



Estimating physical activity level and the role of household chores and gardening activities: Analysis of the 1998 NSW Health Survey

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1. INTRODUCTION

Appropriate measures of physical activity are essential for determining the population prevalence of physical activity, for tracking trends over time, and for guiding intervention efforts. Physical activity measurement is characterised by the synthesis of information on the type, frequency, intensity and duration of activity over a specified period. To date, population-level surveillance of physical activity has focused on measuring leisure-time physical activities such as walking, cycling or other sport-related activities. A key criticism of relying mainly on these standard self-reported measures of leisure-time activities is that they do not cover day-to-day incidental domestic-based activities that involve substantial energy expenditures. Because many people, such as women and elderly adults tend to spend substantial amounts of time engaged in household chores, gardening or yard work rather than or as a supplement to leisure-time physical activity, prevalence estimates of physical activity in these groups based only on standard measures of physical activity may be underestimated (Weller & Corey, 1998).

Although some household chores and gardening activities are assumed to involve considerable amount of energy expenditure (eg. vacuuming, lawn mowing) and have been recognised for accruing moderate-intensity physical activity of 3.0-6.0 METs (Ainsworth et al., 2000), these activities are yet to be accepted as important types of physical activity that would confer health benefits. This is partly due to the lack of current scientific evidence on the validity of the self-reported intensity of strenuous gardening and household tasks, the reliability and precision of measuring domestic-based activities and, therefore, the limited information on energy expenditure during household and gardening activities (Gunn et al., 2002).

Recent developments involving a small but growing number of measurement studies of energy expenditure associated with domestic tasks have demonstrated that household activities can be measured and validated with precision with some domestic activities being performed at moderate intensity for health benefits (Bassett et al., 2000; Gunn et al., 2002; Hendelman et al., 2000; Welk et al., 2000). Findings from these studies continue to expand the information base for energy expenditure of domestic activities. For example, a recent study measuring energy expenditure during household and gardening chores by Gunn et al concluded that self-paced moderate-intensity activities such as sweeping, lawn mowing, and window cleaning can be measured with precision and reproducibility, although the level of energy expenditure is moderated by different people performing the same task (Gunn et al., 2002).

The growing information on the energy expenditure of domestic activities and the potential contributions of these activities on health had led to the broadening of the self-reported physical activity measures from 1997 to the present. Active Australia included one specific question about vigorous gardening and yard work in its nation-wide telephone surveys of physical activity among Australian adults in 1997 and 1999 (Armstrong et al., 2000), while in 1998 one question on vigorous household chores and one on vigorous gardening activities in the previous week were included in the 1998 NSW Health Survey, representing efforts to capture strenuous incidental physical activities often commonly performed in the household. In their analyses of the 1997 and 1999 surveys, Armstrong and colleagues demonstrated that the exclusion of vigorous gardening and yard work activities from the standard measures of physical activity participation have yielded substantially different estimates of the prevalence of sufficient physical activity in the population (Armstrong

et al., 2000). Initial analyses of the 1998 NSW Health Surveys showed that excluding vigorous household chores and heavy gardening activities decreased the proportions of adults engaged in adequate physical activity from 64.7% to 53.8% for males and from 57.2% to 44.2% for females (NSW Health Surveys 1997 and 1998).

Given that domestic activities may be the major source of energy expenditure for certain population groups, determining their relative contribution to the total activity level is an important step to demonstrating independent health benefits of engaging in domestic activities. This report summarises results from a re-analysis of the 1998 NSW Health Survey to determine the prevalence of adults classified as sufficiently active for health benefits based on standard measures of physical activity (PA) only and combined measures of household chores and gardening activities (HH/GA) and standard measures of PA. The report also assesses the analytical impact of including measures of vigorous HH/GA on the population estimates of health-related physical activity according to two definitions of participating in 'sufficient' physical activity for health benefits (see detailed description in Methods and Results). The PA and HH/GA questions used in the 1998 survey and considered in this analysis are shown in Appendix B.

2. METHODS

The NSW Health Surveys in 1997 and 1998 were telephone-based population surveys of approximately 17,000 randomly sampled adults aged 16 years and over each year. The main focus of this report is a re-analysis of the 1998 survey. Comparisons of physical activity estimates derived from the 1997 and 1998 NSW Health Surveys are not possible because of two fundamental differences between the PA questions used in the 1997 and 1998 NSW Health Surveys. First, respondents in the 1998 survey were asked about their physical activity in the previous week, rather than activity in the previous two weeks, as in 1997. Second, broader measures of PA were included in the 1998 survey to allow respondents to report as separate dimensions on other types of activities that include vigorous housework and gardening. The inclusion of questions on HH/GA ensures that these activities are reported separately from walking and other leisure-time physical activities while still allowing for the analysis of these items in the overall leisure time physical activity estimates.

A detailed report describing the survey design and technical aspects of the 1998 survey is available from the NSW Health publications (PHD, 2000 and 2003). For the purpose of the present analyses, the physical activity dimensions of interest were:

- Walking continuously for at least 10 minutes, for recreation, exercise or to get to or from places in the previous week
- Other moderate-intensity leisure-time physical activities, such as swimming, sailing
- Vigorous-intensity physical activities which made you breathe harder or puff and pant, such as jogging, cycling, squash
- Vigorous-intensity household chores and gardening activities

Engaging in household chores was measured using the questions: 'In the last week, how many times did you do any vigorous household chores which made you breathe harder or puff and pant?' followed by 'What do you estimate was the total time you spent doing these vigorous household chores in the last week?' and for gardening activities 'In the last week, how many times did you do any vigorous gardening or heavy work around the yard which made you breathe harder or puff and pant?' To ensure that activities that result in moderate-intensity energy expenditures of 3.0–6.0 METs are reported, the term 'vigorous' instead of 'moderate' was used in these questions. All reported vigorous household chores and gardening activities are classified and analysed as moderate-intensity activities. Examples of household chores and gardening activities with the METs level between 3.0 and 6.0 include scrubbing floors, vacuuming or mowing lawn (Ainsworth et al., 2000).

Respondents were asked to report the frequency (session) and duration (minutes) of each activity in the week preceding the survey. Responses to these continuous variables - walking, moderate- or vigorous-intensity physical activities or vigorous household activities – were dichotomised at a threshold value of 150 minutes per week, based on the current recommendations of 'sufficient' physical activity to confer health benefits. The reported frequencies in participation in either leisure-time or household chores and gardening activities were also dichotomised at a threshold of 5 sessions or more per week. This information was used to construct two definitions of 'sufficient' physical activity used in the analyses:

- I. 'Sufficient' active time: The first definition is based on the sum of the total minutes of walking, moderate and/ or vigorous-intensity physical activity. 'Sufficient' health benefits is obtained by minutes walking plus minutes moderate plus vigorous minutes that is greater than or equal to 150 minutes. This definition is used to provide population prevalence estimates in the previous week.
- II. 'Sufficient' active time and sessions: The second definition poses a stricter criteria for achieving adequate physical activity and takes into account total minutes and sessions of participation. 'Sufficient' time and sessions to achieve health benefits is when at least 150 minutes of activity is obtained in at least five separate sessions of activity. This definition is applicable to participation in the previous week.

All analyses were performed for all the respondents as well separately for males and females and for four age groups. Within the two definitions of 'sufficient' physical activity two sets of estimates were calculated and compared:

- i. Walking and other moderate and vigorous physical activity (with minutes of vigorous-intensity physical activity weighted by a factor of two, to take into account its greater intensity)
- ii. Combined walking and other moderate and vigorous physical activity (with minutes of vigorous-intensity physical activity weighted by a factor of two) and vigorous household chores and gardening activities

Analyses were conducted using the SAS Version 8.2 statistical software package and weighted for sex and age to the NSW population.

3. RESULTS

This report describes weighted results for NSW estimates. Results are presented as proportion of adults meeting the 'sufficient' time and 'sufficient' time and sessions criteria for walking and other leisure time physical activities, with and without household chores and gardening activities, for the entire sample, for each sex and for the specified age groups. Confidence intervals were also calculated for the estimates and difference in estimates.

Table 1: Proportions of NSW adult population meeting minimum criteria of 'sufficient' active with vigorous household chores and gardening activities excluded and included from the total physical activity score (n=16,741), weighted[#]

	'Sufficient' active (time)* Percentage (95% CI)			'Sufficient' active (time and session)** Percentage (95% CI)		
	Walking and other recreational activities	Household chores and gardening activities included	Difference estimates	Walking and other recreational activities	Household chores and gardening activities included	Difference estimates
Total	58.7 (58.0-59.5)	71.7 (71.0-72.3)	12.8 (12.3-13.3)	48.8 (48.1-49.6)	60.8 (60.1-61.6)	12.0 (11.5-12.5)
Sex						
Men	64.1 (63.4-64.8)	75.8 (75.1-76.4)	11.6 (11.1-12.1)	53.8 (53.0-54.5)	64.7 (64.0-65.4)	10.9 (10.4-11.4)
Women	53.5 (52.8-54.3)	67.7 (67.0-68.4)	14.0 (13.5-14.6)	44.1 (43.3-44.8)	57.2 (56.4-57.9)	13.0 (12.5-13.5)

[#] Weighted data for sex and age to provide a representative sample to the reference population.

* Time only: ≥ 150 minutes per week

** Time and session: ≥ 150 minutes and ≥ 5 sessions per week

Based on a sample size of 16,930, 49.3% of those surveyed comprised of male respondents. Approximately 16.2% of all respondents were aged 16-24 years, 19.7% aged 25-34 years, 20.0% aged 35-44 years, 16.9% aged 45-54 years, 11.4% aged 55-64 years, and 15.8% aged 65 years and older. Of the original 16,930 aged 16 years and older who were randomly sampled for a telephone interview, 16,741 respondents with physical activity data were included in the final analysis (PHD, 2000). Table 1 shows the distribution of estimates of adults meeting the criteria of 'sufficient' active with household chores and gardening activities excluded and then included in the total physical activity score. The 95% confidence intervals are also presented for the proportions and the difference proportions in Table 1.

Excluding household chores and gardening activities decreased the prevalence of adults meeting the first definition of 'sufficient active' in minutes by 12.8% (95%CI:12.3%-13.3%) and for the second definition of 'sufficient active' in minutes and sessions by 12.0% (95% CI:11.5%-12.5%). Although proportionately more men than women were more likely to report adequate levels of physical activity, participation generally declined with age for both genders. The prevalence of 'sufficient active' in terms of time increased significantly for both genders when household chores and gardening activities were included, with the difference proportions being substantially higher for women (14.0%; 95% CI: 13.5%-14.6%) than men (11.6%; 95% CI: 11.1%-12.1%). A similar pattern was observed with the criteria of sufficient active in time and sessions (women: 13.0%; 95% CI:12.5%-13.5%; men: 10.9%; 95% CI:10.4%-11.4%). While

participating in vigorous domestic-based activities was more common among men than women in both time and sessions in this sample, the difference estimates for being 'sufficient' active were relatively higher for women than men when household chores and gardening activities were included in the analyses.

The proportions of adults being 'sufficient' active in terms of time and sessions plus time, excluding and including household chores and gardening activities, according to age groups for men and women are presented in Figures 1 and 2, respectively.

Figure 1: Proportions of men engaged in 'sufficient' activity (time)

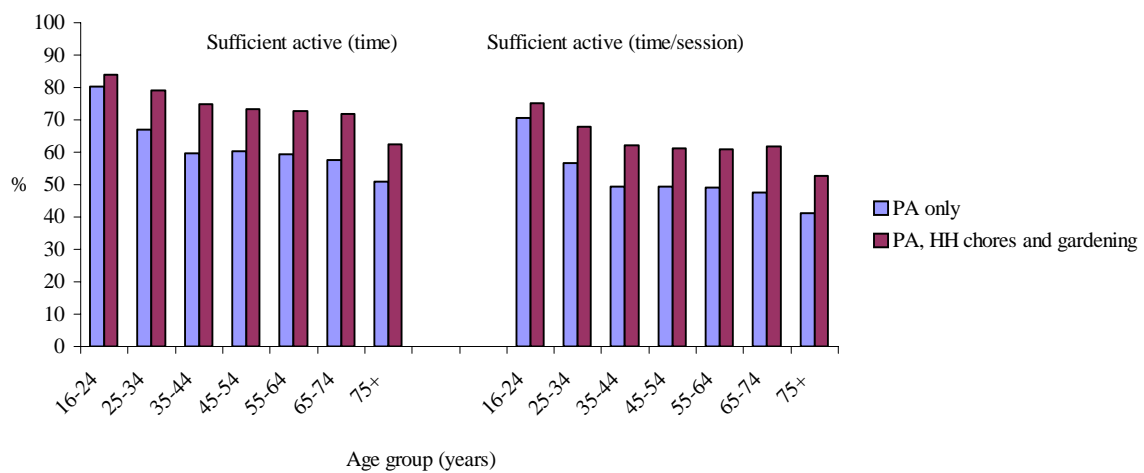
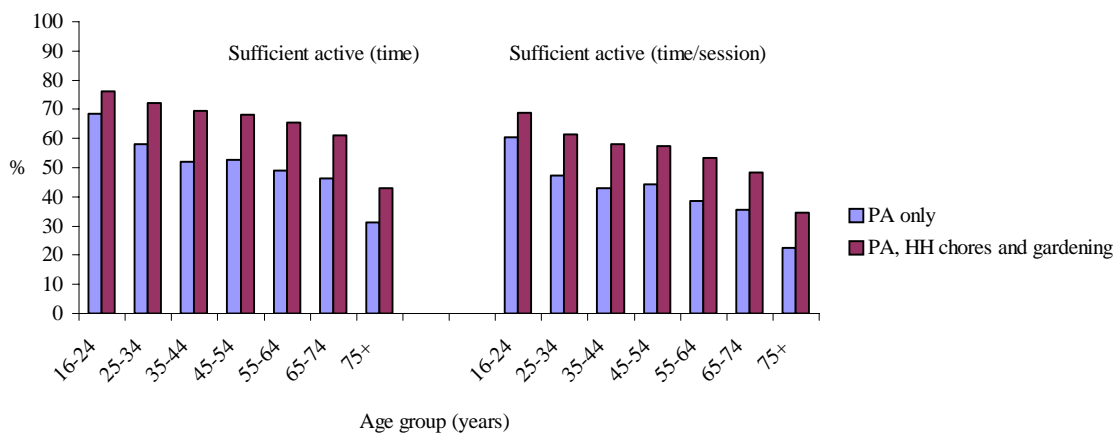


Figure 2: Proportions of women engaged in 'sufficient' activity (time and session)



Including household chores and gardening activities in the analysis substantially increased the proportions of sufficient active for all age groups and genders but a steady decline in physical activity was observed with age for both groups (see Table A1 in Appendix A for actual proportions and corresponding confidence intervals). Difference estimates between leisure-time physical activity and when domestic-based activities were included were substantially higher among women than men across all age groups, in particularly among those aged 25-64 years, indicating that women in this sample and age groups engage in more vigorous household chores and gardening activities than leisure-time physical activity compared to men. Although men spent more time than did women doing vigorous household chores and gardening activities, and this increased with age, the difference proportions among women were still higher than those observed among men, especially those aged 25-74 years when using the definition of sufficient time and for those aged 25-64 years when sufficient time and sessions criteria was used. Both men and women aged over 25 years, however, reported substantially more domestic activities than their younger counterparts.

4. DISCUSSION

The importance of routinely assessing domestic-based activities that would significantly benefit health is yet to be realised. Current public health recommendations specify *that every adult should accumulate at least 30 minutes physical activity of light to moderate intensity on all or most days of the week* to gain better health (Pate et al., 1995), but it is unclear if engaging in regular strenuous home activities is considered as important source of physical activity for better health. Yet, household chores, gardening or yard work are commonly reported physical activities. This report represents a secondary analysis of the 1998 NSW Health Survey data set examining the analytical impact of including self-reported vigorous household chores and heavy gardening activities in the measurement of the total physical activity prevalence estimates.

Including data on household chores and vigorous gardening activities in the total physical activity score significantly increase the prevalence of achievement of sufficient active to approximately 12% (time and session) and 12.8% (time only). When examining the effects of including household chores and gardening activities in the analysis, it was found that total physical activity participation did not decrease gradually with age as would have normally expected. This age pattern was evident among both men and women, but mainly for the criteria of 'sufficient' active in terms of time only. These results highlight the important contribution 'vigorous domestic activities' can make to the overall prevalence levels of adults meeting the 'sufficient' physical activity criterion, particular for women. This is important, as fewer women reported 'sufficient' leisure-time physical activity compared to men, but when domestic activities were included the difference between men and women, whilst still substantial, decreased by 2.1%. The current leisure-time physical activity measures may be under-estimated, and when estimating total physical activity levels the consideration of domestic activities is important. Recent studies (Mutrie et al., 2003; Lawlor et al., 2002) have questioned the mental and physical health benefits of vigorous domestic activities. Consistent evidence on this is still lacking and future assessments of domestic activities in estimating total physical activity levels in population should not, however, be dismissed given the current emphasis on promoting active lifestyles.

The findings in this report showed that gender difference in total physical activity remained despite inclusion of the household chores and gardening activities in the total physical activity score. However, women reported less total sufficient physical activity than men but whose total physical activity levels were substantially influenced by the greater contribution of household chores and gardening activities. The findings underscore the importance of domestic-based activities as a potential contribution to the total physical activity level. Specifically, the report adds to our understanding of the relevance of domestic activities to females and to their overall physical activity level. The importance of identifying and assessing various domains of physical activity also cannot be overlooked for promoting physical activity participation through a combination of leisure-time and domestic-based physical activities in a range of settings.

The potential for selection bias due to non-respondents or reporting bias in respondents either over-reporting their behaviour or actually doing relatively more domestic chores at home could not be ruled out in these analyses. Studies validating self-reported measures of domestic activities together with studies determining energy expenditure associated with vigorous domestic activities that are linked to health outcomes should be carried out, to assure their usefulness in routine population-based physical activity surveys.

ACKNOWLEDGMENT

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ANNEX A: Proportions of NSW adult population meeting minimum criteria of 'sufficient' active with vigorous household chores and gardening activities excluded and included from the total physical activity score

Table A1: Proportions (%) of NSW adult population meeting minimum criteria of 'sufficient' active with household chores and gardening activities excluded and included from the total physical activity score (n=16,741), (95% CI), by gender

	Number	'Sufficient' active (time)* Percentage (95% CI)			'Sufficient' active (time and session)** Percentage (95% CI)		
		Walking and other recreational activities	Household chores and gardening activities included	Difference estimates	Walking and other recreational activities	Household chores and gardening activities included	Difference estimates
Males							
16-24 yrs	767	80.4 (79.5-81.3)	83.9 (83.0-84.7)	3.5 (3.1-3.9)	70.5 (69.4-71.5)	75.2 (74.2-76.2)	4.8 (4.3-5.3)
25-34 yrs	1081	67.1 (66.0-68.1)	79.1 (78.1-80.0)	12.0 (11.3-12.8)	56.7 (55.6-57.9)	67.9 (66.8-69.0)	11.2 (10.4-11.9)
35-44 yrs	1649	59.6 (58.5-60.8)	74.7 (73.7-75.7)	15.2 (14.4-16.0)	49.5 (48.3-50.7)	62.2 (61.1-63.3)	12.8 (12.0-13.6)
45-54 yrs	1292	60.2 (59.2-61.5)	73.3 (72.2-74.3)	12.9 (12.1-13.7)	49.3 (48.1-50.4)	61.1 (60.0-62.3)	11.9 (11.2-12.7)
55-64 yrs	954	59.5 (58.3-60.6)	72.7 (71.6-73.7)	13.0 (12.2-13.8)	48.9 (47.8-50.1)	60.9 (59.8-62.1)	11.9 (11.2-12.7)
65-74 yrs	835	57.7 (56.5-58.8)	71.7 (70.7-72.8)	13.6 (12.8-14.4)	47.5 (46.3-48.6)	61.8 (60.6-62.9)	14.0 (13.1-14.8)
75+ yrs	404	51.1 (49.9-52.2)	62.5 (61.3-63.6)	11.2 (10.5-12.0)	41.1 (40.0-42.3)	52.6 (51.4-53.8)	11.4 (10.7-12.2)
Females							
16-24 yrs	930	68.5 (67.6-69.4)	76.3 (75.5-77.2)	7.8 (7.3-8.4)	60.3 (59.4-61.3)	68.9 (68.0-69.8)	8.9 (8.0-9.1)
25-34 yrs	1757	58.1 (57.2-59.2)	72.1 (71.2-73.0)	14.0 (13.3-14.6)	47.4 (46.4-48.4)	61.5 (60.5-62.5)	14.1 (13.4-14.8)
35-44 yrs	2185	52.1 (51.1-53.0)	69.4 (68.4-70.3)	17.0 (16.3-17.8)	42.9 (41.9-43.8)	57.9 (56.9-58.9)	14.9 (14.2-15.6)
45-54 yrs	1682	52.8 (51.8-53.8)	68.2 (67.3-69.1)	15.3 (14.6-16.0)	44.3 (43.3-45.3)	57.4 (56.4-58.4)	12.9 (12.3-13.6)
55-64 yrs	1279	48.9 (47.9-49.9)	65.4 (64.4-66.3)	16.7 (15.9-17.4)	38.6 (37.7-39.6)	53.5 (52.5-54.4)	15.1 (14.4-15.8)
65-74 yrs	1190	46.2 (45.3-47.2)	60.9 (60.0-61.9)	14.8 (14.1-15.5)	35.7 (34.8-36.7)	48.4 (47.4-49.4)	12.8 (12.1-13.5)
75+ yrs	742	31.1 (30.2-32.0)	43.0 (42.0-44.0)	11.9 (11.3-12.6)	22.3 (21.5-23.2)	34.4 (33.5-35.4)	11.8 (11.2-12.5)

* Time only: ≥ 150 minutes per week

** Time and session: ≥ 150 minutes and ≥ 5 sessions per week

ANNEX B: 1998 NSW HEALTH SURVEY PHYSICAL ACTIVITY QUESTIONS

69. In the last week, how many times have you walked continuously for at least 10 minutes for recreation or exercise or to get to or from places?

Number of times

Don't know

70. What do you estimate was the total time you spent walking in this way in the last week? (in hours and or minutes)

Number of hours

Number of minutes

Don't know

71. The next question does not include gardening. In the last week, how many times did you do any vigorous household chores which made you breathe harder or puff and pant?

Number of times

Don't know

72. What do you estimate was the total time you spent doing these vigorous household chores in the last week?

Number of hours

Number of minutes

Don't know

73. In the last week, how many times did you do any vigorous gardening or heavy work around the yard which made you breathe harder or puff and pant?

Number of times

Don't know

74. What do you estimate was the total time you spent doing vigorous gardening or heavy work around the yard in the last week?

Number of hours

Number of minutes

Don't know

75. The next question excludes household chores or gardening. In the last week, how many times did you do any vigorous physical activity which made you breathe harder or puff and pant? (eg: football, tennis, netball, squash, athletics, cycling, jogging, keep-fit exercise and vigorous swimming).

Number of times

Don't know

76. What do you estimate was the total time you spent doing this vigorous physical activity in the last week?

Number of hours

Number of minutes

Don't know

77. This next question does not include household chores or gardening. In the last week, how many times did you do any other more moderate physical activity that you haven't already mentioned? (eg: lawn bowls, golf, tai chi, and sailing).

Number of times

Don't know

78. What do you estimate was the total time that you spent doing these activities in the last week?

Number of hours

Number of minutes

Don't know