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Gender, Age, and Educational-Attainment Differences in Australian Adults' Participation in Vigorous Sporting and Fitness Activities

Eva Leslie, Ester Cerin, Christopher J. Gore, Alexis St. George, Adrian Bauman, and Neville Owen

Background: Participation in regular vigorous physical activity could confer health benefits additional to those derived from moderate-intensity physical activities that are currently the focus of public health strategies. Methods: Sociodemographic differences in reported participation in vigorous sporting and fitness activities over the past 2 weeks were examined using cross-sectional data from an Australian urban population sample. Results: Participation at least once in any form of vigorous physical activity and regular participation (six or more sessions) both decreased across successive age groups and from high to low levels of education. The most frequently reported types of vigorous physical activity were cycling (13.3%), jogging (10.1%), swimming (8.4%) for men; and swimming (8.9%), cycling (8.8%) and aerobics (8.6%) for women. Conclusion: Rates of regular participation in vigorous activities were low. Interventions might focus on ways to encourage younger adults to engage more regularly in these activities and to maintain participation through the lifespan.

Key Words: vigorous physical activity, prevalence, demographic differences

Regular physical activity reduces the risk of many chronic diseases, including coronary heart disease, obesity, type 2 diabetes, osteoporosis, and some cancers. Maintenance of regular physical activity across the lifespan is a key to health and functional benefits. Several lines of evidence and argument suggest that no segment of the population can benefit more from the effects of regular physical activity than older adults. Despite these findings, epidemiological studies have shown...
that with increasing age, there are lower rates of participation in both moderate-intensity and vigorous physical activity.\textsuperscript{1,7,8}

Although it is not always clear whether the specific health gains derived from participation in vigorous physical activity can be attributed specifically to the intensity or to the increased volume of energy expenditure associated with it, many studies have identified a range of health and functional benefits of vigorous sporting and fitness activities for the general population and for older adults.\textsuperscript{9-12} It has been argued that the mean intensity of physical activity might need to be at least 6 metabolic equivalents (METS) to reduce the risk of coronary disease,\textsuperscript{13} although this is likely to vary across age groups.\textsuperscript{1,2} Lee and Paffenbarger\textsuperscript{1} compared the effect of light, moderate, and vigorous physical activity on longevity and found that the greater energy expended in vigorous activities predicted lower mortality rates. It is not known to what extent this effect was due to the higher intensity levels of activity, however, as the study did not control for differences in volume of energy expenditure associated with vigorous activity. A recent review cites several studies showing that the greater intensity of vigorous physical activities is associated with metabolic changes that reduce health risk.\textsuperscript{13}

For the prevention of weight gain in adults, the International Obesity Task Force identifies the equivalent of 80 to 90 minutes of brisk walking every day.\textsuperscript{14} For the prevention of colon and breast cancer, recommendations from the International Agency for Research on Cancer suggest 30 to 60 minutes every day of at least moderate-level physical activity.\textsuperscript{15} To achieve the equivalent of such high weekly volumes of energy expenditure, a sedentary adult would need to engage in many hours of walking, or could incorporate additional regular vigorous activity. Increased involvement in vigorous physical activity is advantageous, as it markedly reduces the time needed to achieve higher volumes of energy expenditure, as well as making it likely to be easier to engage in greater amounts of general walking and other moderate physical activities, as a result of increased fitness.

Overall, the volume of physical activity decreases over successive age groups, and there is an even greater age-related reduction in participation in vigorous sporting and fitness activities.\textsuperscript{16,17} In the US, the average decrease in moderate-intensity activity per decade among adults age 18 to 95 years was 0.7% for men and 3.7% for women from the initial level of physical activity.\textsuperscript{7} For vigorous physical activities, the per-decade reduction was found to be much greater, (12.7% for men, 11.9% for women). Hirvensalo et al.\textsuperscript{17} examined physical activity patterns in a population of Finnish men and women age 65 and over and found that 26% of the men and 11% of the women had maintained a high level of physical activity across an 8-year period. Stephens and Craig\textsuperscript{18} found that prevalence of vigorous physical activity was slightly lower (32.5%) in the old (≥ 65) than in the young (age 20 to 29) segment (36.5%) of the Canadian population.

Examining participation in vigorous physical activities and how this varies with age, gender, and education level provides important basic descriptive epidemiological data and might also assist policymakers in determining how volumes of actual participation might best be increased. We used home-based interview data from an urban population sample of adult Australians to examine differences in the prevalence of participation in specific vigorous sporting and fitness activities across four different age groups. Data for men and women were compared and associations with levels of educational attainment were examined.

### Methods

Data were extracted from the Pilot Survey of the Fitness of Australians (PSFA),\textsuperscript{18} an urban representative population survey of adults (n = 2298). Methods for this survey have previously been described in detail elsewhere\textsuperscript{19-23} and are summarized here. All participants provided written informed consent and the project was approved by the University of Adelaide Human Ethics Committee.\textsuperscript{19} A sample of Australian adults was drawn from metropolitan Adelaide, South Australia, using a stratified random sampling procedure generated by the Australian Bureau of Statistics (ABS) to over sample older people. In the first stratum, 282 ABS Census Collectors' Districts were selected randomly. In the second stratum, 12 dwellings in each census district were randomly selected from a randomly assigned start and using a predetermined skip between selections. From within the selected dwellings, every adult age 45 and over and every second adult age 18 to 44 was selected to participate in the study.

A unique element of the PSFA was the identification and quantification of participation in specific sporting and fitness activities.\textsuperscript{19} Such specific activities have not been identified in the items used in the “Active Australia” surveys used to monitor participation in health-related physical activity.\textsuperscript{22,23} As part of a series of questions on activity, respondents were shown a list of 20 activities on a prompt card and asked “In the last 2 weeks, which, if any, of these activities have you done?” Up to 7 activities could be identified. The 20 activities and sports were classified as vigorous or moderate based on their relative MET level.\textsuperscript{24} The following activities and sports were classified as vigorous: athletics, table tennis, snow skiing, water skiing, ice skating, jogging, aerobics, circuit training, swimming, bicycling, netball/basketball, tennis, and squash. The rest were classified as moderate-intensity activities. Football and cricket were a combined category and thus were excluded from the vigorous activity category, as cricket does not meet the criteria for vigorous activity. The frequency and duration for each of the activities identified were also collected. Respondents who indicated that they had participated in “other” activities (an activity not listed and therefore with an unknown intensity) and did not participate in any of the activities categorized as vigorous were excluded (n = 193), leaving a total sample of 2105.

Respondents were divided into four age categories: < 25 years (n = 227); 25 to 39 (n = 605); 40 to 54 (n = 614) and ≥ 55 years (n = 659). Classification of education was based on the highest level completed and categorized as university, secondary, and subsecondary. The under-25 age category was excluded from the analysis of the association between level of educational attainment and participation in vigorous physical activities, as a high proportion of this age group would not have completed university.

Data were analyzed using the SPSS statistical package version 11.0 (SPSS, Inc., Chicago, IL), with chi-square tests to determine if there were significant differences (P < 0.05) in participation rates in vigorous physical activity as a function of gender, age, and education level.
Results

Participation in Vigorous Physical Activity by Gender and Age

Figure 1 shows age-related differences in participation in at least one vigorous sporting or fitness activity over the previous 2 weeks, for men and women. Overall, 42.1% of the survey sample (46.5% of the men; 38.1% of the women) indicated that they had participated at least once in a vigorous physical activity in the previous 2 weeks. Overall, gender differences in vigorous physical activity participations were statistically significant ($\chi^2(1) = 15.4; P < 0.001$). Participation in vigorous physical activity was lower across successive age groups ($\chi^2(3) = 140.4; P < 0.001$ for men; $\chi^2(3) = 120.9; P < 0.001$ for women). Among both men and women, the prevalence of vigorous physical activity among the oldest age group (~20 to 25%) was only one third of that among the youngest age group (~60 to 80%). Women had significantly lower rates of participation in a vigorous physical activity than men, in the under-25 age category (60.6% for women and 80.5% for men; $\chi^2(1) = 11.0; P = 0.001$) and in the 40 to 54 year age category (32.5% for women and 43.0% for men; $\chi^2(1) = 7.1, P = 0.008$).

Regular Participation in Vigorous Physical Activity by Gender and Age

Figure 2 shows the level of participation in six or more sessions over 2 weeks of any vigorous sporting or fitness activity in each age category, for men and women. The six or more sessions criterion was chosen as most closely approximating the recommendation that 3 sessions each week are likely to be required to improve fitness. Only 16.1% of all respondents (18.6% of the men; 13.8% of the women) had participated in six or more sessions of any vigorous sporting or fitness activity in the previous 2 weeks. The difference between genders was significant ($\chi^2(1) = 8.8; P < 0.003$).

Among both men and women, the prevalence of 6 sessions or more of vigorous physical activity in the previous 2 weeks among the oldest age group (~5 to 8%) was only about one third of that among the youngest age group (~27 to 38%). Between the different age groups, the only significant difference between men and women was in the 40 to 54 year age category ($\chi^2(1) = 5.9; P = 0.003$).

Participation in Specific Sports

Table 1 shows participation levels in specific sporting and fitness activities in the previous 2 weeks for men and women. Activities with a prevalence of any participation lower than 6% across both genders and all age groups are not reported (this was the case for athletics, snow skiing, water skiing, ice skating, squash, and circuit training).

For men, the three most frequently reported vigorous sporting and fitness activities were jogging, cycling, and swimming. Cycling was the most frequently reported vigorous sporting and fitness activity across all age groups. Jogging was more prevalent in the under-55 age groups, whilst swimming was more popular in older adults (~55-year age group). For women in the under-25 and 25 to 39 year age groups, the most frequently reported vigorous physical activity was aerobics, followed by cycling, basketball or netball, and swimming. In the 40 to 54 and ≥55-year age category, cycling and swimming were the most frequently reported vigorous physical activities.
Table 1  Prevalence of Participating at Least Once (%) in Specific Sporting and Fitness Activities in the Previous 2 Weeks, by Age Category and Gender; Numbers in Brackets (R) Denote Ranking of the Specific Activity Within the Gender by Age Groups

<table>
<thead>
<tr>
<th>Activity</th>
<th>Gender</th>
<th>&lt; 25 (R)</th>
<th>25-39 (R)</th>
<th>40-54 (R)</th>
<th>&gt; 54 (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobics</td>
<td>M</td>
<td>0.0 (7)</td>
<td>1.4 (7)</td>
<td>0.7 (7)</td>
<td>2.5 (4)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>23.9 (1)</td>
<td>15.9 (1)</td>
<td>6.0 (3)</td>
<td>2.1 (4)</td>
</tr>
<tr>
<td>Cycling</td>
<td>M</td>
<td>28.8 (1)</td>
<td>17.6 (1)</td>
<td>12.9 (1)</td>
<td>7.1 (1)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>18.3 (2)</td>
<td>13.1 (3)</td>
<td>7.5 (2)</td>
<td>5.9 (1)</td>
</tr>
<tr>
<td>Jogging</td>
<td>M</td>
<td>20.3 (2)</td>
<td>16.9 (2)</td>
<td>10.8 (3)</td>
<td>2.2 (5)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>7.3 (5)</td>
<td>8.0 (5)</td>
<td>2.7 (6.5)</td>
<td>0.6 (7)</td>
</tr>
<tr>
<td>Netball / Basketball</td>
<td>M</td>
<td>9.3 (5)</td>
<td>5.0 (6)</td>
<td>1.8 (6)</td>
<td>0.0 (7)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>17.4 (3)</td>
<td>10.7 (4)</td>
<td>2.7 (6.5)</td>
<td>0.9 (6)</td>
</tr>
<tr>
<td>Swimming</td>
<td>M</td>
<td>11.9 (4)</td>
<td>11.2 (3)</td>
<td>11.5 (2)</td>
<td>4.0 (2)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>14.7 (4)</td>
<td>14.4 (2)</td>
<td>8.7 (1)</td>
<td>5.0 (2)</td>
</tr>
<tr>
<td>Table tennis</td>
<td>M</td>
<td>13.6 (3)</td>
<td>9.7 (4)</td>
<td>3.9 (5)</td>
<td>1.9 (6)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>5.5 (6)</td>
<td>3.1 (7)</td>
<td>3.0 (5)</td>
<td>1.8 (5)</td>
</tr>
<tr>
<td>Tennis</td>
<td>M</td>
<td>7.6 (6)</td>
<td>6.5 (5)</td>
<td>7.2 (4)</td>
<td>3.7 (3)</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>3.7 (7)</td>
<td>7.0 (6)</td>
<td>4.5 (4)</td>
<td>4.5 (3)</td>
</tr>
</tbody>
</table>

Participation by Level of Educational Attainment

Figure 3 shows participation in any vigorous sporting or fitness activities at least once in the previous 2 weeks, in each age category, by level of educational attainment.

Overall, 60.6% of those who completed university education participated in a vigorous sporting or fitness activity at least once in the previous 2 weeks, compared with 48.8% of those who completed secondary education and 31.3% of those who completed subsecondary education. These differences were statistically significant ($\chi^2 (2) = 89.8; P < 0.001$).

Figure 4 shows participation in six or more sessions of any vigorous sporting or fitness activities in the previous 2 weeks, in each age category, by educational attainment.

Overall, 25.5% of those who completed university education participated in six or more sessions of a vigorous sporting or fitness activity in the previous 2 weeks, compared with 18.0% of those who completed secondary education and 12.1% of those who completed subsecondary education ($\chi^2 (2) = 26.2; P < 0.001$).

Discussion

Clear patterns of age, gender, and educational attainment differences emerged for participation in vigorous sporting and fitness activities. Participating at least once in the previous 2 weeks was found to be most prevalent at younger ages (80.5% for men and 60.6% for women in the under-25 age group). The level of any participation amongst older adults, however, was low (24.5% for men and 19.9% for women in the over-55 age group). The level of participation in vigorous sporting...
or fitness activities at least once in the previous 2 weeks in those age 40 and over was half that of those under age 40. Other studies in Canadian, US, Finnish, and Australian samples have similarly found lower levels of participation in vigorous physical activities in older adults.  

The specific vigorous sporting or fitness activities reported by men and women were different. Men more commonly reported jogging and women more commonly reported aerobics. These results were similar to trends found in the US, where some 13% of men reported participating in jogging or running compared with 6% of women. For aerobics or aerobics dance, the reported participation rates of US women (11%) were much higher than men (3%). These gender differences in participation in different types of physical activity are important for targeting inactive adults in the population.  

The overall level of participation in 6 sessions or more of vigorous physical activity in the previous 2 weeks found in this study (16%) is similar to that reported for adults in the US (15%). Such comparisons need to take into account the variance in the means by which physical activity was measured, including wording of the questions, definitions of physical activity, time of year, and differences in population samples.

As with participation at least once in the previous 2 weeks, the proportion of older Australian adults participating more regularly (6 sessions or more) in any vigorous sporting or fitness activities in the previous 2 weeks was about one third of that of younger age groups. Despite that 81% of men less than 25 years of age participated at least once in any vigorous sporting or fitness activity in the previous 2 weeks, only 38% participated in 6 sessions or more. The fact that, as a result of combining football and cricket in one category, football was not included in the list of the examined vigorous sporting activities might have contributed to the high difference between the two participation rates. Moderate-intensity physical activities, such as walking, might not be of sufficient intensity to provide optimal health benefits to many young adults and regular participation in more vigorous activities could be important. For this reason, the relatively low rates of participation in 6 sessions or more in the past 2 weeks, particularly in the under-25 age group, is of concern.  

In a study on the continuity of physical activity, Hirvensalo et al. found that participation in competitive sports several times a week in younger years was a powerful predictor of maintaining a high level of physical activity in old age. Public health policies might need to focus on encouraging younger adults to participate in vigorous physical activities, as this could lead to better maintenance of regular participation with increasing age. Consideration needs to be given as to how to replace the school and club sport structures that provided opportunities for participation during earlier school years. Further research on the exercise background of older adults who do participate in vigorous physical activities would help ascertain if regular participation in younger adult life contributes to the maintenance of participation in older years.

Overall, there was a significant difference by gender found between participation in vigorous sporting or fitness activities. Several earlier studies show men are more likely than women to be involved in vigorous sporting and fitness activities at any age. If participation in younger years does predict participation in later life then the low levels of participation in vigorous sporting and fitness activities found in women, particularly those under age 25, should be addressed as a public health priority.

Other studies on exercise participation in Australian adults have found those with lower educational levels to be less active. Our findings show that only half as many of those with lower educational attainment, compared to those with tertiary education, participated in vigorous sporting or fitness activities in the past 2 weeks. Similarly, in Canada and the US, adults with college degrees reported regular, vigorous physical activity approximately two to three times more often than those with lower educational attainment. Although it might be assumed that individuals with a lower educational attainment are less likely to engage in leisure-time vigorous activity because they are much more likely to have occupations requiring higher levels of physical activity, this does not seem to be the case for Australian adults. Consequently, any policy aimed at increasing the number of Australians participating in vigorous sporting or fitness activities will need to address the low participation rates found in those with lower levels of educational attainment. Further research is required to determine barriers to participation in vigorous sporting or fitness activities in this group.

There are limitations to our study, including the use of a representative urban population from a moderate-sized metropolitan city, which might not be representative of smaller country towns or larger cities. Given that a more recent study on the patterns of physical activity in Australian adults found that the prevalence of vigorous physical activity was lower in rural than in urban areas, the prevalence estimates of participation in vigorous sporting and fitness activities reported in this article are likely to be higher than those in the Australian population at the time of the survey. This is a cross-sectional study and as such cannot predict changes in participation in vigorous sporting or fitness activities over time. Self-report measures were used. Short-term recall measures, however, such as those used in the present study, have been shown to be reliable and valid. This study did not consider the effects of age on the fitness stimulus provided by various physical activities. Consequently, the reported prevalence of participation in vigorous sporting or fitness activities in the older segment of the Australian population (age 65 to 78), for whom activities such as brisk walking might be considered vigorous, are likely to have been underestimated. The data reported were gathered in 1990. Since that time, there have been decreases in physical activity participation in some groups of Australian adults. Although the prevalence of participation might now be slightly different, significant changes since that time in the strong gender, age, and educational attainment patterns we have identified, seem unlikely.

Classifications of vigorous exercise differ in the various physical activity population-based studies found in the literature, which needs to be considered when comparing our results with those of other studies. Some physical activity studies have classified all physical activity categories including yard work and brisk walking (> 6.4 km/h) as vigorous (> 6 METS). In this study we included only those sporting and fitness activities with a MET level ≥ 6 and walking and yard work were not included. Given the importance of vigorous sporting and fitness activities to health, well-being, and longevity, the low numbers of older adults participating in vigorous sporting and fitness activities needs to be addressed. DiPietro argues that to preserve physical function and independence, older adults should participate in regular physical activities promoting muscular strength, balance, flexibility,
coordination, and endurance. Many vigorous sporting and fitness activities meet this criterion, although, paradoxically, these requirements are also factors that could prevent older adults from participating in vigorous physical activities.

Increasing age is accompanied by increased reporting of injury or disability as a barrier to being more active. Public health policy initiatives aimed at increasing participation in vigorous sporting and fitness activities would need to focus on increasing regular participation in young adults and removing barriers that prevent the maintenance of participation with aging. In the older segment of the population, the emphasis of population health policies and programs should be on encouraging participation in vigorous physical activity by providing more suitable opportunities. Some vigorous sporting and fitness activities could be modified for the elderly, as they are for children, to increase participation. Safety aspects specifically related to likelihood of injury to older adults could be addressed while maintaining the vigorous load on the cardiovascular system. Improving the knowledge of instructors and coaches of vigorous sporting and fitness activities in the area of exercise and aging and how it relates to their particular activity might assist in reducing the risk of injury.

Research examining the barriers for older adults' participation in vigorous physical activities, particularly those most popular with younger adults, such as aerobics, cycling, netball, and basketball, could assist in determining the ways in which continued participation can be supported and encouraged throughout the lifespan. The data presented here highlight that sizable activities like cycling and swimming are more prevalent than are organized team sports. Thus, there is a role for governments to provide supportive physical environments, such as safe (car-free) cycling trails, more swimming pools, and leafy jogging trails, to encourage lifelong participation in these types of vigorous physical activities.

Pate et al. state that the new recommendations and their focus on moderate-intensity activity are "intended to complement, not supersede, previous exercise recommendations." Previous exercise recommendations promoted participation in vigorous sporting and fitness activities. The US Surgeon General's Report on Physical Activity states that following either the "old" or the "new" physical activity recommendations can be beneficial for a sedentary person. Whilst the public health case for promoting participation in moderate-intensity physical activity is clear ("activating the sedentary" is the primary objective), the promotion of vigorous, sporting, and fitness activities should not be neglected. Population strategies to increase physical activity have recently focused on the promotion of moderate-intensity physical activity among inactive people. Additional health and functional benefits of physical activity can be achieved, however, by more vigorous-intensity physical activities which, relative to moderate-intensity activities such as walking, result in higher energy expenditure for the time spent being active. More vigorous activities might help to provide the types and volumes of activity that are optimal for the prevention of weight gain, as well as breast and colon cancer.

Developing policies that focus on increasing participation in vigorous sporting and fitness activities could be a more complex process than for those aiming primarily at increasing incidental activity and participation in moderate-intensity activities such as walking. There will be the need to involve a broader range of federal, state, and local government, community groups, and both public and private institutions.

Differences in Participation in Vigorous Activities

sporting bodies in policy development. These challenges must be embraced and addressed seriously, however, if greater numbers of older adults are to fully enjoy the health benefits of lifelong physical activity.

References