, et al. Critical design features for establishing a childhood obesity monitoring program in Australia. Aust J Prim Health [Internet] 2015;21(4):369-72. doi: 10.1071/PY15052