



Position Statement Physical Activity and Cancer

Key Messages

Physical activity is important for good health and well being. Physical activity can help to prevent a range of health problems, including heart disease, diabetes and some cancers. Being active also helps to maintain a healthy body weight, improve mental well being and helps people feel better and sleep well.

There is *convincing* evidence that physical activity protects against colon cancer. Being physically active *probably* reduces the risk of cancer of the endometrium and breast (especially in post-menopausal women).

There is *limited but suggestive* evidence that physical activity may reduce the risk of lung, pancreatic and ovarian cancers. The evidence on physical activity and prostate cancer risk is *inconsistent*.

The Cancer Council supports and encourages the National Physical Activity Guidelines, which recommend people put together **at least** 30 minutes of moderate intensity physical activity (like brisk walking) on most, if not every day of the week and also undertake some regular vigorous exercise for added health and fitness.

For cancer prevention, the evidence suggests that 30-60 minutes per day of moderate to vigorous physical activity may be most beneficial. Therefore people should try and work up to doing 30 minutes or more of vigorous activity (such as aerobics, jogging or fast cycling) OR 60 minutes or more of moderate activity (such as brisk walking or medium-paced swimming) every day.

For people that are inactive, any increase in physical activity is beneficial. The Cancer Council encourages people to increase the amount of incidental activity they do, as this can help increase the total amount of energy burnt and assist in maintaining a healthy body weight.

Background

Physical activity (including exercise, sport, active transport, occupational and domestic incidental activities) is when the body contracts skeletal muscle to move, which results in increased energy expenditure.¹

Physical activity is important for good health and well being. Physical activity can help to prevent a range of health problems, including heart disease, diabetes, osteoporosis and some cancers.²⁻⁴

Being active also helps to maintain a healthy body weight.⁴ The World Health Organization (WHO) has found there is convincing evidence that regular physical activity decreases the risk of weight gain and obesity, and sedentary lifestyles

increase the risk.⁴ Being overweight or obese can increase the risk of developing cancers of the colorectum, kidney, pancreas, oesophagus and endometrium, as well as breast cancer in post-menopausal women.⁵ Excess body weight has also been linked with gallbladder and liver cancers.⁵

In addition, being active can help people feel and sleep better, giving them more energy and vitality. And it can improve mental well being by reducing depression, anxiety and stress.⁶

There are environmental benefits from people engaging in physical activity too. More walking and cycling leads to less cars on the road, which leads to less greenhouse emissions and other forms of pollution.

Rationale

In Australia, being physically inactive ranks second only to tobacco smoking in terms of adding to the cancer burden from different known risk factors.⁷ Recent Australian data suggests that physical inactivity accounts for 5.6% of the total cancer burden and 6.6% of the total burden of disease.⁷

The International Agency for Research on Cancer (IARC) estimates that 14% of all cases of colon cancer and 11% of post-menopausal breast cancers are attributable to physical inactivity.⁸

Colon cancer is reduced by 40% among the most active individuals, compared with the least active.⁸ Studies for breast cancer have shown a 20-40% reduction in risk, in both pre- and post-menopausal women.⁸

Therefore it is important for the Cancer Council to evaluate the effects of physical activity and exercise on cancer.

Evidence from Major Reviews of the Epidemiological Literature

In 2002, the International Agency for Research on Cancer (IARC) published a handbook on the evidence for body weight and physical activity in relation to cancer risk.⁸ Most studies showed a consistent reduction in risk of colon cancer with increasing levels of activity.⁸ Studies of rectal cancer and colorectal cancer gave less consistent results.⁸ Regular physical activity was also associated with a reduced risk of breast cancer, and possibly endometrial and prostate cancers.⁸

An expert report by the WHO in 2003 observed that physical activity was consistently associated with a reduced risk of colon, but not rectal cancer.⁴ The report concluded that physical activity convincingly decreased the risk of colon cancer.⁴

The World Cancer Research Fund (WCRF) in 2007 released a comprehensive report on food and the prevention of cancer.⁵ The report found there was abundant epidemiological evidence from prospective studies showing colorectal cancer risk was reduced with higher levels of physical activity (Figure 1).⁵ However the effect was not as clear for rectal cancer as it was for colon cancer.⁵

The WCRF concluded that physical activity is *convincingly* linked to a reduced risk of colon cancer, and *probably* reduces the risk of cancer of the breast (in postmenopausal women) and endometrium.⁵ In addition, there is some *limited but*

suggestive evidence that physical activity can lower the risk of lung, pancreatic and breast (in premenopausal women) cancers.⁵ For prostate cancer, the evidence on physical activity was inconsistent, so WCRF stated *no conclusion* could be made.⁵

The evidence on physical activity can also be interpreted that sedentary ways of life may increase the risk of these cancers.⁵

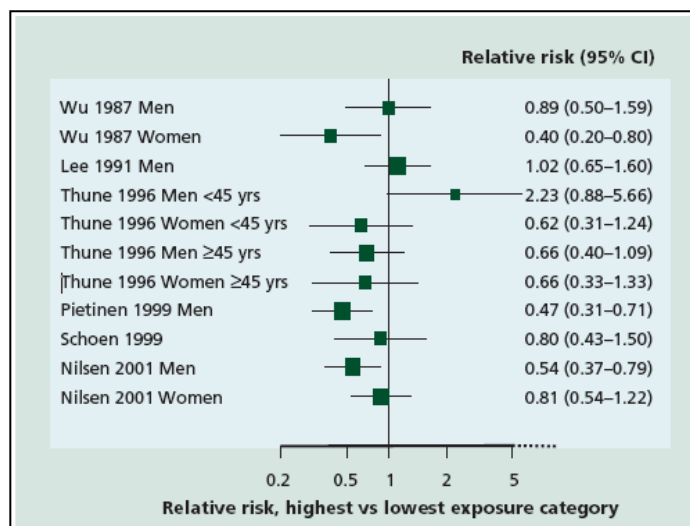


Figure 1. Results from cohort studies on total physical activity and colorectal cancer for highest versus lowest exposure category as reported by the World Cancer Research Fund.⁵

Evidence from Epidemiological Studies

Colorectal Cancer

In 2003, a systematic review on physical activity and the mechanisms for lowering colon cancer risk found that all cohort and case-control studies published between 1997 and 2002 showed physical activity to be inversely related to colon or colorectal cancer risk.⁹ Although the risk reduction was present for colorectal cancer, there was no association with physical activity when rectal cancer was analysed separately.⁹

The risk reduction from physical activity for colon and colorectal cancer occurred in both men and women at various ages, although the association was stronger for men.⁹ There were also several dose-response associations observed across various physical activity exposures (e.g. occupational and leisure time activity).⁹

Another review in 2003 found that physical activity reduced the risk of colon cancer in most of the populations included in the review.¹⁰

Therefore there is strong epidemiological evidence that an association between physical activity and colon cancer exists, with *convincing* evidence from numerous studies that not doing enough physical activity can increase risk.⁵

Breast Cancer

A systematic review in 2007 found there was strong evidence for an inverse association between leisure time physical activity and post-menopausal breast cancer with risk reductions ranging from 20% to 80% among cohort and case-control

studies.¹¹ However the evidence was much weaker for pre-menopausal breast cancer.¹¹

Evidence for a dose-response effect was observed in about half the higher quality studies that reported a decreased breast cancer risk.¹¹ A trend analysis among case-control studies revealed that each additional hour of physical activity per week decreased the risk of breast cancer (all types) by 6%.¹¹

While duration of physical activity (hours/week) was the primary exposure measure in the review, some studies also reported metabolic intensity (MET).¹¹ Three out of four cohort studies found that higher MET hours/week was associated with a lower risk of breast cancer, and one study was statistically significant.¹¹ This was also seen in case-control studies, with three out of four showing breast cancer risk was reduced with higher MET hours/week, and one study was statistically significant.¹¹

In 2003, a systematic review examining health behaviours in early adulthood found that case-control studies appear to show a weak link between physical activity in early life (i.e. adolescence) and risk of breast cancer (both pre- and post-menopausal), although no relationship was seen in two out of three cohort studies.¹² However these results only reflect a particular life stage (i.e. adolescence) and it is likely that the accumulation of physical activity over many years is important for cancer protection.

Overall, epidemiological studies suggest that being physically active *probably* reduces the risk of breast cancer, especially in post-menopausal women.⁵

Endometrial Cancer

In 2007 a systematic review found that both cohort and case-control studies showed a link between physical activity and decreased endometrial cancer risk.¹⁶ This effect was determined to be independent of body weight.¹⁶ Pooled analysis of seven cohort studies showed a significantly decreased risk of endometrial cancer for the most active women (odds ratio (OR)= 0.77, 95% confidence interval (CI)= 0.70-0.85) compared with the least active.¹⁶

Therefore the evidence for physical activity and endometrial cancer appears to be consistent among different study types, and it is *probable* that being physically active can lower the risk of endometrial cancer.⁵

Ovarian Cancer

In 2007 a pooled analysis of six case-control studies in 2007 found that recreational physical activity reduced the risk of ovarian cancer (relative risk (RR)= 0.79, 95% CI= 0.70-0.85).¹⁷ However a meta-analysis of cohort studies found there was no association between ovarian cancer risk and recreational physical activity (RR= 0.81, 95% CI= 0.57-1.17), and there was significant heterogeneity between studies (P=0.004).¹⁷

When all studies were pooled, the risk of ovarian cancer was reduced by recreational physical activity (RR= 0.81, 95% CI= 0.72-0.92).¹⁷

Evidence for occupational activity, vigorous activity and sedentary behaviour on ovarian cancer risk was not as consistent as fewer studies had examined these measures.¹⁷

Therefore there appears to be some *limited* evidence, particularly from case-control studies, that physical activity may reduce the risk of ovarian cancer.⁵

Prostate Cancer

A review published in 2004 found mixed results.¹³ Nine out of 13 more recent cohort studies showed an association between physical activity and reduced prostate cancer risk, while only five out of 11 case-control studies found a similar result.¹³

In 2003, another review noted that findings from studies on physical activity and prostate cancer were inconsistent.¹⁴ While individual studies have reported as much as a 70% reduction in the risk of prostate cancer among most active compared to least active men, several studies have reported an increased risk.¹⁴ However the median relative risk across all studies for most active versus least active men is around 0.9.¹⁴

An earlier review in 2002 also found that the evidence for an association between physical activity and prostate cancer was not consistent.¹⁵ Fifteen out of 30 studies (both cohort and case-control) found a reduction in risk in those more physically active, while two found a reduction in risk only in subgroups of the population, nine found no association, and four found an increased risk.¹⁵ Inconsistencies across these studies may be due to methodological issues e.g. some studies did not have enough subjects who attained very high levels of activity.¹⁵

Therefore, the available epidemiological evidence suggests that physical activity might protect against prostate cancer, however inconsistencies mean that *no conclusion* can be made at this stage.⁵

Potential Mechanisms of Action

It is not entirely clear how physical activity protects against cancer. However the following mechanisms may be involved, as physical activity can:^{18, 19}

- Reduce insulin and insulin-like growth factors, which can enhance tumour development by stimulating cell proliferation or inhibiting apoptosis
- Increase prostaglandin PGF, which acts as an inhibitor of colonic cell proliferation
- Lower the level of endogenous hormones such as oestrogens, which exert stimulatory effects on breast tissue
- Reduce body fatness (see position statement on overweight and obesity: http://www.cancercouncil.com.au/html/healthprofessionals/nutrition_physical/downloads/positionstatement_obesity_cancer.pdf)
- Decrease systemic inflammation by lowering production of inflammatory cytokines
- Enhance immune function by improving the function of natural killer cells, which have a role in tumour suppression
- Decrease gut transit time, thereby reducing carcinogen exposure in the colon.

Benefits for Cancer Survivors

Physical activity may be important for reducing the risk of cancer recurrence (particularly colorectal and breast cancers) and extending overall cancer survival.²⁰ It

can also help maintain a healthy body weight and *convincing* data exists that obesity is associated with breast cancer recurrence.²⁰

One of the first studies to show that physical activity improved breast cancer survival was published in 2005.²¹ Results from the Nurses Health Study showed that the greatest survival benefit occurred in women who performed moderate activity, such as the equivalent of walking 3 to 5 hours per week at an average pace, compared with those women who were sedentary.²¹ There was a 26-40% improvement in survival outcomes for those women who were more active compared to the least active women.²¹

It is currently not known what exercise prescription is most beneficial for certain types of cancer, at which stage of disease or treatment. However other benefits of physical activity for cancer survivors can lead to an improved quality of life. This includes the ability to help alleviate fatigue, improve cardiovascular fitness, muscle strength, body composition and self-esteem, as well as reduce anxiety and depression.²²⁻²⁴

Current physical activity levels in Australian adults

Around two-thirds of Australian adults exercised for recreation, sport or fitness in 2004-2006.^{25, 26} Walking was the most commonly reported activity for both males and females, with 25% participating.²⁶ This was followed by aerobics/fitness (13%), swimming (9%) and cycling (6%).²⁶

The highest participation rates were reported by people aged 25-34 years (75%) and 15-17 years (75%) and the lowest for those aged 65 years and over (49%).²⁶ Females were more likely to walk for exercise, while men were more likely to do moderate and vigorous exercise.²⁵ For those doing exercise (walking, moderate or vigorous activity), around 80% or more did so for 30 minutes or more.²⁵

In Australia, NSW is the only state that shows a sustained increase in the number of people doing sufficient physical activity.²⁷ Increased participation in walking has mainly driven the change, but there has been a slight increase in moderate and vigorous activities such as aerobics and swimming.^{26, 27}

Groups at higher risk of physical inactivity include:^{26, 28}

- Young women
- Older people
- Unemployed
- People who are socially disadvantaged
- People from CALD communities and indigenous Australians.

Current physical activity levels in Australian children

The NSW Schools Physical Activity and Nutrition Survey (SPANS) survey found moderate to vigorous physical activity increased markedly from 1997 to 2004 in school students, particularly those in Year 8.²⁹ Rural girls (but not boys) were more active than those in urban areas while children from Asian and Middle Eastern backgrounds were less active.²⁹ There was no association between socioeconomic status and physical activity levels, and only slightly fewer overweight and obese students were active compared to healthy weight students.²⁹

In 2005, a national survey of secondary school students in Australia found that only 14% of students reported doing at least 60 minutes of moderate to vigorous activity each day.³⁰ Males were more likely than females to meet the activity recommendations.³⁰ As with the SPANS survey, socioeconomic status was not related to the number of students doing the recommended level of physical activity.³⁰

In 2007, a national survey covering both children and adolescents found that around 69% of boys and girls aged 9-16 accumulated at least 60 minutes of moderate to vigorous physical activity on most days, while just 32% of children met the guidelines on all days.³¹ Energy expenditure was lowest while children were on school holidays.³¹ Time spent watching television or playing computer games each day rose rapidly until the ages 13-14, peaking at over 4 hours for boys and 3.5 hours for girls, with just 7% of children aged 9-16 yrs meeting the national sedentary recommendations of <2 hrs/day spent in electronic entertainment media (TV, computer, electronic games) on all days.³¹

Children's physical activity levels decreased with age in all three surveys.²⁹⁻³¹

Factors Influencing Physical Activity Levels

Recent studies suggest that lack of time and environmental factors such as urban location and climate/season are associated with lower physical activity levels.³²

Improving health and fitness are two common motivating factors for exercise.^{26, 32} In addition, social support, access to facilities and neighbourhood safety have all been positively associated with increased levels of physical activity.³²

Recently, motivation for adults to do more exercise may have been influenced by increased media coverage on physical activity and body weight between 2001 and 2004, as well as changes to the way people commute to work e.g. higher petrol prices leading to the decreased use of cars and increased walking, cycling and use of public transport.²⁷

While the frequency of school sport increased, the number of school students walking or cycling to and from school declined from 1985 to 2001, as did the frequency of participation in physical education lessons at school.³³

In addition, sedentary leisure activity in children is high, with Year 6, 8 and 10 students spending around 34, 41 and 45 hours each week respectively engaged in sedentary behaviours such as watching television, playing video games and using computers.²⁹ Forty percent of children aged 5-12 years reportedly watch two hours or more of television each day,³⁴ and children aged 5-12 years had the highest share of pay television viewing in 2001.³⁵

Therefore further increases in physical activity levels could be best achieved by finding ways to incorporate physical activity into busy lifestyles, for example encouraging:

- Exercise breaks at school and work
- Active methods of transport and
- Less time spent in sedentary activities such as watching television.

For children, working with families and schools is likely to have the largest effect on activity levels.³⁶

Recommendations

The Cancer Council supports and encourages the National Physical Activity Guidelines,² which recommend people:

- Think of movement as an opportunity, not an inconvenience
- Be active every day in as many ways as you can
- Put together **at least** 30 minutes of moderate intensity physical activity (like brisk walking) on most, if not every day of the week. This can be achieved by doing three 10-minute sessions in a day.
- Undertake some regular vigorous exercise, if possible, for added health and fitness.

However evidence suggests that the risk of cancer decreases with higher total activity, as well as with greater frequency and intensity, and there is evidence of a dose-response effect.⁵ The amount of activity to reduce the risk of cancer is not clear, but it has been estimated that that 30-60 minutes per day of more intense types of activities are needed to see the greatest reduction in risk.⁸

Therefore to **reduce cancer risk**, the Cancer Council recommends people work up to doing:

- 30 minutes or more of vigorous activity each day, or
- 60 minutes or more of moderate activity each day.

Moderate intensity activity is defined as activity that causes a “slight but noticeable increase in breathing and heart rate”. It includes brisk walking, mowing the lawn, digging in the garden, medium-paced swimming or cycling.

Vigorous activity makes people “huff and puff”. Vigorous activity can come from active sports such as football, squash, netball and basketball, and activities such as aerobics, circuit training, jogging, fast cycling or brisk rowing.

For people that are inactive, any increase in physical activity is beneficial. People should be encouraged to be active every day in as many ways as they can. Increasing incidental activity in everyday tasks can help increase the total amount of energy burnt, and using energy assists in maintaining a healthy body weight.

Cancer survivors should be physically active as well. The Cancer Council recommends cancer survivors aim for **at least** 30 minutes of moderate activity daily.

Future Research

Because of the variation and difficulty in measuring physical activity level, its impact on cancer may be underestimated.⁸ In the future, there is a need for more studies that clarify:

- The nature of the dose response relationship
- The duration and intensity of activity required for cancer protection (e.g. vigorous versus moderate intensity activity; planned versus incidental activity)
- The temporal relationship to the incidence of the cancer (e.g. is there more value in doing exercise in adolescence or adulthood, before the onset of menopause or post menopause).

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References

1. US Department of Health and Human Services. Physical Activity and Health: a Report of the Surgeon General. Atlanta, Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion. 1996.
2. Commonwealth Department of Health and Aged Care. National Physical Activity Guidelines for Adults. Canberra, Australian Government Publishing Service. 1999.
3. Warburton DE, Nicol CW, Bredin SS. Health benefits of physical activity: the evidence. *Canadian Medical Association Journal*. 2006; **174**(6): 801-809.
4. World Health Organization. Diet, nutrition and the prevention of chronic diseases. Geneva, WHO. 2003.
5. The World Cancer Research Fund and American Institute for Cancer Research. *Food, nutrition, physical activity and the prevention of cancer: a global perspective*. Washington DC: AICR. 2007.
6. Teychenne M, Ball K, Salmon J. Physical activity and likelihood of depression in adults: a review. *Preventive Medicine*. 2008; **46**(5): 397-411.
7. Begg S, Vos T, Barker B, Stevenson C, Stanley L, Lopez A. The burden of disease and injury in Australia 2003. Canberra, AIHW. 2007.
8. International Agency for Research on Cancer. *Weight control and physical activity*. Volume 6. Lyon: IARC. 2002.
9. Quadrilatero J, Hoffman-Goetz L. Physical activity and colon cancer. A systematic review of potential mechanisms. *Journal of Sports Medicine & Physical Fitness*. 2003; **43**(2): 121-138.
10. Bi L, Triadafilopoulos G. Exercise and gastrointestinal function and disease: an evidence-based review of risks and benefits. *Clinical Gastroenterology & Hepatology*. 2003; **1**(5): 345-355.

11. Monninkhof EM, Elias SG, Vlems FA, van dT, I, Schuit AJ, Voskuil DW *et al.* Physical activity and breast cancer: a systematic review. *Epidemiology*. 2007; **18**(1): 137-157.
12. Okasha M, McCarron P, Gunnell D, Smith GD. Exposures in childhood, adolescence and early adulthood and breast cancer risk: a systematic review of the literature. *Breast Cancer Research & Treatment*. 2003; **78**(2): 223-276.
13. Torti DC, Matheson GO. Exercise and prostate cancer. *Sports Medicine*. 2004; **34**(6): 363-369.
14. Lee IM. Physical activity and cancer prevention - data from epidemiologic studies. *Medicine & Science in Sports & Exercise*. 2003; **35**(11): 1823-1827.
15. Friedenreich CM, Orenstein MR. Physical activity and cancer prevention: etiologic evidence and biological mechanisms. *J Nutr*. 2002; **132**(11 Suppl): 3456S-3464S.
16. Voskuil DW, Monninkhof EM, Elias SG, Vlems FA, van Leeuwen FE, Task Force Physical Activity and Cancer. Physical activity and endometrial cancer risk, a systematic review of current evidence. *Cancer Epidemiology, Biomarkers & Prevention*. 2007; **16**(4): 639-648.
17. Olsen CM, Bain CJ, Jordan SJ, Nagle CM, Green AC, Whiteman DC *et al.* Recreational physical activity and epithelial ovarian cancer: a case-control study, systematic review, and meta-analysis. *Cancer Epidemiology, Biomarkers & Prevention*. 2007; **16**(11): 2321-2330.
18. Kruk J, Boul-Enein HY. Physical activity in the prevention of cancer. *Asian Pac J Cancer Prev*. 2006; **7**(1): 11-21.
19. McTiernan A. Mechanisms linking physical activity with cancer. *Nat Rev Cancer*. 2008; **8**(3): 205-211.
20. Doyle C, Kushi LH, Byers T, Courneya KS, Demark-Wahnefried W, Grant B *et al.* Nutrition and physical activity during and after cancer treatment: an American cancer society guide for informed choices. *CA Cancer J Clin*. 2006; **56**(6): 323-353.
21. Holmes MD, Chen WY, Feskanich D, Kroenke CH, Colditz GA. Physical activity and survival after breast cancer diagnosis. *JAMA*. 2005; **293**(20): 2479-2486.
22. Ahlberg K, Ekman T, Gaston-Johansson F, Mock V. Assessment and management of cancer-related fatigue in adults. *Lancet*. 2003; **362**(9384): 640-650.
23. Courneya KS, Friedenreich CM. Physical exercise and quality of life following cancer diagnosis: a literature review. *Ann Behav Med*. 1999; **21**(2): 171-179.
24. Galvao DA, Newton RU. Review of exercise intervention studies in cancer patients. *J Clin Oncol*. 2005; **23**(4): 899-909.
25. Australian Bureau of Statistics. National Health Survey: Summary of Results. Canberra, Australian Bureau of Statistics. 2006.

26. Linacre S. Participation in sports and physical recreation. Canberra, Australian Bureau of Statistics. 2007.
27. Chau J, Smith B, Chey T, Merom D, Bauman A. Trends in population levels of sufficient physical activity in NSW 1998-2005. Sydney, NSW Centre for Physical Activity and Health. 2007.
28. Bauman A, Bellew B, Vita P, Brown W, Owen N. Getting Australia Active: Towards better practice for the promotion of physical activity. National Public Health Partnership. Melbourne. 2002.
29. Booth M, Okely T, Denney-Wilson E, Hardy L, Yang B, Dobbin T. NSW Schools Physical Activity and Nutrition Survey (SPANS) 2004: Summary report. NSW Department of Health. 2006.
30. Scully M, Dixon H, White V, Beckmann K. Dietary, physical activity and sedentary behaviour among Australian secondary students in 2005. *Health Promot Int.* 2007; **22**(3): 236-245.
31. Commonwealth Scientific Industrial Research Organisation (CSIRO), University of South Australia. 2007 Australian National Children's Nutrition and Physical Activity Survey. Canberra, Department of Health and Ageing. 2008.
32. Trost SG, Owen N, Bauman AE, Sallis JF, Brown W. Correlates of adults' participation in physical activity: review and update. *Med Sci Sports Exerc.* 2002; **34**(12): 1996-2001.
33. Salmon J, Timperio A, Cleland V, Venn A. Trends in children's physical activity and weight status in high and low socio-economic status areas of Melbourne, Victoria, 1985-2001. *Aust N Z J Public Health.* 2005; **29**(4): 337-342.
34. Centre for Epidemiology and Research. New South Wales Child Health Survey 2001 (HOIST). 13 (S-4). Sydney, NSW Department of Health. 2002.
35. ACNielsen Media International. Australian Pay TV trends 2001. Sydney, AC Nielsen Company. 2001.
36. Salmon J, Booth ML, Phongsavan P, Murphy N, Timperio A. Promoting physical activity participation among children and adolescents. *Epidemiol Rev.* 2007; **29**: 144-159.