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Muscle strengthening activities among Australian adults

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Key findings

When adapting the United Kingdom classification of muscle strengthening activities and applying it to 2017–18 AusPlay data, **around 4 in 10** Australian adults aged 18–64 are doing the recommended amount of muscle strengthening activities. This was higher than the estimate provided by the 2017–18 Australian National Health Survey.

Men and younger people are more likely to be doing sufficient muscle strengthening activities than women and older people.

The most popular activities included **gym workouts, running, swimming and cycling**.

Introduction

Physical activity is any body movement produced by skeletal muscles that uses energy (WHO 2018). It includes structured activities such as sport or organised recreation, and unstructured activities such as walking or cycling for leisure or transport (NHMRC 2013). Participating in regular physical activity can have significant health benefits—it reduces the risk of chronic conditions and other disease risk factors such as overweight and obesity, and also improves social and emotional health and wellbeing (AIHW 2018). Physical activities that improve the strength, power, endurance and size of skeletal muscles (referred to as muscle strengthening activities (MSAs)) have specific health benefits and are an important part of regular physical activity (Brown et al. 2012; Seguin & Nelson 2003; Stamatakis et al. 2018).

MSAs are often associated with activities such as lifting free weights, using gym equipment or one's own body weight. However, there is evidence to suggest that there are many other types of physical activities or sports that involve major muscle groups, which can improve muscular strength and endurance if they are done often enough and for long enough (Foster & Armstrong 2018; Oja et al. 2015).

This report describes the guideline for MSA included in Australia's Physical Activity and Sedentary Behaviour Guidelines (Department of Health 2019). It discusses what types of activities may be considered MSAs using different definitions, and why MSAs are important for health. It presents estimates from the 2017–18 Australian Bureau of Statistics National Health Survey (ABS NHS) of how many Australians do the recommended amount of MSAs. Results from an analysis of Sport Australia's AusPlay survey (AusPlay) data are also presented, to provide alternative estimates of how many Australians may be doing sufficient MSAs when a wider range of MSAs than those mentioned in the ABS NHS are included.

What is the guideline for muscle strengthening activities?

Australia's Physical Activity and Sedentary Behaviour Guidelines (the Guidelines) provide recommendations on the amount of physical activity required for optimal health. The Guidelines are available on the Department of Health website at https://www1.health.gov.au/internet/main/publishing.nsf/Content/health-pubhlth-strateg-phys-act-guidelines.

In 2014, in response to growing evidence of the many health benefits of MSAs, the Guidelines, which had previously focused on the frequency and amount of overall physical activity, were updated to include a specific recommendation that Australian adults (aged 18–64) should do MSAs on at least 2 days per week (Bennie et al. 2016; Brown et al. 2012). There are no recommendations in the Guidelines as to how long MSAs should be performed for on each of the 2 days. There are different guidelines for children and for older people aged 65 years and over. Data presented in this report are for adults aged 18–64 only. For more information on physical activity in children and older adults, please see *Physical Activity across the Life Stages* (AIHW 2018).

Australia's Physical Activity and Sedentary Behaviour Guidelines for Adults (18–64 years)

- Doing any physical activity is better than doing none. If you currently do no physical activity, start by doing some, and gradually build up to the recommended amount.
- Be active on most, preferably all, days every week.
- Accumulate 150 to 300 minutes (2½ to 5 hours) of moderate intensity physical activity or 75 to 150 minutes (1¼ to 2½ hours) of vigorous intensity physical activity, or an equivalent combination of both moderate and vigorous activities, each week.
- **Do muscle strengthening activities on at least 2 days each week**.

Source: Department of Health 2019.

What are the data sources for muscle strengthening activities in Australia?

Currently, there are two national surveys that can be used to estimate how many adults are meeting the MSA guideline: the ABS NHS and the AusPlay survey. Both of these surveys are nationally representative, and for physical activity data, rely on self-reported information from respondents. However, there are a number of key differences between these two surveys that may have some impact on how respondents report their physical activities and the resulting physical activity estimates. For more information about the data sources and these differences, please see the Appendix.

What are muscle strengthening activities?

The muscle strengthening component of the Guidelines is based on an evidence review (Brown et al. 2012) that defines MSAs (referred to as strength (resistance) training) as activities for improving strength, power, endurance and size of skeletal muscles. Examples given include exercises that use either body weight (e.g. push-ups), free weights (e.g. dumbbells), or machines as resistance (Brown et al. 2012). These types of exercises are often the focus of studies investigating MSA participation (Bennie et al. 2019, 2020; Loustalot et al. 2013). While not mentioned or measured specifically in either of the data sources for this report, evidence suggests that resistance bands may also be incorporated into some activities to improve muscle strength (Iverson et al. 2017). However, there is no universally accepted definition of MSAs, or agreement upon which activities should be classified as MSAs (Foster & Armstrong 2018; Milton et al. 2018; Oja et al. 2015).

There is some international evidence that there are activities, other than resistance training or weightlifting, that can potentially strengthen muscles when performed at a certain intensity and frequency (Foster & Armstrong 2018; Oja et al. 2015). These include, but are not limited to, aerobics, circuit training, yoga and Pilates (AIHW 2018; Foster & Armstrong 2018; NHS Digital 2017; Oja et al. 2015; Strain et al. 2016).

There have been attempts to classify activities as to whether or not they are muscle strengthening in national health surveys in Scotland (Strain et al. 2016) and England (NHS Digital 2017). Starting in 2012, the Health Survey for England and the Scottish Health Survey asked respondents if they had participated in a pre-defined list of activities—which had been determined to be MSAs by a panel of experts—in the previous 4 weeks. Activities were only counted as MSAs if they were carried out in sets of at least 10 minutes. Some activities had to meet the additional requirement of making the participant's muscles feel some tension, shake or feel warm, to be considered MSAs.

In addition to these international studies, there is one notable Australian study, Pumping Iron in Australia, which used data from the Sports Commission's Exercise, Recreation and Sport Survey (ERASS) (Bennie et al. 2016). This survey focused on 'leisure-time' physical activities, asking participants to report 'any physical activity done for exercise, recreation or sport in the past 12 months', excluding 'any physical activity associated with work, household or garden chores'. Authors identified 9 leisure-time physical activities as 'primarily muscle strengthening': calisthenics, gymnasium workouts, military exercise, prime movers (over 50s), body building, circuits, power team, weight training for fitness, and weightlifting (competition). Responses were further categorised using frequency and duration measures to determine which respondents were doing sufficient MSAs. The 'sufficient frequency and duration' category was defined as ≥4 sessions and ≥80 minutes in the past 2 weeks.

The criteria from the United Kingdom (UK) studies and, to a lesser extent, the Pumping Iron in Australia study, have been adapted for this report to classify the activities reported in the AusPlay survey. However, the question about whether performing each activity made a participant's muscles feel some tension, shake or feel warm was not asked in AusPlay, so using the UK method will likely result in an overestimate of the number of people performing MSAs. Additionally, there does not appear to be a consensus across these studies as to the duration of MSAs that is sufficient for health, so this element has been omitted from this report. The description of MSAs used in the 2017–18 ABS NHS survey question (which focuses on resistance training) was also considered when developing these classifications (see Box 1). Estimates from the NHS are based on responses to the following question about doing MSAs:

> 'Some activities are designed to increase muscle strength or tone, such as lifting weights, resistance training, pull-ups, push-ups, or sit-ups. Including any activities already mentioned [in previous questions about physical activity], in the last week did you do any strength or toning activities?' (ABS 2019).

Box 1: Muscle strengthening activity classifications applied to AusPlay activities for this report

Background

In this report, activities collected in AusPlay data have been classified as 'resistance training', 'definitely' or 'potentially' MSAs.

This activity classification has been primarily adapted from the 2016 Health Survey for England. This classification contains a list of activities that is broader than only resistance training, and includes sports or activities that are considered to activate major muscle groups and to 'definitely' or 'potentially' improve muscle strength (see the Appendix for further information).

Results are presented for activities that were considered 'resistance training', 'definitely MSA' (which includes resistance training), and using a combined list of 'definitely or potentially MSA' (which is expected to be an overestimate of actual MSAs; see the Appendix).

All activities classified as 'not muscle strengthening' were excluded from the analysis.

Resistance training activities

Activities in AusPlay that were considered resistance training were: bodybuilding, boot camp, calisthenics, circuits, CrossFit, gym workouts, powerlifting, weight training and weightlifting.

Definitely MSAs (including resistance training)

Resistance training, weightlifting and other similar activities (like those outlined above) were classified as definitely muscle strengthening. Additional activities from the Health Survey for England that were included as definitely muscle strengthening include canoeing/kayaking, cycling, football, running/jogging, swimming and tennis (see the Appendix for full list).

Potentially MSAs

Activities were classified as potentially muscle strengthening if people reported that they felt muscle tension. The inclusion of these activities has been reported separately as participants in AusPlay have not been asked if these activities caused muscle tension. Potentially MSAs include basketball, golf, hiking, Pilates and yoga (see the Appendix for full list).

Determining sufficient levels of muscle strengthening activities

MSA data from the AusPlay 12-month recall period was categorised as:

i) no MSA (0 sessions)

ii) insufficient MSA (1–103 sessions in the past 12 months, or fewer than 2 times per week)

iii) sufficient MSA (104 or more sessions in the past 12 months, or 2 or more times per week).

For this analysis, an assumption has been made that sessions of MSA reported in AusPlay took place on separate days (as per the Guidelines recommendation that MSAs be done on 2 days per week).

For more information on the activities included in each classification, see the Appendix.

Why are muscle strengthening activities important?

As outlined in the Introduction, participation in physical activity has significant health and wellbeing benefits. Participating in MSAs is equally as important as completing aerobic exercise and also has many positive health benefits. Many of our daily activities—including climbing stairs, gardening and housework—require muscle strength (Hillsdon & Foster 2018).

Doing sufficient MSAs is also important for long-term health outcomes. Undertaking at least 2 sessions of MSAs per week may reduce premature death by as much as 21% and cancer related mortality by up to 34% (Stamatakis et al. 2018). Doing sufficient MSAs may also reduce the risk of chronic conditions such as osteoporosis and sarcopenia (loss of muscle mass and strength) in older Australians (Seguin & Nelson 2003). These conditions may limit functional capacity and increase the risk of falls (Seguin & Nelson 2003).

As with physical activity in general, doing some MSAs is better than doing none, as benefits increase as activity increases (Brown et.al 2012). However, evidence suggests that meeting the guideline of doing MSAs on at least 2 days per week is important to achieve the maximum possible health benefits from MSAs (Brown et. al. 2012).

How many Australian adults aged 18–64 meet the muscle strengthening guideline?

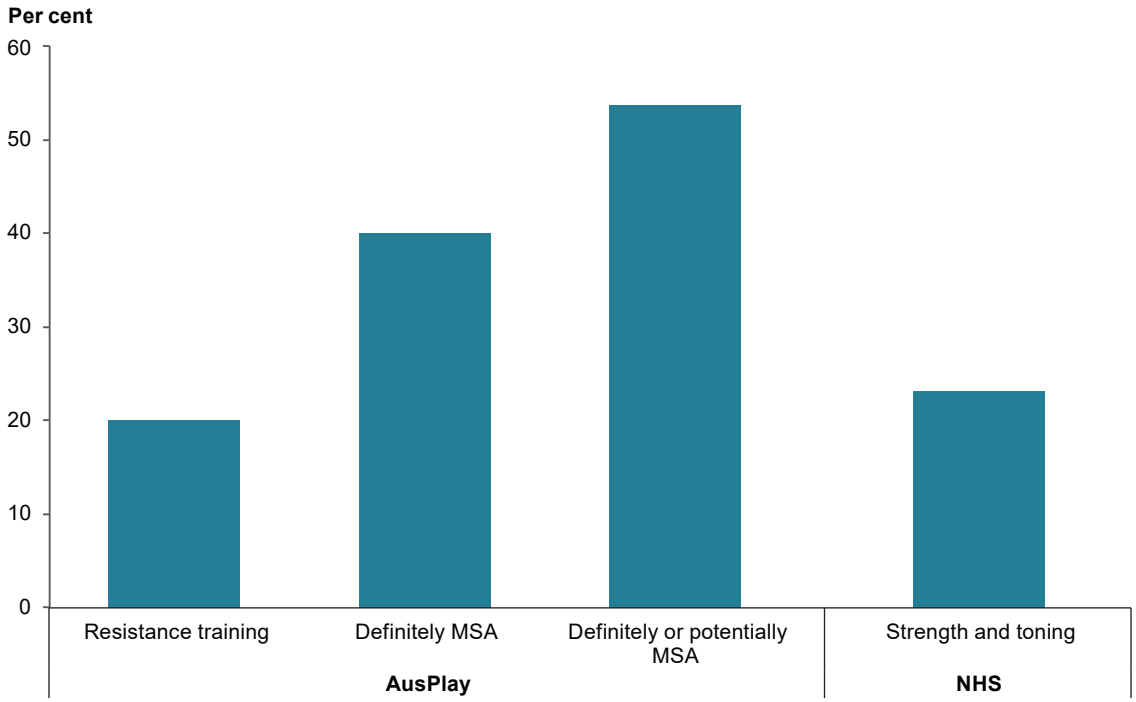
When 2017–18 AusPlay activities that were classified as 'definitely MSA' (including resistance training) (see Box 1) were included in the analysis, the proportion of adults who could have met the MSA guideline was 40%. This estimate was higher than the 2017–18 ABS NHS estimate that 1 in 4 Australian adults aged 18–64 (25%) were meeting the MSA guideline.

When only activities from AusPlay that were classified as 'resistance training' were included (such as those activities that are given as examples for the MSA question in the ABS NHS, see Box 1), the proportion of adults who could have met the MSA guideline was 20%, lower than the 2017–18 ABS NHS estimate of 25%.

When including all AusPlay activities classified as 'definitely or potentially MSA', the proportion of adults who could have met the MSA guideline was 54%. This will include some people for whom the activity did not make their muscles feel tension, shake or feel warm (see 'What are muscle strengthening activities?') and therefore is likely to be an overestimate.

These results indicate that estimates of the proportion of adults who met the MSA guideline are dependent on the definition used and the activities subsequently included in the analysis (Figure 1).

Figure 1: Proportion of adults who met the muscle strengthening guideline, by classification used, based on analysis of AusPlay data and the ABS NHS, 2017–18



Note: See Table A1 in Appendix for AusPlay activities included in the 'resistance training', 'definitely MSA' and 'definitely or potentially MSA' categories.

Source: Sport Australia 2018; ABS 2018 (Table S1).

How does meeting the guideline vary by age?

The proportion of adults aged 18–64 estimated to be meeting the MSA guideline generally decreased with age across all classifications of AusPlay activities (Figure 2).

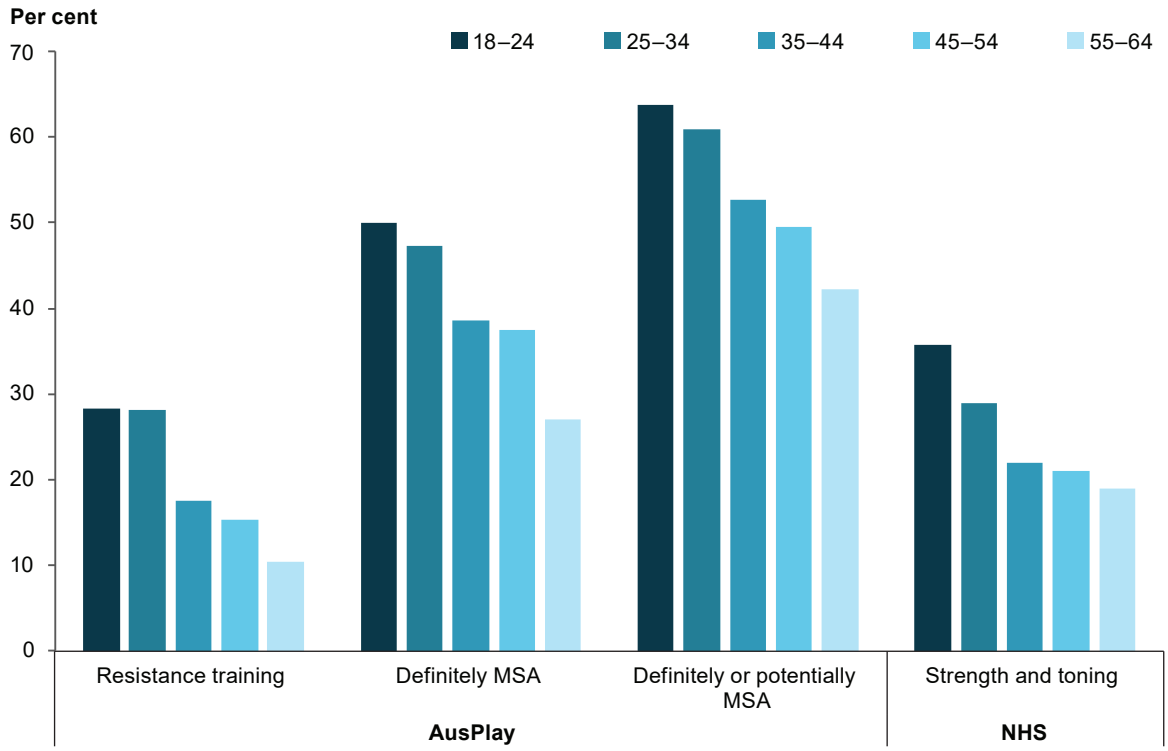
When only AusPlay activities classified as 'resistance training' were included, the proportion meeting the MSA guideline was estimated to be highest for those aged 18–24 (28%), decreasing with age to 11% of those aged 55–64. This was slightly lower than the proportion of people who were estimated to have met the MSA guideline in the 2017–18 ABS NHS, which ranged from 36% of those aged 18–24 to 19% of those aged 55–64.

When the AusPlay activities that were classified as 'definitely MSA' were included, those aged 18–24 and 25–34 were estimated to be the most likely to be meeting the MSA guideline (50% and 47% respectively), followed by those aged 35–44 and 45–54 (39% and 37% respectively) and 27% of those aged 55–64.

The same pattern was observed when AusPlay activities classified as 'definitely or potentially MSA' were included. In this scenario, the proportion of people who could be meeting the MSA guideline ranged from 64% for those aged 18–24 to 42% of those aged 55–64.

Regardless of which classification of MSAs was used, estimates from the AusPlay survey of the proportion of adults who met the MSA guideline were lowest in the oldest age group (55–64), which is consistent with the estimates from the 2017–18 ABS NHS. Given the barriers reported by older people in AusPlay (such as poor health or injury), it is possible that older people are changing the type of physical activities they are doing from sport-based activities to other activities not recorded in AusPlay, such as gardening or lifting heavy groceries (Department of Health 2014), or that these reported barriers are preventing people in older age groups from doing 2 sessions of MSAs per week (AIHW 2018).

Figure 2: Proportion of adults who met the muscle strengthening guideline, by age group and classification used, based on analysis of AusPlay data and the ABS NHS, 2017–18



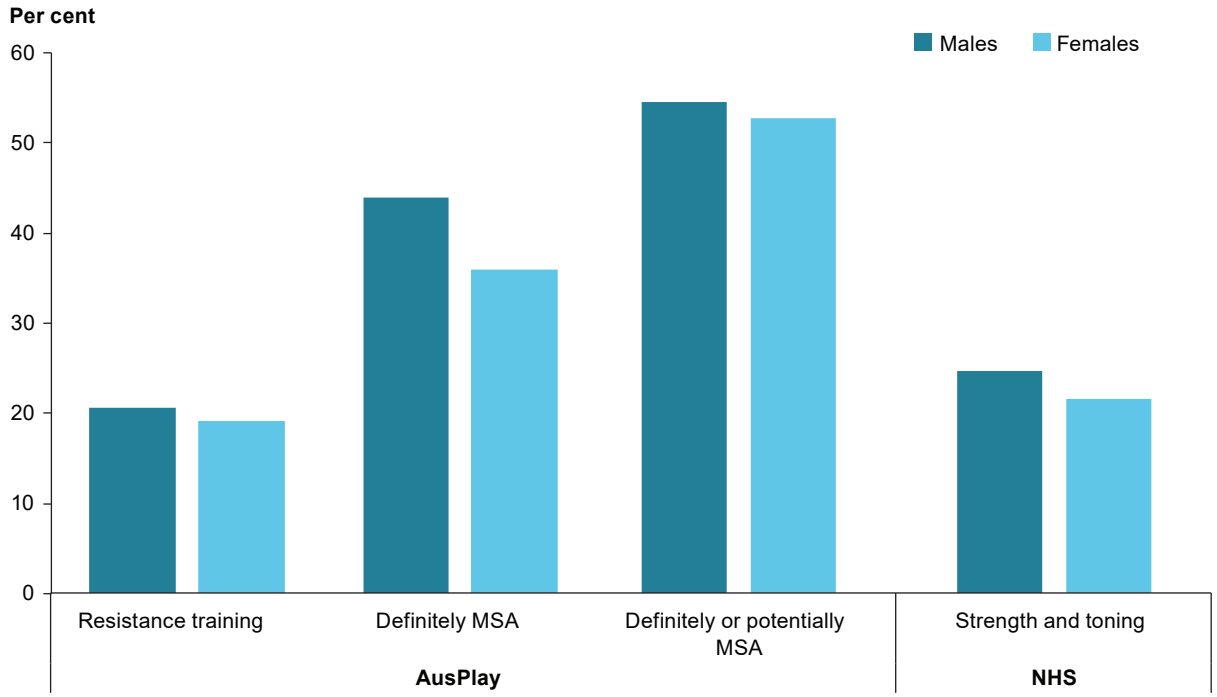
Note: See Table A1 in Appendix for AusPlay activities included in the 'resistance training', 'definitely MSA' and 'definitely or potentially MSA' categories.

Source: Sport Australia 2018; ABS 2018 (Table S1).

How does meeting the guideline vary for men and women?

Analysis of AusPlay data estimates that a higher proportion of men than women met the MSA guideline for all classifications (although this difference was not statistically significant for the 'definitely or potentially MSA' classification) (Figure 3). The difference between men and women was greatest when only activities classified as 'definitely MSA' were included, where men were 1.2 times as likely as women to meet the MSA guideline (44% and 36%, respectively). This was a larger difference than was estimated in the 2017–18 ABS NHS, which was 27% of men and 23% of women. However, when only activities classified as 'resistance training' were included, the difference between men and women was reduced (21% of men and 19% of women), which was closer to the difference found in the 2017–18 ABS NHS results.

Figure 3: Proportion of adults who met the muscle strengthening guideline, by sex and classification used, based on analysis of AusPlay data and the ABS NHS, 2017–18



Note: See Table A1 in Appendix for AusPlay activities included in the 'resistance training', 'definitely MSA' and 'definitely or potentially MSA' categories.

Source: Sport Australia 2018; ABS 2018 (Table S1).

How does activity level vary by age and sex?

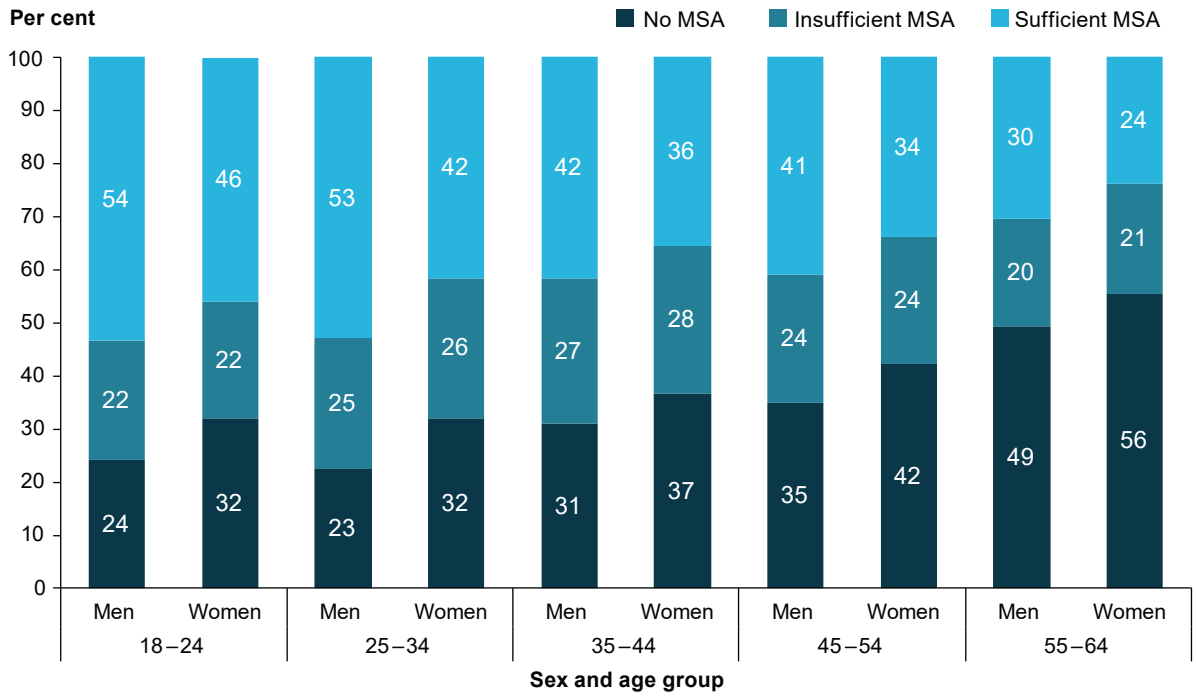
When only AusPlay activities classified as 'definitely MSA' were included, estimates indicate that more men than women did sufficient MSAs to meet the MSA guideline of 2 or more days per week across all age groups (Figure 4). More women than men did no MSAs at all across all age groups.

Around 1 in 4 adults aged 18–64 (24%) did some MSAs, but not a sufficient amount to meet the MSA guideline. There was some variation across age groups, but little variation between men and women in the proportion doing insufficient MSAs.

Of the 24% of adults who did some but insufficient MSAs to meet the MSA guideline (fewer than 104 sessions in the previous 12 months):

- around 3 in 5 (57%) did between 1 and 51 MSA sessions in the previous 12 months, or less than once per week on average
- around 1 in 4 (23%) did 52 MSA sessions in the previous 12 months, or once per week on average
- around 1 in 5 (21%) did between 53 and 103 MSA sessions in the previous 12 months, or more than once but less than twice per week on average.

Figure 4: Proportion of adults doing activities classified as 'definitely MSA', by sex, age group and activity level, according to AusPlay 2017–18



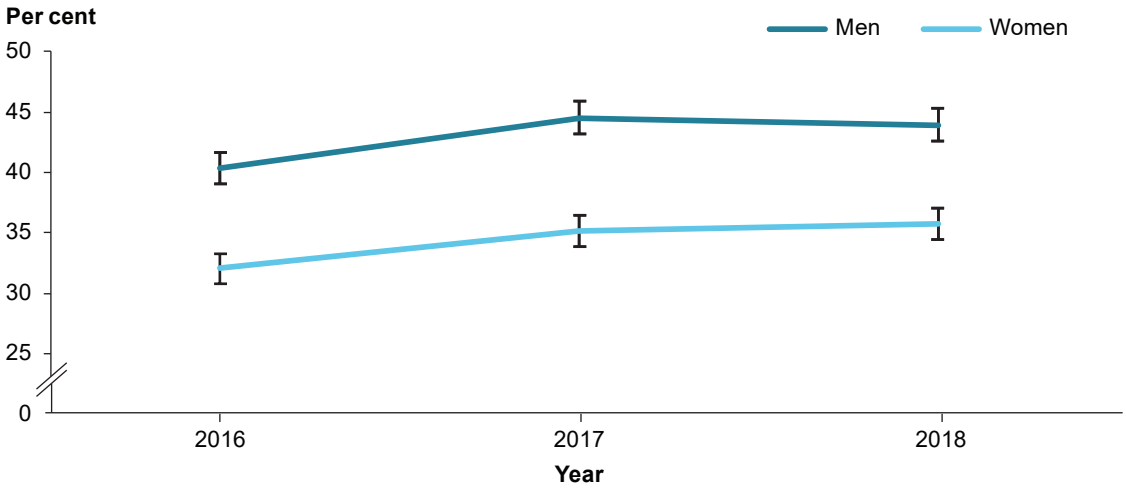
Note: See Table A1 in Appendix for AusPlay activities included in the 'definitely MSA' category.

Source: Sport Australia 2018 (Table S2).

How does meeting the guideline vary over time?

AusPlay data collection began in late 2015, with the first full calendar year of data being for 2016. In the years between 2016 and 2018 (the most recent year of data available at the time of analysis) more men than women were estimated to have met the MSA guideline by participating in activities that were 'definitely MSA' (Figure 5). The proportion of people estimated to be meeting the MSA guideline increased from 2016 to 2018 for both men (40% to 44%) and women (32% to 36%).

Figure 5: Proportion of adults doing activities classified as 'definitely MSA', by sex and calendar year, according to AusPlay, 2016 to 2018



Note: See Table A1 in Appendix for AusPlay activities included in the 'definitely MSA' category.

Source: Sport Australia 2018 (Table S3).

What type of muscle strengthening activities are Australian adults doing?

The 4 most common activities classified as 'definitely MSA' that Australian adults reported participating in were gym workouts (26%), running (18%), swimming (15%) and cycling (13%). This includes people who may have undertaken these activities on fewer than 2 days per week, therefore not meeting the MSA guideline of 2 or more days per week.

What are the most common activities among men and women?

When only AusPlay activities that were classified as 'definitely MSA' were included, the most commonly reported activity among both men and women was gym workouts (25% and 27%, respectively). Running, swimming and cycling were all among the top 4 activities for both men and women but in a different order, with more men participating in running (20%) and cycling (16%) than swimming (14%), compared with more women participating in swimming (17%) and running (16%) than cycling (9.7%). Football/soccer was the 5th most common for men and tennis was the 5th most common for women (Figure 5).

Figure 6: Most common AusPlay activities classified as 'definitely MSA', by sex, 2017–18

Sex	1st	2nd	3rd	4th	5th
Males	Gym workouts (25%)	Running (20%)	Bike riding/cycling (16%)	Swimming (14%)	Football/soccer (8.8%)
Females	Gym workouts (27%)	Swimming (17%)	Running (16%)	Bike riding/cycling (9.7%)	Tennis (3.3%)
Persons	Gym workouts (26%)	Running (18%)	Swimming (15%)	Bike riding/cycling (13%)	Football/soccer (5.7%)

Notes

1. Gym workouts represents a subset of the AusPlay output group Fitness/Gym. Only some of the activities in Fitness/Gym were classified as 'definitely MSA'. The Fitness/Gym activities that counted as 'definitely MSA' included: gym workouts, weight training, boot camp and circuits.
2. Running is the simplified title for the AusPlay output group Athletics, track and field. This is used because running and other running-related activities made up the majority of this output group. Activities included in this category were: running, jogging, parkrun, marathon, cross-country running, race walking, trail running and athletic, and track and field (other).
3. Football/soccer includes the following activities: football/soccer, indoor football/soccer, futsal and small-sided games.

Source: Sport Australia 2018 (Table S4).

What are the most common activities for different age groups?

When only AusPlay activities classified as 'definitely MSA' were included, the most commonly reported activity for all age groups (except 55–64) was gym workouts, ranging from 35% of those aged 18–24 to 21% of those aged 45–54. Swimming and gym workouts were similarly popular for those aged 55–64 (both 15%).

Swimming was one of the top 3 most commonly reported 'definitely MSA' activities for all age groups, and grew more popular with age, ranging from 12% of those aged 18–24 to 18% of those aged 45–54.

Running was the second most common MSA for younger ages (from 20% to 22% of those aged 18–44), but dropped to 4th for adults aged 45–64. Cycling was less popular for younger ages (6.2% and 8.6% of those aged 18–24 and 25–34, respectively), but in the top 3 for those aged 45–54 and 55–64 (18% and 13%, respectively) (Figure 7).

Figure 7: Most common AusPlay activities classified as 'definitely MSA', by age group, 2017–18

Age group	1st	2nd	3rd	4th	5th
18–24	Gym workouts (35%)	Running (20%)	Swimming (12%)	Football/soccer (12%)	Cycling (6.2%)
25–34	Gym workouts (36%)	Running (22%)	Swimming (14%)	Cycling (8.6%)	Football/soccer (8.3%)
35–44	Gym workouts (24%)	Running (22%)	Swimming (17%)	Cycling (16%)	Football/soccer (5.2%)
45–54	Gym workouts (21%)	Cycling (18%)	Swimming (18%)	Running (17%)	Tennis (4.8%)
55–64	Swimming (16%)	Gym workouts (15%)	Cycling (13%)	Running (7.3%)	Tennis (3.7%)

Notes

1. Gym workouts represents a subset of the AusPlay output group Fitness/Gym. Only some of the activities in Fitness/Gym were classified as 'definitely MSA'. The Fitness/Gym activities that counted as 'definitely MSA' included: gym workouts, weight training, boot camp and circuits.
2. Running is the simplified title for the AusPlay output group Athletics, track and field. This is used because running and other running-related activities made up the majority of this output group. Activities included in this category were: running, jogging, parkrun, marathon, cross-country running, race walking, trail running and athletic, and track and field (other).
3. Football/soccer includes the following activities: football/soccer, indoor football/soccer, futsal and small-sided games.

Source: Sport Australia 2018 (Table S5).

Discussion

There is currently no universal definition of what an MSA is, and survey estimates of who is doing sufficient MSAs will be affected by how these activities are defined in the survey and understood by respondents. For example, the 2017–18 ABS NHS only provides examples of lifting weights and resistance training in the MSA question, although people may inconsistently incorporate other activities they believe are muscle strengthening or toning when they answer.

For this report, due to a lack of universal consensus on which activities can be considered muscle strengthening, the definition of MSAs from the 2016 Health Survey for England was adapted for use in the analysis of AusPlay data. However, it should be noted that the AIHW approach to classifying activities in the AusPlay survey employed some measure of subjectivity and assumption, since some AusPlay activities did not have a clear equivalent in the Health Survey for England.

One of the key issues with the classification method used is that there is no follow-up question in AusPlay on whether an activity classified as 'potentially MSA' caused a person to feel muscle tension. This may have led to an overestimate in the proportion of adults doing sufficient MSA when using this classification.

With these caveats understood, the analysis undertaken for this report produced estimates that up to 4 in 10 Australian adults may be meeting the MSA guideline, if activities other than those defined as 'resistance training' are included in the analysis. This is substantially higher than the estimate of 1 in 4 adults produced by the 2017–18 ABS NHS. However, this new analysis produced similar patterns for meeting the MSA guideline as the ABS NHS, such as men and younger people being more likely to meet the MSA guideline than women and older people.

Using the AusPlay data offers a unique insight into the types of activities Australian adults may be doing to strengthen their muscles, with the most popular AusPlay activities varying by age and sex. However, when the 'definitely MSA' classification was applied to the AusPlay data, the most common activities overall were gym workouts, running, swimming and cycling.

There is a need for future work into determining which activities (outside of those resistance activities already defined) can be considered MSAs, for example via biometric testing and long-term follow-ups across diverse groups. Considering that the estimate produced by AIHW analysis that was closest to the 2017–18 ABS NHS was when only activities defined as 'resistance training' were included, it could be assumed that people who answered the MSA question in the ABS NHS restricted their answer to the activities given as examples in the question. If respondents were prompted to consider a wider range of activities, this may affect the estimate of how many adults are meeting the MSA guideline.

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Abbreviations

ABS Australian Bureau of Statistics

NHS National Health Survey

MSA muscle strengthening activity

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