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Physical activity surveillance in Australia: standardisation is overdue

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Physical inactivity remains a major contributor to non-communicable disease globally and in Australia,^{1,2} yet efforts to address it in Australia remain fragmented.^{3,4} One component of a prevention system for this health priority is to monitor population levels of physical activity. Australian adult population prevalence estimates have been obtained since the 1980s using diverse surveys and measures.⁵ By 1996, a consensus process was commenced by the Australian Institute of Health and Welfare (AIHW) to develop standard self-report physical activity questions, subsequently known as the Active Australia Survey. This instrument has shown reasonable reliability and validity⁶⁻⁸ and the AIHW provided detailed guidance on its application in population surveys.⁹

Assessing physical activity prevalence using a stable surveillance system provides prevalence estimates and trends that characterise the magnitude of the problem of inactivity, identify subgroups at particular risk and contribute estimates to calculate the population attributable burden of inactivity.¹⁰⁻¹³ These estimates are essential for policymakers who are required to prioritise risk factors for the prevention of non-communicable disease (NCDs).

There have been several calls for a uniform method for monitoring physical activity, as even small changes to survey questions or methods can result in substantial changes to physical activity estimates.^{5,14} Internationally, standardised approaches to physical activity measurement, such as that used for adolescents and children in more than 40 countries across Europe, has produced comparable trend data.¹⁵ In contrast, the lack of standardised approaches to assess

child and adolescent physical activity across jurisdictions in Australia has resulted in substantial variation in prevalence estimates depending on the survey used.¹⁶

Population physical activity surveys for adults in Australia

The first major population surveys that measured physical activity in Australia were the Heart Foundation Risk Factor Prevalence surveys in 1980, 1983 and 1989. Following these were the National Health Surveys (NHS), conducted every few years since 1989 through household interviews by the Australian Bureau of Statistics (ABS). The states and territories introduced their own population health surveys for physical activity in the early 2000s. All surveys are listed in Supplementary File 1 in the Supplementary Material.

The NHS surveys initially asked about aerobic exercise participation (i.e. structured or planned physical activity), consistent with the 1978 physical activity recommendation of 3 x 20 minutes of weekly vigorous activity.¹⁷ As physical activity guidelines evolved with new epidemiological evidence, the NHS added questions on walking for sport, recreation and fitness in 2002, sitting time in 2007, walking for transport in 2011 and strength training in 2014.

State and territory jurisdictions have used variants of the Active Australia Survey, which comprised questions on participation in moderate-intensity activities, vigorous activities and walking for recreation, exercise or transport. These Active Australia questions have been implemented in slightly different ways across Australian jurisdictions. Sustained and comparable usage of questions and definitions appears to have occurred in

New South Wales, Queensland and South Australia (notes [B], [C] and [E] in Figure 2), with only minor modifications to the physical activity guideline threshold in West Australian population health surveys (note [D] in Figure 2). By contrast, Victoria (points [1]-[4] in Figure 2) and to some extent Tasmania (point [5] and note [A]), have used different definitions and/or questions over time, and unlike other jurisdictions, have always included vigorous household work in their assessment of meeting physical activity recommendations, but did not incorporate moderate-intensity physical activity questions until 2015 in Victoria (point [4] in Figure 2) and 2016 in Tasmania (point [5] in Figure 2). In those same respective years, these jurisdictions also added vigorous gardening questions to their assessment (points [4] and [5] in Figure 2). Another difference compared to other jurisdictions, is that both Victoria and Tasmania have included walking 'during or as part of work' as part of their assessment of walking.

Changes to national and international physical activity guidelines and in the interpretation of these recommendations have further complicated physical activity surveillance. In the late 1980s, the NHS tried to estimate the proportion of adult Australians doing vigorous activities three times a week for 20 minutes. With the advent of the 1996 US Surgeon General's report on physical activity,¹⁸ the guidelines were changed to accumulating 150 minutes of at least moderate to vigorous physical activity (MVPA) over five days (or sessions) per week. This was refined in the 2010 World Health Organization (WHO) guidelines¹⁹ and the evidence was interpreted more recently in the 2014 Australian physical activity guidelines and the 2018 US revised physical activity guidelines as at least 150 minutes of MVPA per week.^{20,21} The Australian guidelines also recommended an upper limit of 300 minutes of MVPA, but this has not been used in prevalence estimates. Since 2010, generic recommendations for reducing sitting time/sedentary behaviour have been made, but the epidemiological evidence is not yet sufficiently well developed for a defined risk threshold to be identified.²²

To identify recent practice in physical activity surveillance for adults, the Australian Systems Approaches to Physical Activity (ASAPa)

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project¹ convened two national workshops in 2018. Policymakers and stakeholders from national, state and territory agencies provided information about their jurisdiction's physical activity policies, programs and prevalence monitoring. A detailed audit of state and territory health sector surveys was then conducted, with a focus on estimates of 'sufficient physical activity for health'. Note that there have been other concurrent survey systems that also estimated physical activity levels, for example, sport sector surveys^{5,23} and the transport sector household travel surveys that can be used to estimate active travel.²⁴ These sport and transport surveys have also changed over time but are outside the scope of this review.

Comparability of prevalence estimates over time and between jurisdictions

To demonstrate prevalence trends, Figure 1 shows the NHS national data over time, and Figure 2 presents jurisdictional differences in prevalence using state and territory variants of the Active Australia Survey. The effects of changes to the definitions of 'sufficiently active for health' and also the addition of walking and other dimensions of physical activity in more recent surveys are evident in

Figure 1 (NHS data) and Figure 2 (state and territory survey data).

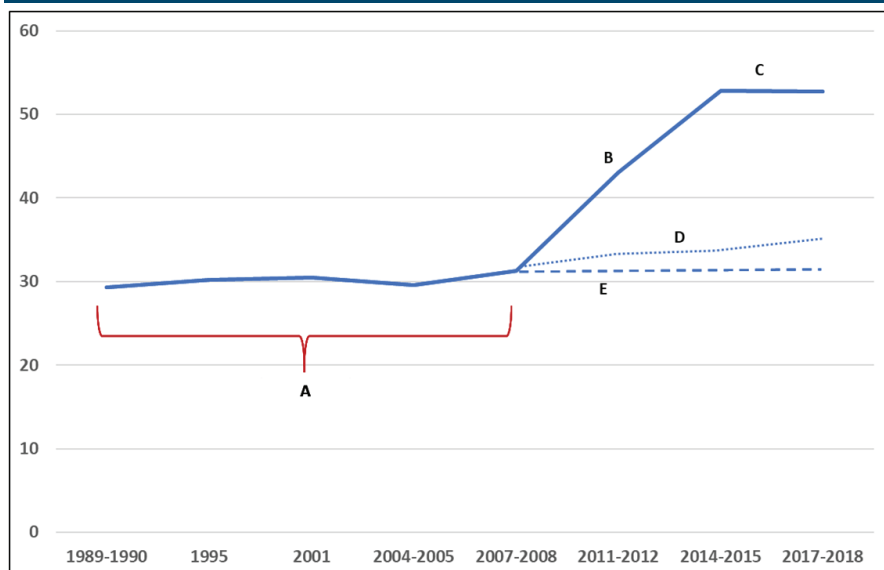
The national 2014/15 increase was contributed to by a change in definition (dropping 'sessions', see point [C] in Figure 1), as suggested by the lower prevalence estimate of 45.5% using 5 sessions and 150 mins (similar to the prevalence in the previous survey year 2011–12; point [B] in Figure 1). Applying the 1980s consistent – but more restricted – definition of exercise (i.e. walking and exercise, for fitness, recreation or sport) would likely show a different prevalence trend (dotted line [E] in Figure 1; also see Chau et al.²⁵) to that observed when walking for transport was included and the threshold for health was changed to '150 minutes in total' (solid line trend from [B] to [C]). The AIHW reanalysis of NHS data from 2007–08 to 2017–18 (dotted line [D]) shows a similar trend to [E] where the age-standardised prevalence of the adult population meeting guidelines was calculated using consistent definitions that included the sessions requirement (i.e. 150 mins over 5 days for 18–64-year-old adults, and 30 mins on at least 5 days for adults over 65 years of age).

Figure 2, with a truncated Y-axis, shows the variation over time and between jurisdictions

due to different applications of the Active Australia instrument. Trends in New South Wales and Queensland show increases in the early 2000s, followed by a plateau, and then a slight relative increase in both states to 2018/2019. Western Australia shows a fairly stable prevalence above 60% since around 2008. Victoria shows variability likely to be due to question changes, with a substantial fall in prevalence when 'strength training behaviour' was included in the definition of meeting guidelines (point [3] of Figure 2) to reflect updates to national guidelines.²¹ In recent years, the NHS and Tasmania have also reported meeting guidelines including a combined MVPA+strength measure as well as separately. They report an even greater drop in prevalence when strength is incorporated into the definition of meeting guidelines (e.g. the NHS in 2017/18 reported 15.4% meeting MVPA+strength compared to 52.7% meeting MVPA alone;²⁶ Tasmania in 2016 reported 29% of 18–64-year-old adults meeting MVPA+strength compared to 81.2% meeting MVPA only²⁷). South Australia shows a reasonably stable prevalence until increasing markedly in 2018 when the age group was constrained to working-age adults (omitting less-active older adults) (point [6] in Figure 2). Rates in South Australia seemed somewhat low, given that they used the definition of '150 minutes/week' throughout (note [E] in Figure 2), which usually provides a higher prevalence of meeting physical activity recommendations than the '5 sessions + 150 minutes' criterion adopted in New South Wales and Queensland (notes [B] and [C] in Figure 2). Tasmania showed a much higher prevalence of meeting the 5+150 guideline from the Tasmanian Population Health Survey in 2016 (66% using 150+5, point [5] in Figure 2), which was 7% less than the prevalence using '150 minutes/week', but substantially greater than the 41.1% meeting the 5+150 recommendation using the NHS data for Tasmania in 2014/15 (Supplementary Figure C). Tasmania's inclusion of vigorous gardening in 2016 towards the calculation of total physical activity (point [5] in Figure 2), may have contributed to some extent to the elevated prevalence compared to the Tasmanian data in the NHS. The marked increase in the most recent period (2016–2018) for the Australian Capital Territory (ACT) remains unexplained.

Apart from the variability between jurisdictions, the absolute differences are substantial, with prevalence estimates from the state and territory surveys varying from

Figure 1: Trends in the national prevalence of meeting Australian physical activity guidelines (ABS National Health Surveys).^a



Notes:
a: Data for 1989-90, 1995 and 2001 are age (and sex) standardised to the population on 30th June 2001. The AIHW reanalysis of NHS data [dotted line 'D'] also age-standardised the data to the 2001 population.

Legend: [A] Used intensity of activity to define low, mod, high 'exercise' levels (mod/high was classified as meeting the 1980s guidelines; no questions on walking for transport until 2004-05 (not included in assessment of meeting guidelines)); [B] 2011/12 'Sufficient physical activity' classified as 150min + 5 sessions and included walking for transport in assessment of meeting guidelines; [C] 2014/5 reported against 150min of physical activity (in addition to 150min + 5 sessions; data not shown), while 2017-18 did not report at all using 'sessions'; [D] AIHW's reanalysis of NHS data, applying two different definitions for 'met guidelines' depending on age group. For 18-64yo, this was 150min + 5 days (this was also used for adults 65+ in 2007-08). For 65+ yo, this was 30 mins x 5 days (except for 2007-2008)²⁶; [E] putative prevalence if continued to use 1989/90 physical activity measures and 'exercise' classification, suggested by Chau.²⁵

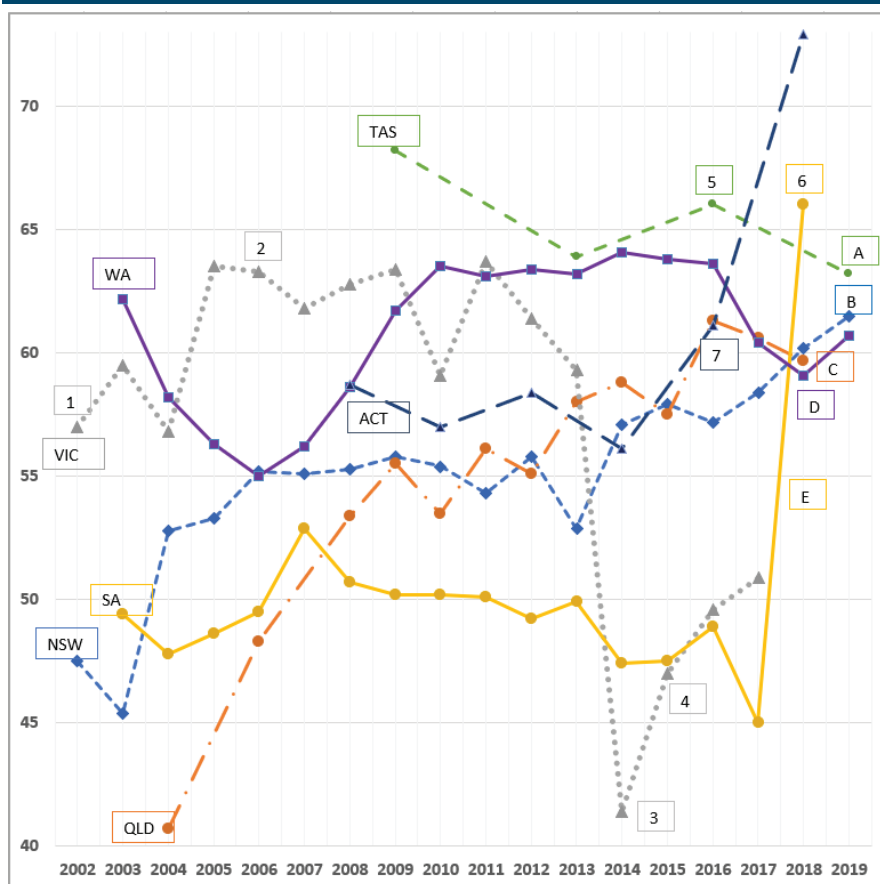
below 50% meeting guidelines to well above 65%. This variation and absolute differences between jurisdictions are markedly greater for physical activity than for the relatively consistent trends and inter-jurisdictional differences in obesity and smoking derived from the same population health surveys over the same time period (see Supplementary Figure 1, Panel A and B). Note that the NHS estimates for physical activity in Figure 1 showed the same patterns when compared by state/territory (Supplementary Figure C) as well as consistent prevalence differences and trends and reasonably similar absolute differences between jurisdictions. Furthermore, rates in New South Wales and Victoria were remarkably similar over time. Supplementary Figure C (which presents the state and territory results from the NHS) also shows that the ACT reported the highest prevalence of meeting guidelines consistently over time, and Tasmania was rated low active, opposite to the conclusions drawn from the state-based population surveys in Figure 2.

Towards an integrated surveillance system for physical activity

If physical activity trends are to be reliably interpreted and to be useful in informing policy and practice, standardisation is required across Australia. The absolute value of the differences and variation over time masks any efforts to understand the relationship between programs delivered and population effects, reducing the usefulness of current surveillance. Over time, different patterns have emerged in physical activity prevalence, with much more variability in the state/territory surveys than in the NHS. Physical activity prevalence appears much more variable than other risk factors, with data on smoking and obesity showing similar prevalence trends across jurisdictions and demonstrating clear trends over time. Similar variability has been noted for child and adolescent physical activity prevalence estimates.¹⁶ Further, differences in analytic approaches and changes to the national surveys have caused similar problems in England.^{28,29} To redress this confused situation, Australia requires a coordinated approach across jurisdictions; specifically, consistent measurement and reporting in the period leading up to and beyond 2030, the year for which the WHO targets for physical activity have been set.³⁰

The explanation for the variability of physical activity estimates could include other

Figure 2: Prevalence data reported by States and Territories, showing prevalence trends and superimposed variations in definitions or questions.



Notes:

Legend: [1] Victoria, 150 mins/week; [2] Victoria 30mins sessions; at all other points between [1] and [3], 5 sessions + 150 mins/week; [3] Victoria dropped sessions, added strength to the definition; [4] Victoria added moderate physical activity and vigorous gardening to the assessment of meeting guidelines; [5] Tasmania added moderate physical activity and vigorous gardening to the assessment of meeting guidelines; [6] SA reported 18-64, previously all ages; [7] ACT added sessions to definition; [A] Tasmania dropped sessions at point [5] but continued to report against 5 sessions + 150 mins/week for the trends analysis shown here [B, C] NSW and Qld consistent 5 sessions + 150 mins/week; [D] Western Australia dropped sessions in 2014, but adjusted previous years' data to the revised guideline of 150 mins/week for the trends analysis shown here [E] SA consistently 150 mins/week

contributory factors, such as amendments to the survey methods and changes from landline phones to include mobile phones numbers in CATI survey samples. However, these could partially be overcome by population weighting of the data. These methodological changes occurred at different times across Australia but did not appear to impact much on smoking or obesity prevalence (supplementary Figures A and B); suggesting that the variability in physical activity estimates is more likely to be due to changes in definitions and questions. These state-based estimates contrast with the consistent physical activity trends and narrow absolute differences in the household-based NHS carried out by the ABS.

It is clear there should be a broader discussion of a physical activity surveillance system – beyond simple measures of physical activity behaviours. Physical activity should take a

systems approach to surveillance and be incorporated into a comprehensive NCD surveillance system. Serial monitoring should occur at the settings and organisational levels, assess policy changes and policy implementation and monitor indicators of the built environment in an integrated physical activity surveillance system.^{13,31} In addition, population information should include estimates from other sectors, rather than separate information silos; this applies to active travel estimates from household transport surveys and sport participation information across ages from the Ausplay sport surveys.^{24,32}

The complexity of physical activity measurement is only outlined here in relation to self-report questions. New device-based measures and inobtrusive population surveillance (for example, using accelerometers in smartphones) may

contribute to future surveillance systems.³³ The differences in state and national physical activity surveillance arose partly through parallel and different surveillance systems that changed over time when: i) the evidence changed as did the guidelines; and ii) jurisdictional changes occurred independently of each other. This could be improved by physical activity coordination and leadership, and a clear physical activity strategic plan, such as that hoped for in the 2018 Sport Australia policy³⁴ or mentioned in the development of the 2021 National Preventive Health Strategy.³⁵ However, we remain sedentary, if not inert, in physical activity policy, with little action over recent decades.^{1,3}

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Supporting Information

Additional supporting information may be found in the online version of this article:

Supplementary Appendix 1: List of online links to physical activity data and questionnaires in National Health Surveys and in State-Territory based health surveys.

Supplementary Figure A and B: Trends in smoking prevalence [Figure A] and self-reported overweight and obesity [Figure B] across jurisdictions using state-based health surveys and the NHS (national).

Supplementary Figure C: State and territory trends in 'meeting physical activity guidelines' as reported by the NHS.