1 Introduction

Physical activity is an important factor in promoting good health, in preventing illness and injury and in reducing the overall burden of disease. Being physically active reduces the risk for certain chronic diseases, such as cardiovascular disease, type 2 diabetes, obesity, some cancers and mental ill-health.[1]

Physical activity is of benefit in six out of seven of Australia's National Health Priorities.[2] At the same time, physical inactivity accounts for 6.7% of the total burden of disease, ranking it second only to tobacco smoking (9.7%) in terms of burden of disease from health risk factors.[3] The total direct health care cost attributable to physical inactivity is about $377 million per year.[4]

In 1998 the NSW Physical Activity Taskforce implemented the *Simply Active Every Day* plan with the aim of increasing and encouraging ongoing participation in physical activity.[5] The plan helped create infrastructure, programs, services and opportunities to support participation, particularly for less active people, while emphasising the health, environmental and economic benefits of participation in physical activity. In addition, the NSW Department of Health provided an overarching framework for planning public health activities in the period from 2000 to 2005 (*Healthy People 2005*), in which promoting physical activity was a strategy to aid chronic diseases prevention.[6] Accordingly, monitoring population levels of physical activity is important for identifying emerging trends and to inform the planning, implementation and evaluation of physical activity-related health programs and services.

The NSW Department of Health first surveyed population levels of physical activity using the Active Australia Survey in 1998.[7] The survey was conducted throughout NSW in 1998 using computer-assisted telephone interviews (CATI). In that survey, 47.6% of the population said they were sufficiently active – that is, they participated in at least 150 minutes of walking or moderate or vigorous physical activity over at least five sessions per week. This is the level of physical activity recommended by the US Surgeon General's Report on Physical Activity and Health in 1996[8] and is the accepted minimum for health benefits.

Since 2002 the NSW Department of Health, in collaboration with all area health services, has monitored the physical activity levels of the people of NSW as part of the ongoing NSW Population Health Survey.[9] The survey is conducted all year round using CATI. Data collected in 1998 have provided a baseline for comparisons with data collected in surveys in 2002, 2003, 2004 and 2005.

Recent data regarding the prevalence of physical activity participation in NSW suggest that significantly more people are achieving recommended levels of physical activity.[10] This change deserves closer examination to determine if it reflects actual behavioural trends. Such an increase, if real, may have significant public health benefits and could be an important indicator of the impact of health promotion initiatives.

This report will examine the trends in physical activity participation in NSW from 1998 to 2005. Specifically, the trends in sufficient physical activity levels will be examined, and there will be further analyses of participation in walking, moderate and vigorous intensity physical activity to delineate the activities contributing to the accumulation of sufficient physical activity in NSW. Comparisons will be made with surveillance data from other states in order to contextualise the NSW trends. Possible explanations for the apparent increase in the prevalence of sufficient physical activity in NSW will also be considered.

2 The NSW Population Health Survey – Physical activity module

The physical activity module of the NSW Population Health Survey consists of questions taken from the Active Australia Survey. The following questions were asked in 1998 and in all surveys from 2002 to 2005.[10]

- 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?
- What do you estimate was the total time you spent walking in this way in the last week?
- In the last week, how many times did you do any vigorous physical activity that made you breathe harder or puff and pant? [For example: football, tennis, netball, squash, athletics, cycling, jogging, keep-fit exercises and vigorous swimming]
- What do you estimate was the total time you spent doing this vigorous physical activity in the last week?
- In the last week, how many times did you do any other more moderate physical activity that you haven't already mentioned? [For example, lawn bowls, golf, tai chi and sailing]
- What do you estimate was the total time that you spent doing these activities in the last week?

In addition, the question, 'How do you usually get to work?' was asked from 2002 onwards to measure the prevalence of active commuting to work.

Respondents were asked to exclude household chores and gardening when answering the vigorous and moderate physical activity module items.

Also, in the 1998, 2002 and 2005 surveys, questions about household and gardening activity were included. These questions were placed in the module before the vigorous and moderate activity questions. The aim was to ensure that this activity was not included in the answers to the leisure time activity questions. In these versions of the survey, respondents were asked,

- 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?
- What do you estimate was the total time you spent doing these vigorous household chores in the last week?
- 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?
- What do you estimate was the total time you spent doing vigorous gardening or heavy work around the yard in the last week?

3 Analysis

3.1 Sample

In 1998, 2002 and 2003 the target sample comprised approximately 1000 people in each of the 17 area health services (AHS), giving a total sample of 17,000 people. In 2004, the number of areas was reduced to eight. The target sample for each area was adjusted to 1500 people per area, giving a total sample of 12,000 people.

The sampling frame was developed as follows.[11] Records from the Australia on Disk electronic white pages (phone book) were geo-coded using MapInfo mapping software 2.3. The geo-coded telephone numbers were assigned to statistical local areas and area health services. The proportion of numbers for each telephone prefix by area health service was calculated. All prefixes were expanded with suffixes ranging from 0000 to 9999. The resulting list was then matched back to the electronic phone book. All numbers that matched numbers in the electronic phone book were flagged and the number was assigned to the relevant geo-coded area health service. Unlisted numbers were assigned to the area health service containing the greatest proportion of numbers with that prefix. Numbers were then filtered to eliminate contiguous unused blocks of greater than 10 numbers. The remaining numbers were then checked against the business numbers in the electronic phone book to eliminate business numbers. Finally, numbers were randomly sorted. Households were contacted using random digit dialing. One person from the household was randomly selected for inclusion in the survey.

3.2 Response rates

The total number of interviews completed, number of interviews completed with people aged 16 years and over, and overall response rates for 1998 and the period from 2002 to 2004 are presented in Table 1.

Table 1: Total number of interviews completed, number of interviews with people aged 16 years and over, and overall response rates for 1998-2005.

	1998	2002	2003	2004	2005
Total number of completed interviews	17,497	15,442	15,837	11,830	13,701
Number of interviews with people aged 16 years and over	17,497	12,622	13,088	9786	11,500
Response rate[a]	65%	67.6%	67.9%	61.2%	57.7%

[a] Response rate = completed interviews divided by completed interviews and refusals

3.3 Data analysis

For analysis, the survey sample was first weighted to adjust for differences in the probabilities of selection among subjects. These differences were due to the varying number of people living in each household, the number of residential telephone connections for the household, and the varying sampling fraction in each health area. Post-stratification weights were used to reduce the effect of differing non-response

rates among males and females and different age groups on the survey estimates. These weights were adjusted for differences between the age and sex structure of the survey sample and the Australian Bureau of Statistics 2003 mid-year population estimates (excluding people resident in institutions) for each area health service. Further information on the weighting process is provided elsewhere[12]

Secondly, for trend analyses, samples for survey years 1998, 2002, 2003 and 2004 were re-weighted, and age and gender standardised to that of the 2005 sample.

The Australian Institute of Health and Welfare (AIHW) developed the scoring protocol for the Active Australia Survey.[13] Total minutes were calculated by summing minutes in the last week spent in walking (continuously for at least 10 minutes), moderate and vigorous intensity physical activity. Any time spent in vigorous intensity physical activity was weighted by two. Sufficient physical activity was defined as achieving a total of at least 150 minutes of moderate intensity physical activity over five separate occasions in the previous week.[14]

As the physical activity data were not normally distributed, the median and interquartile range were calculated to show central tendency and dispersion.

In order to examine differences in participation in physical activity within the population, data were stratified by sex, age, Body Mass Index (BMI), socioeconomic status, geographic remoteness and AHS area of residence.

Socioeconomic status was determined using the Index of Relative Socio-Economic Disadvantage from the Socio-Economic Indexes For Areas (SEIFA),[15] which describe the socioeconomic aspects of geographical areas, including income, educational attainment, level of unemployment and prevalence of people in unskilled occupations. The first quintile indicates the least disadvantage, and the fifth quintile indicates the most disadvantage.

Geographic remoteness was ascertained using the Accessibility-Remoteness Index for Australia (ARIA)[16] in the 2002 and 2003 Surveys, and using the updated Accessibility-Remoteness Index of Australia Plus (ARIA+)[17] in 2004 and 2005. The ARIA and ARIA+ measure the remoteness of a locality based on its accessibility to services,[10] Localities were grouped into three categories: major cities (about 74% of the population); inner regional (about 18% of the population); and outer regional to very remote areas (about 8% of the population).

As the variables for socioeconomic status and geographic remoteness in 1998 were not comparable to those from 2002 onwards, this report does not present data on sufficient physical activity stratified by these two demographic indicators for 1998.

For the purposes of this report, a consistent approach was employed for data analysis, whereby ‘don’t know’ or ‘refused’ responses were excluded. This report found that trends were in the same direction as those reported by the NSW Department of Health, although the figures were slightly lower than those reported by the NSW Department of Health.[7 10 11 18 19]

4 Trends in participation in sufficient physical activity in NSW

4.1 Proportion of people achieving sufficient levels of physical activity

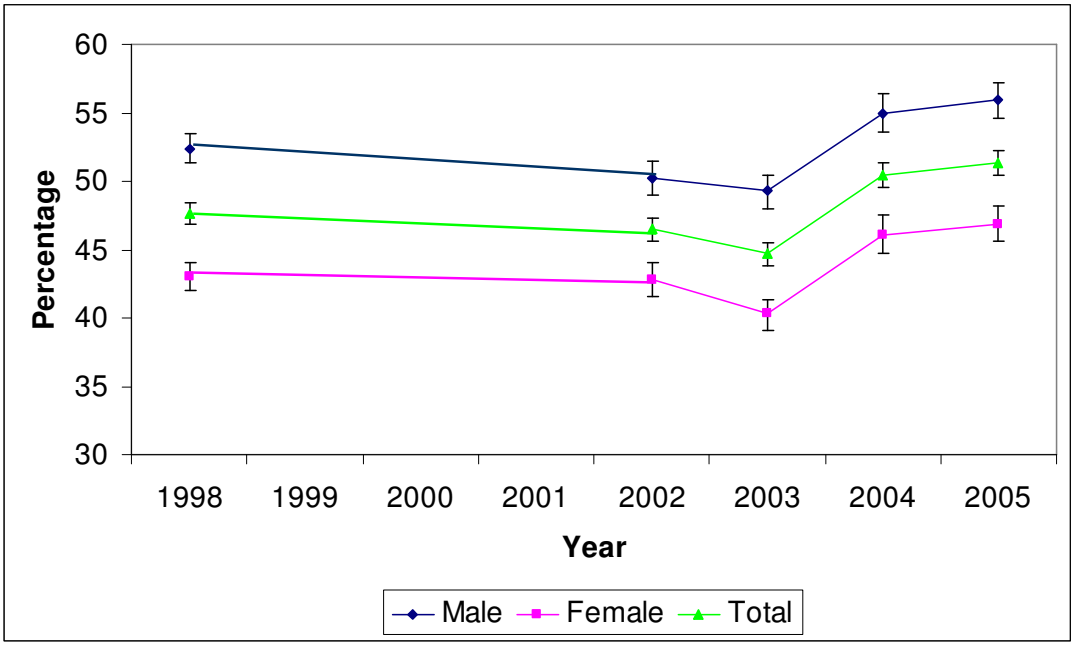
Table 2 presents the proportion of people aged 16 years and over in NSW achieving sufficient amounts of physical activity during the period from 1998 to 2005 with stratification by demographic characteristics.[1]

There has been a significant increase in the proportion of people in NSW who are sufficiently active for health from 1998 to 2005. In 1998, 47.6% of people in NSW over 16 years of age were sufficiently active. The prevalence remained stable at 46.5% in 2002 then dropped slightly 44.7% in 2003. It increased markedly to 50.5% in 2004, then remained steady at 51.3% in 2005.

4.1.1 Differences by sex

The trends in sufficient physical activity levels for males and females were similar to that for the whole population, with significant increases in the proportion of sufficiently active males and females from 2004 (Figure 1). In 1998, 52.4% of males reported achieving sufficient amounts of physical activity, and the prevalence increased in 2004 and 2005 to 55.0% and 55.9% respectively. A similar trend was evident among females, with the proportion of females achieving sufficient physical activity increasing from 43.0% in 1998 to 46.1% and 46.9% in 2004 and 2005 respectively. The prevalence of sufficient physical activity was consistently higher among males than among females.

Figure 1. Participation in sufficient physical activity (%, 95% CI) for males, females and all persons in NSW, 1998-2005



[1] Confidence intervals are presented in Appendix A.

Table 2. Proportion of people in NSW achieving sufficient levels of physical activity by demographic characteristics, 1998-2005

	Year of survey				
	1998 (n=17,494)	2002 (n=12,622)	2003 (n=13,008)	2004 (n=9786)	2005 (n=11,435)
Variable	%	%	%	%	%
Sex					
Male	52.4	50.2	49.3	55.0	55.9
Female	43.0	42.8	40.3	46.1	46.9
Total	47.6	46.5	44.7	50.5	51.3
Age group					
16-24 years	64.9	59.2	60.3	62.6	63.9
25-34 years	51.1	47.5	46.8	54.2	55.3
35-44 years	45.7	46.5	41.8	50.8	51.5
45-54 years	46.1	44.7	42.9	48.3	50.2
55-64 years	43.1	43.8	43.7	47.0	46.8
65-74 years	40.1	41.8	39.8	45.5	45.5
75 years & over	28.6	32.1	26.5	31.8	32.4
BMI category					
Not overweight/obese	51.6	49.6	48.8	56.2	54.2
Overweight	46.7	46.4	43.9	53.0	52.8
Obese	38.3	39.7	34.5	42.7	42.2
Socioeconomic status quintiles[a]					
Quintile 1		51.7	49.8	53.5	56.0
Quintile 2		50.9	51.4	51.7	52.5
Quintile 3		44.9	42.7	50.0	50.6
Quintile 4		44.3	41.5	50.1	49.6
Quintile 5		43.0	40.8	46.5	46.5
Geographic remoteness					
Major cities		47.4	45.8	50.8	52.1
Inner regional		46.6	43.2	50.0	49.5
Outer regional to Very remote		49.8	39.7	50.3	50.0
Area Health Services of residence					
Sydney South West	48.1	44.8	45.4	51.4	50.0
South Eastern Sydney Illawarra	51.2	53.0	48.0	54.6	54.9
Sydney West	43.8	39.6	40.9	44.5	48.5
Northern Sydney Central Coast	50.0	47.1	47.8	53.5	54.3
Hunter New England	45.2	46.1	42.7	46.9	49.8
North Coast	47.5	48.8	43.4	54.2	50.0
Greater Southern	46.9	48.3	42.2	48.4	49.7
Greater Western	43.2	43.5	41.1	46.2	49.6

All estimates weighted and standardised to 2005 age + sex distribution.
PA=Physical activity
Sufficiently active=Total 5 sessions and 150 minutes of PA per week (PA of at least 10 mins; vigorous minutes x 2)
n=NSW total sample size: 'don't know' and 'refused' responses are excluded in the analyses.
[a]Quintile 1=least disadvantaged; Quintile 5=most disadvantaged

4.1.2 Differences by age group

Table 2 shows that the proportion of people in NSW achieving sufficient levels of physical activity decreased with increasing age. The highest proportion of sufficiently active people was among those aged 16-24 years and remained steady from 1998 to 2005 (64.9% and 63.9% respectively). In all other age groups, the prevalence of sufficient physical activity showed similar trends to the state population, increasing noticeably from 2004. Significant increases were observed among people aged 35-44 years and 45-54 years, with rises of 45.7% to 51.5% and 46.1% to 50.2% respectively from 1998 to 2005.

4.1.3 Differences by Body Mass Index

Between 1998 and 2005, the proportion of people achieving sufficient amounts of physical activity was highest among those with BMI in the normal or low range (<25kg/m^2), and lowest among people who were obese (>30kg/m^2)(Table 2). All BMI categories showed significant growth in the prevalence of sufficient activity between 2003 and 2004, with increases maintained in 2005.

4.1.4 Differences by socioeconomic status

The lowest proportion of sufficiently active people was found in the most disadvantaged quintile (Table 2). The proportion of sufficiently active people in the third and fourth quintiles showed the greatest change from 1998 to 2005, with significant increases shown between 2002 and 2004.

4.1.5 Differences by geographic remoteness

As shown in Table 2, the proportion of sufficiently active people increased significantly in major cities between 2002 and 2004.

Major cities (74% of the population), had 47.4% of people reporting sufficient activity in 2002. The prevalence rose to 50.8% in 2004 and was maintained in 2005.

People living in inner regional towns (18% of the population), showed a non-significant upward trend in the prevalence of sufficient physical activity between 1998 and 2005.

People living in outer regional to very remote areas (8% of the population) showed little change in their physical activity levels between 1998 and 2005.

4.1.6 Differences by Area Health Services area of residence

The prevalence of sufficient physical activity by AHS area of residence showed similar trends to the state population with a decline between 1998 and 2003, then an increase from 2004 (Table 2). Significant increases in the proportion of people achieving sufficient physical activity were found among people living in Sydney South West, Sydney West, and Northern Sydney Central Coast AHS between 2002 and 2004.

4.2 Median minutes of physical activity participation

Tables 3, 4 and 5 show the median weekly minutes spent in different types of physical activity stratified by demographic group.[2] Due to the skewed distribution, the median values for moderate and vigorous minutes were almost all zero.

The trends in total median minutes spent in physical activity reflect the increasing trends in the prevalence of sufficient physical activity. The median minutes per week spent walking increased across nearly all demographic groups between 1998 and 2004, with the change maintained in 2005. In contrast, moderate and vigorous activity showed almost no change in median minutes per week across all demographic variables.

Table 3 shows that among males the median weekly minutes spent walking rose from 90 minutes in 2003 to 120 minutes in 2004. The upper quartile limit for vigorous physical activity also increased slightly between 1998 and 2005, suggesting that males participated more often in vigorous activities over this period. Similar patterns in weekly median minutes for walking and vigorous physical activity are evident for females, but with smaller increases.

Walking and total median minutes increased in all age groups (Table 3). People aged 16-24 years old had the highest total median number of minutes spent in physical activity, and greater participation in vigorous activity. The upper quartile values for vigorous physical activity also shifted upwards in the 35-44 and 45-54 age groups, although not enough to shift the median value from zero.

The median weekly minutes spent walking increased across all BMI categories (Table 4). The total median minutes spent doing physical activity decreased as BMI increased, consistent with the prevalence of sufficient physical activity reported earlier. Of particular note is the increase in the upper quartile values for vigorous activity for obese persons in 2004 and 2005, suggesting that there was some increase in the time spent doing vigorous physical activity among some people in this group over this period.

Table 4 shows that walking and total weekly minutes spent in physical activity increased in all socioeconomic quintiles. There were noticeable changes in the walking median minutes among people in the fourth quintile between 2002 and 2005. Among people in the third quintile, the weekly median minutes spent walking increased by 30 minutes between 2003 and 2004.

The amount of time spent walking rose among people living in all localities (Table 5). The median weekly minutes people spent walking increased by 30 minutes in major cities, by 15 minutes in inner regional areas, and by 60 minutes in outer regional to very remote areas between 2003 and 2004. In 2005 the median weekly minutes of walking increased a further 30 minutes in inner regional areas, but dropped 15 minutes in outer regional to very remote areas.

All AHS showed growth in weekly median minutes spent walking between 2003 and 2004, except Sydney West AHS which showed an increase from 2004 to 2005 only (Table 5). The increases in median weekly minutes ranged between 20 and 30 minutes.

[2] Interquartile ranges (25^{th}-75^{th}) are presented in Appendices B, C and D.

Table 3. Median weekly minutes spent in physical activity by sex and age in NSW, 1998-2005

Variable	Median weekly minutes (IQR)	Year of survey				
		1998 (n=17,494)	2002 (n=12,622)	2003 (n=13,008)	2004 (n=9786)	2005 (n=11,435)
Sex						
Male	Walking	90	90	90	120	120
	Moderate PA	0	0	0	0	0
	Vigorous PA	0	0	0	0	0
	Total	240	240	240	300	300
Female	Walking	90	90	90	120	105
	Moderate PA	0	0	0	0	0
	Vigorous PA	0	0	0	0	0
	Total	150	160	150	180	180
Total	Walking	90	90	90	120	120
	Moderate PA	0	0	0	0	0
	Vigorous PA	0	0	0	0	0
	Total	190	200	180	240	210
Age group						
16-24 years	Walking	105	105	90	120	120
	Moderate PA	0	0	0	0	0
	Vigorous PA	60	45	60	80	60
	Total	330	300	300	360	330
25-34 years	Walking	90	90	90	120	120
	Moderate PA	0	0	0	0	0
	Vigorous PA	0	0	0	20	0
	Total	210	200	210	280	240
35-44 years	Walking	80	90	80	100	120
	Moderate PA	0	0	0	0	0
	Vigorous PA	0	0	0	0	0
	Total	180	180	170	240	210
45-54 years	Walking	90	90	90	105	120
	Moderate PA	0	0	0	0	0
	Vigorous PA	0	0	0	0	0
	Total	180	180	180	210	210
55-64 years	Walking	90	90	90	120	120
	Moderate PA	0	0	0	0	0
	Vigorous PA	0	0	0	0	0
	Total	160	180	180	200	180
65-74 years	Walking	80	90	90	120	120
	Moderate PA	0	0	0	0	0
	Vigorous PA	0	0	0	0	0
	Total	150	180	150	210	180
75 years & over	Walking	50	60	40	60	60
	Moderate PA	0	0	0	0	0
	Vigorous PA	0	0	0	0	0
	Total	70	100	72	90	90

All estimates weighted and standardized to 2005 age + sex distribution. PA=Physical activity;
n=NSW total sample size: 'don't know' and 'refused' responses are excluded in the analyses.