1. Introduction

Physical activity—vital for health

Participation in physical activity has important benefits for the physical and mental health of Australians, and for social and cultural values in our communities.

Physical activity is recognised as an important factor in reducing the risk of chronic disease among Australians. It is important for the reduction of mortality and morbidity from cardiovascular disease, type 2 diabetes, some forms of cancer, and morbidity from some injuries, and mental health conditions.

This report presents details of a national physical activity survey conducted with Australian adults in November 1999. It covers patterns of participation in physical activity, along with knowledge and awareness of public health messages about physical activity. Further, the report details changes in participation and knowledge since 1997.

Promoting physical activity

Making people aware of the benefits of participation in physical activity to improve health is a major challenge for public health policy makers, health care providers and communities. Effective interventions are required to fulfil the overall population-health aim to increase total physical activity in the community. One process in Australia has been the development of National Physical Activity Guidelines (DHAC 1999), which serve to bring public attention to the minimum amount of physical activity required to achieve health benefits. These guidelines operate within a broader physical activity initiative in Australia, namely the *Active Australia* campaign. This campaign brings together the major stakeholders from government and non-government sectors to provide the structures for effective promotion of, and opportunities to participate in, physical activity in Australia.

The need for good quality data and evaluation

The information presented in this report relates primarily to leisure-time physical activity. Methods to accurately measure occupational and incidental physical activities are yet to be developed. Further, the relationship between health benefits and occupational and incidental physical activities are yet to elucidated.

One limitation for the effective promotion of physical activity in Australia is a lack of data on participation rates and evaluations of effective interventions. This report takes a first step in remedying the lack of coordinated monitoring of physical activity in Australia. Data on participation in physical activity at recommended levels are presented here, along with knowledge and awareness of specific campaign messages.

Monitoring *Active Australia*

As one of the benchmarks for the *Active Australia* initiative, a national baseline survey was conducted in November 1997. This report documents the results of a second survey two years after the baseline. It provides population data on the trends in physical activity among Australian adults over the two-year time-period of the *Active Australia* initiatives. Monitoring changes in the prevalence of physical activity and demonstrating any changes in the awareness of moderate physical activity are indicators of population changes.

Continued monitoring of patterns and trends in physical activity is needed to help assess the impact of specific interventions and campaigns such as *Active Australia*. To in part achieve this, another national physical activity survey, using comparable methodology, should be conducted in two to three years' time. The peak national body providing leadership in physical activity and health in Australia, the Strategic Inter-Governmental forum on Physical Activity and Health (SIGPAH) endorses replication of the *Active Australia* baseline survey.

Work to further develop nationally agreed standard methods of measurement appropriate for population-based observational studies should continue.

Structure of this report

Chapter 2 provides an overview of the relationship between physical activity and health, specifically in the areas of cardiovascular disease, diabetes, cancer, injury prevention and control, and mental health. Chapter 3 summarises the development of questions used to measure physical activity and includes a discussion of the key concepts in this area. The following chapter details the methodology used in the 1999 survey. The demographic profile of survey respondents is provided in Chapter 5. The results from the 1999 survey are presented in Chapter 6, specifically, the number of sessions spent in activities, the total time spent in activities and the levels of physical activity 'sufficient' to confer a health benefit. Chapter 7 presents information on the recall of generic messages on physical activity, and as they relate to the *Active Australia* campaign. The respondents' knowledge of physical activity is reported, as well as their intentions to become more active in the future. Chapter 8 reviews the trends in physical activity participation levels in Australia by comparing the 1999 survey results with those of a similar survey conducted in 1997. Finally, a discussion is given in Chapter 9.

2. Physical activity and health

Physical activity of moderate intensity has been recommended for health and wellbeing since the time of Hippocrates (460–370 BC). Despite this long interest in physical activity, its recognition as an important public health issue has lagged behind that for other traditional risk factors such as tobacco smoking (Bauman & Owen 1999). Only in the last two decades has consistent epidemiological evidence identified that physical activity is a major modifiable risk factor in the reduction of mortality and morbidity from many chronic diseases. The release in 1996 of the United States Surgeon General's report on physical activity and health (USDHHS 1996) gave physical activity an internationally recognised legitimacy as an important component of public health and wellbeing.

According to recent estimates, physical inactivity is responsible for about seven per cent of the total burden of disease in Australia (Mathers et al. 1999). This places physical inactivity second, behind tobacco control, in terms of national importance in health promotion and disease prevention. Physical inactivity also places an enormous economic cost on Australia (Stephenson et al. 2000).

Data collected from studies using different measurement techniques (i.e. self-reported physical activity, fitness assessments, motion sensors) show similar associations between physical inactivity and a range of health outcomes such as coronary heart disease, ischaemic stroke, type 2 diabetes, osteoporosis and some cancers, as well as disease risk factors such as high blood cholesterol, hypertension and obesity (Bauman & Owen 1999).

The quality of the current evidence showing physical inactivity as a risk factor is similar to that for tobacco smoking in the 1970s. Most of the evidence has been provided by population-based cohort studies. The more recent and better quality studies adjust for confounding factors such as high blood cholesterol, hypertension and obesity. Meta-analyses of the evidence show a stronger association between physical activity and health outcomes where the research methods are optimal (Ainsworth et al. 1998; Berlin & Colditz 1990; Powell et al. 1987).

Physical activity and all-cause mortality

People who participate in moderate to vigorous levels of physical activity and/or have high levels of cardiorespiratory fitness have a lower mortality rate than those with a sedentary lifestyle or low cardiorespiratory fitness. The effects of physical activity on reducing all-cause mortality are strong and consistent across studies and populations (Blair et al. 1996; Lee & Paffenbarger 1997; Villeneuve et al. 1998). Even among diverse elderly populations in studies in Israel and in Holland, relationships between regular physical activity and reduced risks of death are consistently demonstrated (Bijnen et al. 1999; Stessman et al. 2000).

Although these associations are generally stronger for measured cardiorespiratory fitness than for self-reported participation (Blair et al. 1989), moderate types of self-reported physical activity such as climbing at least 20 flights of stairs per week confer a benefit on all-cause mortality (Paffenbarger et al. 1993). Dimensions such as transport-related activity, such as regular bicycling to work, may confer benefits independent of other leisure-time physical activity (Andersen et al. 2000). Participation in more vigorous physical activity confers an even greater benefit in terms of overall risk of death (Lee & Paffenbarger 2000). Overweight or obese individuals who are physically active and fit are

less likely to suffer early death than normal-weight persons who lead a sedentary lifestyle (Blair & Brodney 1999). Further, among obese men, low cardiovascular fitness has been shown to be at least as important a predictor of all-cause mortality as type 2 diabetes, high cholesterol, smoking and high blood pressure (Wei et al. 1999).

Physical activity and cardiovascular disease

Heart disease and stroke

The strongest evidence for the benefits of physical activity is in reducing the risk of mortality and morbidity from cardiovascular disease (CVD). Compared with those that are at least moderately physically active, people who are sedentary have a one-and-a-half to twofold increase in the risk of a fatal or non-fatal cardiovascular event such as coronary heart disease or acute myocardial infarction (Bauman & Owen 1999; Berlin & Colditz 1990; USDHHS 1996). These associations are strong and are independent of the definition of physical activity or cardiorespiratory fitness used. The maximum cardiovascular disease benefit occurred when people moved from a sedentary lifestyle or low state of cardiorespiratory fitness to a moderately active or moderate fitness level (Blair et al. 1995, 1996; Lakka et al. 1994). Participation in walking confers a clear benefit for women, but more vigorous activity confers an even greater reduction in risk (Manson et al. 1999).

It seems that recent participation in physical activity is required for cardioprotective benefits (Sherman et al. 1999), suggesting that ongoing participation may be required for ongoing health gain.

Existing data are less definitive for the association between physical activity and both types of stroke (i.e. ischaemic and haemorrhagic) (Kohl & McKenzie 1994). Generally, for ischaemic stroke, studies show a decrease in the risk of stroke with increasing physical activity (Ellekjaer et al. 2000; Hu et al. 2000; Wannemethee & Shaper 1999).

Box 2.1: Heart disease in Australia

Much progress has been made in recent years in improving the cardiovascular health of Australians. Death rates have fallen dramatically, some risk factors have improved, and there have been major advances in treatment and care.

However, cardiovascular disease is still Australia's greatest health problem. In 1995, an estimated 2.8 million Australians, or 16% of the population, had a cardiovascular condition (AIHW 1999a). The disease kills more people than any other disease (almost 51,000 deaths in 1998) (AIHW 2000) and creates enormous costs for the healthcare system. In 1997–98 there were 434,748 hospitalisations for cardiovascular conditions (AIHW 1999b).

Box 2.2: Stroke in Australia

Stroke is Australia's second greatest single killer after coronary heart disease, claiming almost 12,000 lives in 1998 (AIHW 2000). It is the leading cause of long-term disability in adults and it places great demands on family members and caregivers. Death rates from stroke have been falling since the late 1960s. Given the rapid ageing of the Australian population, however, and a slowing of the decline in stroke death rates in recent years, the number of people dying from stroke and those surviving with a permanent disability is likely to increase in the future (AIHW 1999a).

Risk factors for cardiovascular disease

Physical activity affects CVD independently of other CVD risk factors (Berlin & Colditz 1990; Blair et al. 1996; Paffenbarger et al. 1993; Powell et al. 1987). However, physical activity and fitness are also associated with other risk factors such as high blood pressure, high body mass index (BMI) and unfavourable high-density lipoprotein (HDL)/blood cholesterol levels (Bauman & Owen 1991).

Vigorous physical activity has been shown to decrease systolic and diastolic blood pressure (Arroll & Beaglehole 1992; Kelley & McClellan 1994; McMurray et al. 1998; Mensink et al. 1999). There is some evidence that participation in more moderate physical activity may achieve similar or even greater effects in lowering blood pressure than vigorous activity (Hagberg et al. 1989; Marceau et al. 1993; Matsusaki et al. 1992).

Physical activity and cardiorespiratory fitness are both associated with improved total blood cholesterol levels (McMurray et al. 1998) and improved HDL subfraction profiles (Moore 1994). Recent research suggests that there may be a threshold for the relationship between physical activity and improvements in the HDL subfraction of cholesterol—more prolonged or intensive exercise may be more beneficial for HDL to total cholesterol ratios (Kokkinos & Fernhall 1999).

Physical activity has also been shown to have a role to play in the prevention, maintenance, and treatment of obesity, although more prolonged activity is required for weight loss (Grundy et al. 1999). Most reviews suggest that at least 2,000 Kcal of energy expenditure per week is required for maintained weight loss (Rippe & Hess 1998), which equates to at least one hour of moderate or half-an-hour of vigorous leisure-time physical activity every day. Nonetheless, more moderate levels of activity can assist with weight maintenance, as well as conferring other health benefits.

Box 2.3: Cardiovascular risk factors in Australia

In 1995, around 2.2 million Australian adults (17% of the adult population) had high blood pressure (AIHW 1999a). There have been significant declines in the proportion of people with high blood pressure and/or receiving treatment since the 1980s.

The last national survey to assess blood cholesterol levels in Australia was conducted in 1989. At that time it was estimated that over 4.5 million Australians adults (aged 20–69 years) had higher than desirable cholesterol levels (AIHW 1999a).

In 1995, around 7.4 million Australian adults (around 56% of the adult population) were overweight (BMI = 25) (AIHW 1999a). Almost 2.5 million (or 19% of the adult population) of those were obese (BMI = 30). There have been significant increases in the proportions of overweight and obese Australians in the last 15 years (AIHW 2000).

Adult smoking rates have been declining since the 1960s and this trend has continued into the 1990s. National surveys show, however, that the rate of decline has slowed in more recent years. In 1995, almost 3.2 million Australian adults (around 24% of the adult population) were at risk of developing heart disease and other chronic conditions from smoking tobacco products (AIHW 1999a).

Physical activity and diabetes

A recent review shows that the benefits of physical activity in the prevention and treatment of type 2 diabetes are strongly supported by current research (Ivy et al. 1999). It has been estimated that 30–50% of new cases of type 2 diabetes could be prevented by appropriate levels of physical activity (Manson & Spelsberg 1994). Both moderate and vigorous physical activity reduces the risk of type 2 diabetes in women (Hu et al. 1999). The benefits accrue in diverse populations (Folsom et al. 2000; Okada et al. 2000). The benefits of physical activity for preventing and treating diabetes only occur from regular sustained physical activity patterns. The physiological adaptations that are responsible for the protective effects of physical activity subside within a short period of the cessation of physical activity (Arciero et al. 1999; Dela et al. 1993; Rogers et al. 1990).

Box 2.4: Diabetes in Australia

Diabetes has a major impact on quality of life and its long-term complications include a greater risk of heart attack, stroke, impotence, blindness, kidney problems, lower limb amputations and reduced life expectancy.

In 1995, over 350,000 Australians (2% of the population) reported having type 1 or type 2 diabetes (AIHW 1999a). Self-reported diabetes underestimates the true prevalence of the condition. Studies suggest that there is one undiagnosed person for each known case of type 2 diabetes (AIHW 1999a).

Physical activity and cancer

There is evidence suggesting that participation in physical activity and high cardiorespiratory fitness reduce the risk of developing some forms of cancer. Numerous studies show the protective effect of physical activity on risk of colon cancer (Colditz et al. 1997), and on the prevention of precancerous polyps in the large bowel (Neugut et al. 1996; Slattery et al. 1997).

The evidence relating to physical activity and other cancers is less conclusive. Most studies of physical activity report a reduction in the risk of breast cancer among physically active women (Gammon et al. 1998; Latikka et al. 1998; Verloop et al. 2000). There is some evidence for vigorous activity providing a protective effect for prostate cancer in men (Giovannucci
et al. 1998), although some researchers do not find such a relationship (Liu et al. 2000). There are too few studies to enable clear statements to be made on the associations between physical activity and uterine and ovarian cancer in women, testicular cancer in men, and lung cancer. However, a recent study showed a promising reduction in risk of lung cancer in physically active men (Lee & Paffenbarger 2000).

Box 2.5: Cancer in Australia

Cancer has a major impact on the Australian community in terms of morbidity, mortality and costs. On average, one in three men and one in four women are likely to develop cancer before the age of 75 (DHFS & AIHW 1998).

The incidence of cancer continues to increase and, while the overall death rate has begun to fall, the death rate from many of the most common cancers is either stable or increasing. The most common cancer in Australia in both males and females is the non-melanocytic skin cancer. The next most common cancers in males are cancers of the prostate, colon and rectum, lung, melanoma of the skin, and bladder. Common cancers in females are those of the breast, colon and rectum, melanoma of the skin, and lung (DHFS & AIHW 1998).

Physical activity and injury prevention and control

Participation in physical activity throughout the lifespan can increase, maintain or reduce the decline of musculoskeletal health that generally occurs with aging in sedentary people (Brill et al. 2000). Participation by older adults can help maintain strength and flexibility, resulting in an ability to continue to perform daily activities (Brill et al. 2000; Huang et al. 1998; Simonsick et al. 1993). Further, participation can reduce the risk of falling and hip fractures in older adults (Grisso et al. 1997; Lord 1995).

The development of osteoporosis and bone fractures are associated with physical inactivity (Drinkwater 1994). Weight-bearing activity is important in the development of peak bone density for adolescents (Welten et al. 1994) and for middle-aged women (Zhang et al. 1992). Cross-sectional studies show that participation in physical activity, aerobic fitness and muscular strength are all positively associated with bone density (Gutin & Kasper 1992).

The position statement on osteoporosis by the American College of Sports Medicine (ACSM 1995) stated that functional loading through physical activity exerts a positive influence on bone mass, but the types of activity most effecting such change are still not clear. Systematic reviews of the literature have identified the beneficial role of physical activity in reducing the risks of falls in the elderly, but often in combination with other program components such as reviewing medications and improving the safety of the domestic environment (Gillespie et al. 1998).

Physical activity is essential for maintaining the health of joints and appears to be beneficial for controlling the symptoms of osteoarthritis. There is no evidence that physical activity itself causes osteoarthritis although injuries sustained during participation in training and competition in elite sports may increase risk of osteoarthritis (Kujala et al. 1994; Kujala et al. 1995; USDHHS 1996). However, these studies are based on extremely small sample sizes and this limits their generalisation to the population. Participation in recreational running, as opposed to competitive athletics, over a long period has been shown not to increase risk of osteoarthritis (Lane 1995).

Box 2.6: Injury prevention and control in Australia

Falls account for 15% of deaths from injury in Australia and for 33% of hospitalisations due to injury. The vast majority of falls occur in older people, with 94% of male and 70% of female deaths due to falls being in those aged over 65 years.

Musculoskeletal disorders are a cause of mortality and considerable morbidity and disability in Australia. Chronic musculoskeletal disorders are reported by 29% of Australians aged 15 years and over, and 56% of Australians aged 60 years and over (Mathers & Penm 1999).

Physical activity, mental health and psychosocial benefits

Studies consistently show that participation in physical activity reduces symptoms of stress, anxiety and depression (Glenister 1996; Hassmén et al. 2000; Paffenbarger et al. 1994; Petruzello et al. 1991). Physical activity is associated with increased mental health in population studies (Simonsick 1991; Stephens 1988) and is recognised as an evidence-based treatment for clinical anxiety and depression (Bauman & Owen 1999).

Participation in physical activity may also confer other psychological and social benefits that impact on the health and wellbeing of Australians. Participation by individuals can help build self-esteem (Sonstroem 1984), social skills among children (Evans & Roberts 1987) and positive self-image among women (Maxwell & Tucker 1992), and improve quality of life among children and adults (Hassmén et al. 2000; Laforge et al. 1999; Morans & Mohai 1991). These benefits are probably due a combination of participation in the activity itself and from the sociocultural aspects that can accompany physical activity.

Further, participation in physical activity may reduce self-destructive and antisocial behaviour among young people (Mutrie & Parfitt 1998).

Box 2.7: Mental health in Australia

The progress in physical and material wellbeing for most Australians during the twentieth century has not necessarily been matched by gains in mental health and subjective wellbeing. More than one million Australians are estimated to suffer from a mental disorder, with almost half of these affected long-term (ABS 1997).

Mental health disorders are responsible for a larger number of hospitalisations than any other National Health Priority Area, including cardiovascular disease, diabetes, asthma and cancer (DHAC & AIHW 1999a). Mental health problems also account for much disability, incur high direct and indirect costs, and impose a heavy burden of human suffering.

3. Physical activity measurement

The process to develop national standards for the measurement of physical activity was coordinated by the Australian Institute of Health and Welfare (AIHW). An Expert Working Group was established in 1997 to review national physical activity measures and develop standard data elements to measure physical activity in population surveys. Membership of the Expert Working Group is provided in Appendix 1.

The development of an appropriate tool is a challenging task. Physical activity for health benefit comprises several components (e.g. intensity, frequency, duration and type) that can be carried out in different settings or contexts (e.g. leisure-time, occupational, incidental and transport). Measurement is further complicated because there are several dimensions of physical activity related to health (e.g. energy expenditure, fitness, strength and flexibility). Methods for measuring activity range from self-reported instruments to more objective assessments of movement, fitness or energy balance.

An example of issues surrounding measurement relate to the quantum of activity needed for different health outcomes. For example, the primary type of physical activity required to prevent cardiovascular disease (i.e. moderate-intensity regular physical activity) is not the same as that required to prevent falls in the elderly (i.e. weight-bearing and strength-training activity). Different intensities and duration of activity are needed for different purposes—for example, more vigorous and sustained activity may confer additional benefits for disease prevention, but may be *required* for weight loss or improvements to lipid profiles.

Emanating from the work of the Expert Group, a standard instrument for collecting physical activity information was developed. The instrument questions were derived from questions used in the National Heart Foundation Risk Factor Prevalence Survey (Risk Factor Prevalence Management Committee 1990), the Australian Bureau of Statistics National Health Surveys 1989–90 and 1995, and the New South Wales State Health surveys (Bauman et al. 1996). Information on the utility, reliability and validity of earlier Australian physical activity survey instruments was of great value in helping the Expert Group develop the current proposed instrument (Bauman et al. 1996; Booth et al. 1995, 1996; Gore et al. 1999; National Centre for Health Promotion and Health Promotion Branch 1994). This instrument was used in both the 1997 and 1999 national physical activity surveys to assess participation in physical activity among Australian adults.

A project to assess the reproducibility of this instrument was funded by the Commonwealth Department of Health and Aged Care (DHAC) in late 1999, through the University of Western Australia. Repeatability data for these physical activity questions were collected by Dr Fiona Bull from the University of Western Australia, in a population sample of 237 adults in WA (Bull et al. 2000, in press). Data were collected as a supplementary study to the 1999 National Physical Activity Survey. Data were collected by telephone survey, and again from the same individuals three days later. Recall was of the same week. In general, for those individuals reporting activity (walking, gardening, moderate and vigorous activity), the test–retest agreement coefficients were in the moderate to very good range—intra-class correlation coefficients ranged from 0.6 to 0.8. (personal communication, Bull et al. 2000). This suggests that these questions, in a population setting, are at least as reproducible as other commonly used physical activity instruments.

Underpinning the measurement of physical activity is the integration of information on intensity, frequency, duration and type of physical activity. Furthermore, recent developments in the epidemiology of physical activity suggest that components of

everyday activity, such as transport-related activity and incidental or unplanned activity, might be considered in broader approaches to measurement. Key concepts used to measure physical activity are presented below.

Physical activity concept

Physical activity is defined as 'any bodily movement produced by skeletal muscles that results in energy expenditure' (Caspersen et al. 1985). Some examples of physical activity are walking, walking up stairs, gardening, playing sport and work-related activity. Exercise is a subset of physical activity defined as planned, structured and repetitive bodily movement done to improve or maintain one or more components of physical fitness. Exercise has specific objectives of improving fitness, performance and health, and providing a means of social interaction. Physical activity comprises duration, frequency, intensity, type and context.

Physical activity duration

Duration is defined as the length of time spent participating in physical activity as self-reported by the respondent within a reporting period. This item is generally reported in hours and minutes and may be summed to provide an indication of total time participating in physical activity over the reporting period. Typically, reporting periods have been lengthy, with recall of activity patterns over the previous one to twelve months. More recent surveys focus on a shorter time period, with one or two weeks often used. This is considered to be less prone to recall bias and hence to provide better population estimates of activity patterns.

Physical activity frequency

Frequency is defined as the number of times the respondent self-reported participating in physical activity, within a reporting period.

Physical activity intensity

Intensity is the self-perceived and self-reported intensity at which a respondent participated in physical activity. Generally, to obtain health benefit, physical activity at a moderate intensity (at least) is required. Brisk walking is an example of a moderate-intensity physical activity. Participation in vigorous-intensity physical activities confers even greater health benefits than does participation in more moderate activity. The primary measurement goal is to provide examples within questions of the kinds of activity that reach a sufficient energy expenditure threshold to be of health benefit. This is usually activity that results in energy expenditure of at least three times the resting rate (resting metabolic rate, RMR) or activities which correspond to at least three metabolic equivalents (METs). Brisk walking and other moderate-intensity activities (e.g. gentle swimming, social tennis) correspond to around 3–5 METs. More vigorous activities such as aerobics, jogging and competitive tennis correspond to around 7–9 METs (USDHHS 1996).

Physical activity type

Type is defined as the specific physical activities self-reported by respondents, for example, walking, gardening and yardwork.

Walking is the most prevalent physical activity reported in Australian population surveys. Walking is identified as a specific activity as it is carried out in several contexts (e.g. exercise, recreation, transport, at work, etc.). Although some occupations involve considerable amounts of walking (e.g. traffic warden), there is currently insufficient evidence to assume that self-reported walking at work will provide health benefit on a population basis. A specific question on other walking is therefore included in the questionnaire to ensure that only information on walking that most likely contributes to health benefit is collected.

Gardening and yard work are also commonly reported physical activities. Information on these specific activities is required because it is unclear whether they contribute to achieving a 'sufficient' level of physical activity for health benefit. To ensure that these activities are not included with other leisure-time physical activities, a specific question is included about gardening and yard work. The wording of these questions and the energy expenditure associated with these tasks need further validation for their use in population surveys. Similarly, other important settings for expending energy, such as domestic or occupational settings, require validation studies to determine their usefulness in routine physical activity self-reported surveys.

Physical activity context

This is the context in which a person participates in physical activity. The term physical activity commonly represents sport, active recreation, exercise, fitness, incidental activity and active living. The majority of the data in this report refer to leisure-time physical activity, which refers to an individual's discretionary time that is time left after completion of work, travelling, domestic chores and personal hygiene. The element of personal choice is inherent to this definition (Bouchard & Shephard 1994).

One of the important aims of population physical activity measurement is to measure physical activity in as many settings as possible, using reliable and valid self-reported questions. Hence the questionnaire used as a basis for this report asked about walking 'continuously for at least 10 minutes, for recreation, exercise or to get to or from places', thus capturing leisure-time walking and some walking for transport. In this way, walking that is most likely to be associated with a health benefit (i.e. moderate or brisk-paced walking) is separated from walking at work which is unlikely, in most cases, to be done at an intensity and/or of a duration associated with a health benefit. In this instrument, moderate and vigorous leisure-time activities are illustrated by examples which reflect the appropriate energy expenditures for those pursuits.

Physical activity to confer a health benefit

'Sufficient' leisure-time physical activity for health results from participation in regular physical activity of 'sufficient' duration and intensity. Although there is no clear absolute threshold for health benefit, recommendations from experts agree that for better health, physical activity should be performed regularly. A landmark document, the United States Surgeon General's report on physical activity and health (USDHHS 1996), provided a scientific basis for health benefits to be achieved from the participation of regular, moderate intensity physical activity. In keeping with this concept, the National Physical Activity Guidelines for Australians (DHAC 1999) recommend that the 'accumulation of 30 minutes of moderate physical activity on most days of the week' is beneficial for health. One interpretation of this is the accrual of 150 minutes of moderate-intensity (at least) leisure-time physical activity over a period of one week. This equates to approximately 30 minutes of physical activity on five (most) days of the week. Therefore, the first definition used in this report for 'sufficient' physical activity for health benefit is based on a duration of greater than or equal to 150 minutes of walking and/or moderate-intensity physical activity, and/or vigorous-intensity physical activity per week (where vigorous-intensity physical activity is weighted by a factor of two to reflect its greater intensity). A further refinement to the measure is to take into account the number of sessions and set the criteria of 'sufficient' to include that 150 minutes of moderate-intensity activity (at least) be accrued over at least five sessions. The rationale for this is that, for most people, each session would be undertaken on a separate day.

Physical activity related to gardening and yard work is not accepted as a contributor to 'sufficient' physical activity because there is currently limited research on the validity of the self-reported intensity of these activities. Due to the widespread self-reported participation in gardening and yard work as leisure-time activities, this work, to quantify the health benefit of those activities is required as a matter of urgency.

'Sufficient' physical activity is an important concept because it reflects the amount and type of physical activity that is likely to have a health benefit. This quantum applies to several but not all health benefits—it is chosen as the level where a substantial number of benefits might accrue (USDHHS 1996). It also provides an insight into the remaining proportion of the population that is insufficiently active. This group includes people who are completely inactive or sedentary (i.e. who report no physical activity) as well as those who are active but not sufficiently active for good health as defined by the National Physical Activity Guidelines for Australians (DHAC 1999).

4. Survey methodology

Overview

The data presented in this report are from the 1999 National Physical Activity Survey with trend information from the 1997 *Active Australia* Baseline Survey (ASC 1998) (referred to in this report as the 1999 survey and 1997 survey, respectively).

The 1999 survey was jointly funded by AIHW and DHAC. Data were collected by telephone by the Hunter Valley Research Foundation (HVRF) on behalf of the funding agencies.

Details of the survey methodology are presented in a technical report (HVRF 1999) and a brief outline is provided below.

Sample size

The scope of the survey was Australian adults aged 18–75 years. The national sample size required for the 1999 survey was estimated to be at least 2,500 and was distributed proportionally by population across States and Territories. The age range of 18–75 years, rather than the standard 18–74 years, was to ensure data were collected for the entire age range (18–75 years inclusive) for which public health messages on physical activity were targeted and to maintain consistency with the 1997 survey.

The NSW Health Department contracted the HVRF to increase the sample size in New South Wales to 2,000 (originally estimated at 846) to allow for within-State comparisons. Also, to assess the impact of a physical activity campaign targeted at an older age group within New South Wales, a further 100 respondents aged between 55 and 75 years were interviewed.

The additional interviews for New South Wales were obtained using the existing survey methodology. To obtain the additional 100 interviews, the wording of the introduction was changed to ask for the number of people aged 55 to 75 years in the household rather than the number of people aged 18 to 75 years.

The final national sample includes the additional interviews from New South Wales, which increased the sample size to 3,841.

Sample selection

The 1999 survey was conducted by the HVRF using a Computer Assisted Telephone Interviewing (CATI) system. Respondents were selected using a two-stage sampling process. Firstly, households were randomly selected using the electronic White Pages telephone directory. Then, once contact with the household was established, the person aged between 18 and 75 years who had the most recent birthday was asked to participate. Once identified, the respondent was not substituted with other members of the household for any reason.

A small pilot test conducted by the HVRF in early November 1999 tested the wording and flow of the survey. More extensive pilot testing was not considered necessary as comparable questions were tested for the 1997 survey.

Interviewers were trained using the CATI system and familiarised with material from the *Active Australia* campaign using posters, brochures and a videotape of the 'Rusty' television commercial.

The 1999 survey was conducted between 10 November 1999 and 17 December 1999 to ensure comparability with the 1997 survey, which was conducted during November–December 1997. Conducting the surveys at the same time of year ensures that participation rates are not affected by seasonal conditions. It was also important to conduct the surveys before the December holiday period (late December) as participation rates may be influenced by increased leisure time.

The CATI system directed all wording used by the interviewers for the introduction, and for all of the survey questions. Survey answers were entered by the interviewers during the interview and automatically checked for validity by the CATI system. Open-ended responses were transcribed verbatim by the interviewer.

Response rate

A potential respondent was defined as a person currently living in the household aged between 18 and 75 years. If there was more than one person in this category, the person with the most recent birthday was selected.

Several methods were used by HVRF to improve response rates. A minimum of six call attempts were made to establish contact with a survey respondent. A further five attempts were made once contact had been made, to obtain either a completed interview or a refusal. Respondents were able to make appointments to complete the interview at a more convenient time. Interviewers left messages on answering machines as well as providing a toll-free number to potential respondents.

Telephone contact was made with 5,936 households and resulted in 3,841 completed interviews. This represented a *household* response rate of 65%. Of the eligible individuals contacted, the *individual* response rate was 89%.

The response rate in 1999 was higher than in 1997, where *household* response rate was 61% and *individual* response rate was 81%.

Response rates were similar between States and Territories, although rates in the Australian Capital Territory, South Australia and Tasmania were slightly higher.

Questionnaire

Questions asked about respondents' awareness and understanding of the moderate-intensity physical activity messages, their intentions to become more active in the future, their participation in predominantly leisure-time physical activities (including walking for transport) during the previous week and their usual physical activity patterns over the last six months (i.e. a 'usual' week) (Appendix 2).

Information was collected on:

- walking continuously for at least 10 minutes, for recreation, exercise or transport;

- other moderate-intensity physical activities, e.g. gentle swimming, social tennis;
- vigorous-intensity physical activities, e.g. jogging, cycling, aerobics, competitive tennis; and
- vigorous-intensity gardening or heavy yardwork.

Participants were asked to report the frequency and duration for each activity. Prescriptive definitions of the terms 'vigorous' and 'moderate' were not provided, and thus respondents interpreted these terms in the context of the questions and examples provided. Perceptions of intensity may therefore vary, and are likely to be influenced by factors such as fitness level and age.

Unlike the 1997 survey, the 1999 survey did not include questions on the frequency and duration of participation in vigorous-intensity household and domestic chores and hours of television watching.

Open-ended questions

Following a response of 'yes' to the message recall questions, survey participants gave an open-ended response. For open-ended questions, two of the authors developed coding frames, and then independently content-analysed the responses into closed coded categories (Appendix 4). The authors then met and discussed coding frames, and reconciled any differences. These data are shown in the relevant sections.

Derivation of the physical activity measures

The measures identified below are an informative way of examining population levels of physical activity. As well as providing an indication of population prevalence, they can assist in identifying particular population groups that need to be targeted by specific intervention strategies.

Total sessions per week

The number of times a respondent reported participating in a physical activity is presented. This is of interest because, the majority of participants report fewer than six sessions per week and it is assumed that the sessions relate to 'days' of activity. Hence, the number of sessions can be related to the current recommendations, which are to participate in activities on most, if not all, days of a week, i.e. five sessions or more in one week.

Total time per week

The total time spent participating in physical activity is calculated from the sum of total time spent in walking, moderate-intensity physical activity and vigorous-intensity physical activity during the previous week.

Physical inactivity (sedentary)

Respondents reporting no participation in physical activity are classified as being physically inactive or sedentary.

‘Sufficient’ physical activity to confer a health benefit

The level of physical activity that is ‘sufficient’ to confer a health benefit has been subject to debate. The accrual of 150 minutes of moderate-intensity (at least) physical activity over a period of one week is believed to confer health benefit and reflects the current National Physical Activity Guidelines message (DHAC 1999). Walking is included as a moderate-intensity physical activity.

Health benefits can also be obtained by participating in vigorous-intensity physical activity, in approximate proportion to the total amount of activity performed, measured in minutes of physical activity. Participation in vigorous-intensity leisure-time physical activity for 60 to 90 minutes over a period of a week will confer health benefits.

The definition of ‘sufficient’ does not include gardening or heavy yardwork (although these activities were self-rated as being of vigorous intensity) because there is limited research regarding the actual energy expenditure of these activities. It is likely that, in future, these activities will be included as indicators of moderate-intensity physical activity.

Insufficient physical activity is defined as some reported physical activity, but not meeting either of the ‘sufficient’ criteria.

To avoid measurement error due to over-reporting (Bauman 1987), data were truncated using the following criteria:

- maximum ‘allowable’ recorded time doing any of the three types of physical activity was 14 hours per week (any reported time spent greater than 14 hours was recoded to 14 hours); and
- maximum ‘allowable’ recorded total hours per week was 28 hours per week (any total hours greater than 28 were recoded to equal 28 hours).

Fewer than 1% of the data required truncation.

Two working definitions of ‘sufficient’ physical activity are used in this report, derived from the information collected on total time and total sessions.

‘Sufficient’ time

The first definition of ‘sufficient’ physical activity was based on the sum of the total minutes of walking, moderate-intensity and/or vigorous-intensity physical activity. ‘Sufficient’ health benefit is obtained if minutes walking plus minutes moderate plus (twice vigorous minutes) is greater than or equal to 150 minutes. Vigorous-intensity physical activity was weighted by a factor of two, to account for its greater intensity.

This definition is used to provide estimates of participation in the previous week and in the past six months (i.e. ‘usual’ week).

‘Sufficient’ time and sessions

A second definition of ‘sufficient’ activity to confer health used in this report takes into account frequency of participation. For this definition, ‘sufficient’ activity is only achieved when 150 minutes of activity (when vigorous-intensity activity is weighted by a factor of two) is accrued in at least five separate sessions of activity.

This definition is applied only to participation over the previous week.

Weighting

The data collected in the survey were provided with weights which were used to obtain estimates which were representative of the national population. The age groups used for weighting were the standard age groups, except for the age group 70–74 which was replaced by 70–75 (see page 14).

To allow for the impact of relatively more interviews in New South Wales compared to the number of interviews in other States and Territories, data were down-weighted to an effective sample size of 3,000. This weighting ($WSAMP_{ras}$) was used when estimating the proportion of people who are physically active and for statistical tests of significance at the national level.

The formulas used to calculate the weights are:

To estimate numbers for total and regional populations,

$$WPOP_{ras} = \frac{N_{ras}}{n_{ras}}$$

where $WPOP_{ras}$ is the weight used to estimate numbers applied to each respondent in region *r*, age group *a*, with sex *s*, N_{ras} is the population in region *r*, age group *a*, with sex *s*, and n_{ras} is the sample size (i.e. number of respondents) in region *r*, age group *a*, with sex *s*.

To estimate proportions and to perform statistical tests at the national level,

$$WSAMP_{ras} = WPOP_{ras} \times \frac{n}{N}$$

where $WSAMP_{ras}$ is the weight used to estimate proportions applied to each respondent in region *r*, age group *a*, with sex *s*, $WPOP_{ras}$ is the weight used to estimate numbers applied to each respondent in region *r*, age group *a*, and with sex *s*, N is the total national population (aged 18 to 75 years), and *n* is the total national sample size (i.e. number of respondents).

Predictor variables of participation

Logistic regression was used to summarise associations between the sociodemographic predictor variables and participation in 'sufficient' physical activity.

5. Demographic profile of survey respondents

This section provides a demographic profile of respondents in the 1999 survey. Australian Bureau of Statistics (ABS) Population Statistics Group (PSG) standards were used for the demographic categories sex, age and main language spoken at home. For the other demographics listed below, definitions used in the 1997 survey were adopted for comparability.

The following demographic characteristics of respondents are provided:

- Sex
- Age
- Number of children under 18 years living in the household
- Number of children aged 5 and under living in the household
- Main language spoken at home
- Marital status
- Education level
- Occupation status
- BMI.

Age and sex

Table 5.1 shows the profile of respondents by age group and sex. The mean age of respondents in 1999 was 42 years.

The 1999 survey comprised a weighted sample of 3,000 adults, derived from an actual sample of 3,841 telephone survey respondents. In the weighted sample, men comprised 49.6% and women comprised 50.4% of the total. The age and sex distribution of respondents in the 1999 survey was very similar to that in the 1997 survey (ASC 1998).

The distribution by age and sex of the 1999 survey respondents is comparable with the Australian population in 1998 (ABS 1999) (Table 5.1).

Table 5.1: Age and sex of survey respondents (per cent), 1999

	Men		Women		Persons	
Age group (years)	1999 survey	Australian population	1999 survey	Australian population	1999 survey	Australian population
18–29	26.0	25.8	25.4	25.1	25.7	25.5
30–44	33.1	32.7	33.4	32.8	33.2	32.8
45–59	25.0	25.7	24.1	25.1	24.6	25.4
60–75	15.9	15.8	17.1	16.9	16.5	16.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: Australian population data is for 1998 (ABS 1999).

Children in the household

Table 5.2 shows the percentage of children in the household for respondents in 1999. It shows the percentage of households with children under 18 years and the percentage of households with children aged 5 years or under.

Forty-three per cent of households had one or more children under 18 years and less than 20% had children aged 5 years or under.

Table 5.2: Percentage of children in the household for survey respondents, 1999

Household composition	Percentage of respondents
Children (aged 5 years or under)	
Nil	80.9
1 or more	19.1
Total	**100.0**
Children (less than 18 years)	
Nil	56.9
1 or more	43.1
Total	**100.0**

Note: Components may not add to totals due to rounding.

Language spoken, marital status, education level, occupation status

Table 5.3 shows the main language spoken at home, marital status, education level and occupation of respondents.

Six per cent of respondents used a main language other than English at home.

Nearly 70% of respondents were married or in a de facto relationship, 28% were single or never married and 3% were widowed.

Thirty-eight per cent of respondents had attained the Higher School Certificate or equivalent, 37% had less than 12 years' education and 25% had a tertiary education.

Nearly one-third of respondents were managers or administrators, 25% were in white collar professions, 14% did home duties, 12% were retired, 9% in blue collar occupations, 5% were students, and 3% were unemployed.

Table 5.3: Language spoken, marital status, education level, occupation of survey respondents, 1999

	Percentage of respondents
Main language spoken at home	
English	94.4
Other	5.6
Total	**100.0**
Marital status	
Never married/single	27.8
Married/de facto	69.1
Widowed	3.0
Total	**100.0**
Education level	
Less than 12 years	37.0
HSC or equivalent	38.0
Tertiary	25.0
Total	**100.0**
Occupation status	
Manager/administrator	32.6
White collar	25.0
Home duties	14.1
Retired	11.9
Blue collar	8.5
Student	4.6
Unemployed	3.2
Total	**100.0**

HSC = Higher School Certificate. White collar = professional, para-professional. Blue collar = tradesperson, clerk, salesperson and personal service worker, plant and machine operator/driver, labourer.

Note: Components may not add to totals due to rounding.

Body mass index

BMI is a measure of a person's weight in relation to their height, calculated as weight in kilograms divided by height in metres squared. Physical measurement of overweight and obesity was beyond the scope of this survey, but data were collected on self-reported height and weight for calculation of BMI.

The BMI categories are:

- underweight: BMI less than 18.5
- healthy weight: BMI from 18.5 to less than 25
- overweight: BMI from 25 to less than 30
- obese: BMI greater than or equal to 30.

The mean BMI of respondents in 1999 was 25.1. This was similar to that of respondents in 1997 (mean = 24.8) (ASC 1998).

Table 5.4 shows the distribution of the sample according to the BMI categories, based on self-reported height and weight. Forty-four per cent of people were above healthy weight (32% overweight and 12% obese), 53% were within the healthy weight range, and 3% were underweight. The proportion of overweight and obese adults (18–75 years) in 1999 was similar to that found for adults 18–74 years from self-reported information collected in the 1995 National Health Survey (ABS 1997; DHAC & AIHW 1999b).

Table 5.4 shows that women were more likely to have a healthy weight (59%) than were men (47%). Levels of obesity were similar for men (12%) and women (13%). Underweight was more common among women (4%) than men (2%). The proportion of people in the healthy weight category decreased with age and increased with level of education. The prevalence of obesity generally increased with age and decreased with level of education, from 15% in those with less than 12 years of education to 8% among those with tertiary education.

Table 5.4: BMI categories of survey respondents by age, sex, education level (per cent), 1999

	Underweight	Healthy weight	Overweight	Obese
Sex				
Men	1.7	46.9	39.5	11.9
Women	4.2	59.0	24.0	12.7
Persons	*3.0*	*52.9*	*31.8*	*12.3*
Age group (years)				
18–29	7.5	65.9	19.8	6.8
30–44	1.9	53.1	32.9	12.2
45–59	0.8	46.0	36.9	16.3
60–75	1.5	42.8	40.5	15.2
Education level				
Less than 12 years	2.5	46.9	35.5	15.2
HSC or equivalent	3.7	55.6	28.1	12.7
Tertiary	2.9	57.7	31.8	7.7

HSC = Higher School Certificate.