Journal of Physical Activity and Health, 2007, 4, 411-422

Associations Between Physical Activity and Other Lifestyle Behaviors in Older New Zealanders

W. Kerry Mummery, Gregory Kolt, Grant Schofield, and Grant McLean

Background: Physical activity is a key component of healthy aging. We investigated the relationships between physical activity measures and lifestyle risk factors. ***Methods:*** Representative population data (N = 1894) of New Zealand adults aged 60 years and older were analysed to study the association between physical activity, smoking, overweight, and fruit and vegetable consumption. ***Results:*** Activity prevalence of 4 activity measures were 18.3% inactive/sedentary; 67.6% some recreational walking; 30.7% some vigorous activity; and 51.4% regular physical activity. Females were more likely than males to be inactive, and activity levels decreased across age groups. Activity displayed a negative association to smoking and being overweight or obese and a positive association with fruit and vegetable consumption. ***Conclusion:*** Associations between lifestyle risk factors and physical activity indicate a need to address the issue of healthy aging by means of a multi-factorial approach.

Key Words: aging, lifestyle risk factors, surveillance, nutrition

Like most developed countries, the population of New Zealand is aging. The dawn of the 20th century found children outnumbering those age 65 years and over by a factor of 8:1.[1] Decreases in mortality and fertility reduced this ratio to 2:1 in 1999, with the expectation that 1 in every 4 New Zealanders will be over age 64 y by the year 2051.[1] One of the keys to healthy aging is the maintenance of a physically active lifestyle. Regular physical activity has been shown to reduce the risk of premature death and disability from a number of health conditions[2-7] in older adults.

Correlates of physical activity participation in older adults have been identified by various studies. Demographic variables that have been shown to be associated with health-related physical activity include gender, age, income, educational attainment, residential location, and marital status.[8,9] Social support and a supportive physical environment have been positively related to physical activity behavior.[10-

Mummery is with the Dept. of Health and Human Performance, Central Queensland University, Australia; Kolt is with the School of Biomedical and Health Sciences, University of Western Sydney, Australia; Schofield is with Centre for Physical Activity and Nutrition Research, Auckland University of Technology, Auckland, New Zealand; McLean is with the Policy & Research Unit, Sport and Recreation New Zealand, Wellington, New Zealand.

[12] Lifestyle risk factors such as lower body mass index (BMI), nonsmoking, and positive diet have also been reported as correlates of health-related physical activity in older adults.[13-15] However, only a few studies have addressed these issues at a population level.

Internationally, efforts to address the issue of health-related physical activity have been founded in regular, systematic assessment of activity levels within the population.[16-18] There is limited information, however, on the prevalence of various physical activity measures in older adults in general and in New Zealand in particular. It remains unclear how demographic and lifestyle risk factors are associated with various measures of health-related physical activity participation in older adults in this population. Importantly, to date there has been no population-level surveillance of physical activity and other lifestyle risk factors in New Zealand.

Our purpose in this article is to, in a representative sample of New Zealanders ages 60 years and older: (1) describe the patterns of physical activity among older New Zealanders using a range of activity definitions that encompass various aspects of public health, and (2) to examine the demographic and lifestyle behaviors associated with the selected activity measures in a representative sample of New Zealanders, ages 60 years and older.

Methods

Data Source

The data utilized in this study were a subsample of all respondents who participated in the Obstacles to Action Survey conducted in 2003 by Sport and Recreation New Zealand (SPARC). The Obstacles to Action Survey examined the motivators and barriers to physical activity in a representative sample of over 8000 New Zealanders. Full details of the survey are contained within the related technical report available on the SPARC Web site.[19] The research has been conducted with the approval of the Auckland University of Technology Ethics Committee (AUTEC).

Questionnaire Design and Implementation

The Physical Activity and Nutrition in New Zealand survey instrument was adapted from an American Cancer Society questionnaire.[20] SPARC and the New Zealand Cancer Society modified the initial survey for the New Zealand context, and after a pilot trial, implemented it with a nationally representative population sample in December 2003. The survey required participants to self-report current physical activity levels, associated barriers and motivators (physical and social environmental), and current perceptions surrounding these variables. Physical environment variables assessed in the questionnaire included infrastructure, aesthetics, and accessibility. Social environment variables examined social support, motivation, time management, cost, and safety. A variety of nutrition variables were also assessed including the prevalence of consuming 5 or more servings of fruit and vegetables a day. A full copy of the questionnaire is available online at www.sparc.org.nz/research-policy/research-/obstacles-to-action.

Initially, a sample of 14,000 households was randomly drawn from the New Zealand electoral roll and each household was mailed the 26-page survey. After

subtracting the "gone, no address respondents," 13,574 households were eligible for participation. The adult with the first birthday after June 1 in each household was invited to complete and return the questionnaire. Incomplete surveys, wrong person completion, or questionnaires received after the cut-off date were deemed ineligible for analysis. After incorporating a 3-stage follow-up system (reminder postcard, first letter reminder and questionnaire, and couriered second letter reminder and questionnaire), 7916 eligible surveys were used for this analysis (58.3% response rate). All respondents ages 60 years and older at the time of the survey (N = 1894) were included in the analyses in the present article.

Definitions of Physical Activity

Four measures of physical activity were constructed using available data to reflect differing aspects of public health recommendations and concerns. The following definitions were used:

1. *Inactive*: Given the public health concerns relating to sedentary lifestyles,[21] a composite measure of physical inactivity was constructed that reflected no reported walking, moderate, or vigorous activities during the 7-day period preceding completion of the survey.
2. *Any walking*: A reduction in walking is one of the prime contributors to the overall loss of physical activity in the population,[22] yet participation offers great potential benefits for health.[23, 24] Individuals who reported participation in any brisk walking for at least 10 min at a time, including walking at work, walking to travel from place to place, and any other walking done solely for recreation, sport exercise, or leisure, were coded as doing any walking.
3. *Any vigorous activity*: Current evidence supports the inclusion of some vigorous activities for long-term health benefits.[25] Any vigorous activity was defined as reported participation in any vigorous activity such as heavy lifting, digging, aerobics, running, rugby, netball, or cycling.
4. *Regular physical activity*: The definition of regular physical activity approximates common definitions used internationally, which call for 30 min of moderate-to-vigorous physical activity to be performed in at least 5 sessions in a week.[8, 26, 27] Individuals were classed as being regularly active if they reported a minimum of 150 min of activity in at least 5 sessions, with the min of vigorous activity being weighted by a factor of 2. The nature of this combined measure means that respondents may be classified into more than 1 category.

Other behavioral risk factors included in the analysis were defined as follows:

Smoker: reported the smoking of any cigarettes on any day in the month previous to the data collection period.

Overweight: body mass index (BMI; weight in kilograms divided by height in meters squared) ≥25.0.

Five-a-day fruit and vegetable consumption: self-reported consistent consumption of an average of 5 or more servings a day of fruit and vegetables.

Data Analysis

Statistical analyses included descriptive statistics for the 4 measures of physical activity constructed from the data set and for related demographic and lifestyle risk factors. A series of binary logistic regressions were performed to estimate the association of the 4 dichotomous dependent variables with available demographic and lifestyle risk measures of interest. Analyses were weighted to account for survey design effects and nonresponse adjustments. All coding and analyses were carried out using the Statistical Package for the Social Sciences (SPSS, Inc., Chicago, Ill), Version 13.0.

Results

Overall, 18.3% of older New Zealanders reported no physical activity in response to the survey questions and were therefore classified as inactive. Slightly over half of the total sample (51.4%) reported participating in regular physical activity. In the other 2 independent measures of activity behavior—any walking and any vigorous activity—the prevalence was 67.6% and 30.7% of the sample, respectively. Table 1 presents information relating to the characteristics of the sample population and includes the prevalence estimates of the 4 physical activity measures by demographic and risk factor category.

Table 2 presents the adjusted odds ratios and 95% confidence intervals displaying the associations between demographic and lifestyle risk factors and the 4 independent measures of physical activity.

Prevalence and Correlates of Physical Inactivity

On crude analysis, physical inactivity was most strongly and consistently associated with age group, with respondents ages 80 years and over significantly more likely to be inactive (COR = 4.76, 95% CI = 3.07-7.36) when compared to those ages 60 to 64 years. Women were more likely than men to be inactive. Physical inactivity was also associated with lack of a secondary school education and lower income. People who reported consuming at least 5 servings of fruit and vegetables per day were nearly 60% less likely to be inactive (COR = 0.44, 95% CI = 0.31-0.63).

When adjusting for all other variables in the analysis, the resultant odds ratios indicate a significant association between age group and inactivity, with members of the 80 and over group being significantly more likely to be inactive than their youngest counterparts (OR = 6.96, 95% CI = 3.74-12.90). Individuals who were overweight were significantly more likely to be inactive than their healthy-weight counterparts (OR = 1.43, 95% CI = 1.01-2.02), and those who reported 5-a-day fruit and vegetable consumption were less likely to be inactive than those who did not achieve that behavioral measure. Associations between inactivity and education, income, and marital status were attenuated in the adjusted model, failing to reach significance at the 95% level of confidence.

Table 1 Prevalence of Selected Measures of Physical Activity (PA): New Zealand Adults Ages 60 Years and Over

	N	Sample (%)	Inactive (%)	Any walking (%)	Any vigorous activity (%)	Regular PA (%)
Total sample (N = 1894)	1894		18.3	67.6	30.7	51.4
Gender (n = 1887)						
male	878	46.5	16.4	69.0	37.6	55.2
female	1009	53.5	20.4	66.2	24.7	47.4
Age group (n = 1894)						
60-64 y	603	31.8	12.7	75.3	33.9	56.5
65-69 y	445	23.5	13.7	71.3	36.2	52.8
70-74 y	363	19.2	21.3	68.9	26.7	51.1
75-79 y	270	14.3	23.1	61.7	28.5	47.7
≥80 y	213	11.2	40.9	42.3	19.6	32.3
Secondary education (n = 1894)						
no	767	40.5	21.6	66.2	28.6	48.2
yes	1127	59.5	16.1	68.5	32.2	53.5
Income per y (n = 1580)						
0-$10,000	329	20.8	19.9	67.5	28.0	47.8
$10,001-$15,000	392	24.8	19.3	64.5	27.1	49.0
$15,001-$30,000	477	30.2	16.2	70.8	31.9	51.6
>$30,000	382	24.2	12.9	74.1	39.0	59.6
Location (n = 1816)						
large city	619	34.1	18.2	67.4	28.0	48.8
small city	444	24.4	19.5	68.0	28.6	51.0
town	482	26.5	13.9	70.4	36.5	53.9
small town or rural area	271	14.9	19.4	65.8	32.7	57.3
Marital status (n = 1877)						
married	1319	70.3	16.9	68.8	32.0	52.8
separated/divorced	130	6.9	11.1	76.0	28.7	55.6
widowed	355	18.9	28.1	60.2	25.4	45.5
single	73	3.9	18.6	66.7	31.9	40.7
Smoking status (n = 1894)						
no	1691	89.3	17.9	68.7	30.5	51.9
yes	203	10.7	22.0	58.2	32.2	46.7
Overweight (n = 1744)						
no	822	47.1	17.3	69.3	32.9	55.4
yes	922	52.9	18.8	67.9	29.7	49.4
Five-a-day fruit and vegetable consumption (n = 1834)						
no	587	32.0	27.1	62.3	30.1	45.6
yes	1247	68.0	14.3	70.2	31.3	53.9

Note: Item response differences resulted in differing subsample sizes.

Table 2 Multivariate Correlates of Selected Measures of Physical Activity: New Zealand Adults Ages 60 Years and Over

	Inactive (n = 1149)	Any walking (n = 1075)	Any vigorous activity (n = 1388)	Regular PA (n = 1149)
Gender				
male	1.00	1.00	1.00	1.00
female	1.33 (0.90-1.94)	0.82 (0.62-1.09)	0.54 (0.41-0.70)	0.73 (0.56-0.96)
Age group				
60-64 y	1.00	1.00	1.00	1.00
65-69 y	1.18 (0.72-1.93)	0.78 (0.56-1.10)	1.21 (0.89-1.63)	0.79 (0.58-1.08)
70-74 y	2.08 (1.24-3.49)	0.71 (0.48-1.03)	0.75 (0.52-1.07)	0.79 (0.54-1.14)
75-79 y	2.91 (1.69-5.02)	0.39 (0.26-0.59)	0.68 (0.45-1.01)	0.55 (0.36-0.82)
≥80 y	6.96 (3.74-12.90)	0.19 (0.11-0.30)	0.34 (0.20-0.58)	0.26 (0.15-0.45)
Secondary education				
no	1.00	1.00	1.00	1.00
yes	0.92 (0.65-1.30)	0.94 (0.73-1.21)	1.08 (0.85-1.38)	1.0 (0.78-1.30)
Income per y				
0-$10,000	1.00	1.00	1.00	1.00
$10,001-$15,000	0.81 (0.50-1.32)	0.99 (0.69-1.41)	1.02 (0.70-1.48)	1.03 (0.71-1.50)
$15,001-$30,000	0.65 (0.40-1.05)	1.28 (0.90-1.82)	1.20 (0.85-1.70)	1.24 (0.87-1.76)
>$30,000	0.77 (0.46-1.30)	1.13 (0.77-1.65)	1.45 (1.01-2.09)	1.34 (0.92-1.94)

Location				
large city	1.00	1.00	1.00	1.00
small city	1.06 (0.69-1.63)	1.04 (0.76-1.44)	1.08 (0.78-1.48)	1.14 (0.83-1.57)
town	0.79 (0.51-1.24)	1.17 (0.86-1.61)	1.59 (1.18-2.15)	1.28 (0.94-1.75)
small town or rural area	1.10 (0.66-1.82)	0.96 (0.66-1.40)	1.31 (0.91-1.88)	1.45 (1.01-2.12)
Marital status				
married	1.00	1.00	1.00	1.00
separated or divorced	0.61 (0.28-1.33)	1.86 (1.08-3.21)	0.98 (0.61-1.56)	1.01 (0.63-1.62)
widowed	1.03 (0.64-1.67)	1.21 (0.78-1.60)	1.42 (0.99-2.05)	1.27 (0.87-1.86)
single	0.41 (0.14-1.22)	1.34 (0.70-2.58)	1.39 (0.76-2.56)	0.68 (0.36-1.28)
Smoking status				
no	1.00	1.00	1.00	1.00
yes	1.63 (0.96-2.78)	0.51 (0.34-0.75)	1.04 (0.70-1.53)	0.66 (0.44-0.99)
Overweight				
no	1.00	1.00	1.00	1.00
yes	1.43 (1.01-2.02)	0.74 (0.58-0.95)	0.78 (0.61-0.99)	0.72 (0.56-0.92)
Five-a-day fruit and vegetable consumption				
no	1.00	1.00	1.00	1.00
yes	0.44 (0.31-0.63)	1.37 (1.05-1.79)	1.09 (0.84-1.42)	1.25 (0.95-1.64)

Note: Odds ratios were mutually adjusted for all variables in the table; all data are at the 95% confidence level.

Prevalence and Correlates of Any Walking

In our univariate study of the correlates of any walking activity, the crude odds ratios indicated significant negative associations to age, marital status (widowed), and smoking. Each 5-y increment in age showed reduced odds of doing any walking compared to those in the 60- to 64-y age group. Widowed individuals were less likely to walk than their married counterparts (COR = 0.68, 95% CI = 0.53-0.87). Smokers were less likely to report any walking than nonsmokers (COR = 0.63, 95% CI = 0.47-0.85). Five-a-day fruit and vegetable consumption was positively associated with walking (COR 1.40, 95% CI = 1.15-1.75).

Multivariate adjustment removed the significant association between widowhood and walking, but increased the odds of any walking for separated and divorced individuals, so that, when adjusting for all other parameters, those individuals were more likely to do any walking than those who were married (COR = 1.86, 95% CI = 1.08-3.21). With multivariate adjustment the association between age and walking remained, as did that for smoking and fruit and vegetable consumption. In addition, the adjusted odds ratios indicated that overweight individuals were significantly less likely to walk than their healthy-weight counterparts (OR = 0.74, 95% CI = 0.58-0.95).

Prevalence and Correlates of Any Vigorous Activity

Examinations of the crude odds ratios showed that women were less likely than men to do any vigorous activity (COR = 0.54, 95% CI = 0.41-0.66). Those ages 70 to 74 years and 80 years and older were less likely to do any vigorous activity than their counterparts ages 60 to 64 years. People in the highest income bracket were 64% more likely to do any vigorous activity than those reporting an annual income of $10,000 or less (COR = 1.64, 95% CI = 1.19-2.25). A location effect was evident with people living in towns being more likely to report any vigorous activity than their city-dwelling counterparts (COR = 1.47, 95% CI = 1.14-1.91). In addition, widowed individuals were less likely to report any vigorous activity than were married participants. No significant associations were observed between any reported vigorous activity and any of the other lifestyle risk measures (smoking, overweight, five-a-day fruit and vegetable consumption).

In assessing the adjusted odds ratios, it is evident that gender, age, income, and location effects remain, whereas the effect of marital status is weakened to a point where there are no longer any significant associations between any marital category and participation in any vigorous activity. The adjustment increases the strength and significance of the association between overweight and vigorous activity such that overweight individuals were found to have a reduction in the odds of taking part in any vigorous activity when compared to those who were not overweight (OR = 0.78, 95% CI = 0.61-0.99).

Prevalence and Correlates of Regular Physical Activity

There were significant crude associations between the measure of regular physical activity and gender and age group. Women were less likely than men to achieve regular physical activity, and the oldest 2 age groups were significantly less likely than the reference group to be regularly active. Crude associations were noted

between education, income, and marital status, but each of these associations failed to reach significance when assessing the adjusted model. A location effect was found, this time with small town or rural residents displaying significantly higher odds of regular physical activity than city dwellers (COR = 1.41, 95% CI = 1.02-1.95). Overweight individuals were less likely to partake in regular activity than the associated referent group; whereas those who consumed 5 servings per day of fruit and vegetables were significantly more likely to be regularly active (COR = 1.25, 95% CI = 0.95-1.64). Multivariate adjustment attenuated the associations between education, income, marital status, and fruit and vegetable consumption such that the resultant adjusted odds ratios failed to reach significance. Age, gender, location, and overweight effects remained consistent, and the association between smoking and regular activity achieved significance, indicating that smokers were less likely than nonsmokers to be regularly active (OR = 0.66, 95% CI = 0.44-0.99).

Discussion

This article reports prevalence estimates of selected physical activity measures in a representative sample of older New Zealanders. Although population-level surveillance of physical activity has been conducted by both SPARC and the Ministry of Health since the 1990s,[28] differences in measurement tools make it difficult to reliably comment on changes over time. The 1997 and 2001 New Zealand Sport and Physical Activity surveys reported an increase in regular physical activity in adults ages 18+ from 67% to 70% between 1997 and 2001. The New Zealand Sport and Physical Activity survey also tracked sedentary behavior, defined as no reported leisure-time physical activity or sport participation in the previous 4 weeks. In the case of older people (50-65 years), sedentary behavior decreased from 14% to 11% between 1997 and 2001. A recent study by McLean et al.[29] showed differences in activity prevalence, defined as a minimum of 3000 MET min/wk, between Australia and New Zealand, were primarily influenced by relatively high levels of activity in the male population ages 50 to 65 years, where over 63% of the sample were classed as sufficiently active.

It is also possible to make some rough comparisons to other recent research in similar populations. The finding that just over 51% of older New Zealanders take part in "regular physical activity" is comparable to recent studies completed in Australia, New Zealand's closest neighbor. The current results compare to those of the Australian National Physical Activity Survey of 1999, where 54% of older people ages 60 to 75 years were classed as "sufficiently active."[8, 30] The present results are also comparable to those of a recent study in New South Wales, Australia, that indicated that just under half of all older people reported "adequate physical exercise."[31] Comparisons to these 2 studies must be made with caution, however, as the measurement tools and resultant activity indices differed slightly, and the Australian data did not include individuals over the age of 75 years.

The present study demonstrates important associations between the selected measures of physical activity and demographic and lifestyle risk factors. Consistent with numerous other studies,[16, 18, 29] women were less likely than men to take part in regular or vigorous activity, with a decline in physical activity in terms of all 4 measures across the age groups studied. Although not consistent across all 4 measures of activity investigated, the significantly higher rates of physical activity for

nonsmokers, individuals of healthy weight, and those with sufficient intake of fruit and vegetables demonstrate a clustering of health behaviors in relation to a consistently positive association between lifestyle risk factors and physical activity.

We found a location effect in terms of vigorous and regular activity, with people living in towns or small towns and rural areas more likely to be vigorously and regularly active, respectively. This finding compares to the recent New South Wales study, where rural location was independently associated with adequate physical exercise.[31] The instrument utilized in the current study assessed activity such as heavy lifting and digging, which may be more common in a regional or rural setting. Lim and Taylor speculated that their similar finding may have reflected more regional/rural participation in organized sporting activities, a factor that may be pertinent to the present population.

There are a number of limitations to this study. The cross-sectional nature of the data does not allow for the establishment of causation, leaving us only with the ability to infer directionality in discussion. The measurement instrument, although validated in the study population, does not allow for direct comparison with other existing measures internationally. This demonstrates the need for consistent international measurement instruments to be used, so as to make such comparisons across time and location more feasible. As with most self-report instruments, the current measure may suffer from recall or self-report bias. Given the increased media attention given to a physically active lifestyle, there exists the possibility that respondents may have found it socially desirable to report participation in regular physical activity. Despite these limitations, the current study utilizes a robust nationally representative database to describe the levels and correlates of an important public health behavior, physical activity.

From a New Zealand perspective, it is imperative that regular, comparable studies of this type are conducted and analyzed so as to develop an accurate reflection of behavioral trends in this population segment. Regular surveillance in this manner will provide guidance as to the success of existing physical activity promotion programs, with the potential to guide new ones. Efforts need to be made to slow the decline in activity levels across age groups. Associations between lifestyle risk factors and selected physical activity measures indicate a need to address the issue of healthy aging by means of a multifactorial approach. Given the consistent association between other lifestyle risk behaviors such as smoking, overweight, and adequate fruit and vegetable consumption, it is apparent that future surveillance research relating to physical activity and health should not be collected in absence of other lifestyle risk factors. In addition, there is evidence that physical activity is not the only lifestyle behavior that should be targeted in attempts to increase the health of the older New Zealand population.

Acknowledgments

The study was funded in part through the Royal Society of New Zealand ISAT Linkages Fund. We gratefully acknowledge Sport and Recreation New Zealand for providing access to the data. Kerry Mummery was a visiting professor in the Centre for Physical Activity and Nutrition Research at Auckland University of Technology during this project.

References

1. Khawaja M, Thompson N. Population aging in New Zealand. In: *Statistics.* Wellington, New Zealand: Statistics New Zealand; 2000:4.
2. Taylor AH, Cable NT, Faulkner G, Hillsdon M, Narici M, Van Der Bij AK. Physical activity and older adults: a review of health benefits and the effectiveness of interventions. *J Sports Sci.* 2004;22(8):703-725.
3. Wagner EH, LaCroix AZ, Buchner DM, Larson EB. Effects of physical activity on health status in older adults. I. *Annu Rev Public Health.* 1992;13:451-468.
4. Buchner DM, Beresford SA, Larson EB, LaCroix AZ, Wagner EH. Effects of physical activity on health status in older adults. II. Intervention studies. *Annu Rev Public Health.* 1992;13(6):469-488.
5. Lee IM, Paffenbarger RS, Hennekens CH. Physical activity, physical fitness and longevity. *Aging* (Milano). 1997;9(1-2):2-11.
6. Mummery WK, Schofield G, Caperchione C. Physical activity dose-response effects on mental health status in older adults. *Aust N Z J Public Health.* 2004;28(2):180-184.
7. Brown DW, Balluz LS, Heath GW, et al. Associations between recommended levels of physical activity and health-related quality of life. Findings from the 2001 Behavioral Risk Factor Surveillance System (BRFSS) survey. *Prev Med.* 2003;37(5):520-528.
8. United States Department of Health and Human Services. *Physical Activity and Health: A Report to the Surgeon General.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease and Health Promotion; 1996.
9. Brownson RC, Eyler AA, King AC, Brown DR, Shyu YL, Sallis JF. Patterns and correlates of physical activity among US women 40 years and older. *Am J Public Health.* 2000;90(2):264-270.
10. Brassington GS, Atienza AA, Perczek RE, DiLorenzo TM, King AC. Intervention-related cognitive versus social mediators of exercise adherence in the elderly. *Am J Prev Med.* 2002;23(2 Suppl):80-86.
11. Booth ML, Owen N, Bauman A, Clavisi O, Leslie E. Social-cognitive and perceived environment influences associated with physical activity in older Australians. *Prev Med.* 2000;31(1):15-22.
12. Kaplan MS, Newsom JT, McFarland BH, Lu L. Demographic and psychosocial correlates of physical activity in late life. *Am J Prev Med.* 2001;21(4):306-312.
13. Peel NM, McClure RJ, Bartlett HP. Behavioral determinants of healthy aging. *Am J Prev Med.* 2005;28(3):298-304.
14. Peeters A, Barendregt JJ, Willekens F, Mackenbach JP, Al Mamun A, Bonneux L. Obesity in adulthood and its consequences for life expectancy: a life-table analysis. *Ann Intern Med.* 2003;138(1):24-32.
15. Drewnowski A, Evans WJ. Nutrition, physical activity, and quality of life in older adults: summary. *J Gerontol A Biol Sci Med Sci.* 2001;56(Spec No 2):89-94.
16. Rutten A, Ziemainz H, Schena F, et al. Using different physical activity measurements in eight European countries. Results of the European Physical Activity Surveillance System (EUPASS) time series survey. *Public Health Nutr.* 2003;6(4):371-376.
17. Macera CA, Pratt M. Public health surveillance of physical activity. *Res Q Exerc Sport.* 2000;71(2 Suppl):S97-S103.
18. Craig CL, Russell SJ, Cameron C, Bauman A. Twenty-year trends in physical activity among Canadian adults. *Can J Public Health.* 2004;95(1):59-63.
19. Sullivan C, Oakden J, Young J, Butcher H, Lawson R. Obstacles to Action: A study of New Zealanders' physical activity and nutrition. Technical Report. In: ACNielson;

2003. Available online at http://www.sparc.org.nz/research-policy/research-/obstacles-to-action. Accessed July 15, 2007.
20. Flagg EW, Coates RJ, Calle EE, Potischman N, Thun MJ. Validation of the American Cancer Society Cancer Prevention Study II Nutrition Survey Cohort Food Frequency Questionnaire. *Epidemiology.* 2000;11(4):462-468.
21. Powell KE, Blair SN. The public health burdens of sedentary living habits: theoretical but realistic estimates. *Med Sci Sports Exerc.* 1994;26(7):851-856.
22. Brownson RC, Boehmer TK, Luke DA. Declining rates of physical activity in the United States: what are the contributors? *Annu Rev Public Health.* 2005;26:421-443.
23. Morris JN, Hardman AE. Walking to health. *Sports Med.* 1997;23(5):306-332.
24. Galloway MT, Jokl P. Aging successfully: the importance of physical activity in maintaining health and function. *J Am Acad Orthop Surg.* 2000;8(1):37-44.
25. Blair SN, LaMonte MJ, Nichaman MZ. The evolution of physical activity recommendations: how much is enough? *Am J Clin Nutr.* 2004;79(5):913S-920S.
26. Commonwealth Department of Health and Aged Care. National physical activity guidelines for Australians. Canberra, Australia: University of Western Australia and the Centre for Health Promotion and Research; 1999.
27. Health Canada. Canada's Physical Activity Guide to Healthy Living. In: *Health Canada.* Ottawa; 2000.
28. Sport and Recreation New Zealand. Results of the New Zealand Sport and Physical Activity Surveys (1997-2001). Wellington; 2003.
29. McLean G, Smith B, Bauman A, Tobias M, Carr H. The public health 'Bledisloe Cup': physical activity prevalence differences between New Zealand and Australia. *Aust N Z J Public Health.* 2005;29(5):490-491.
30. Lee YS. Gender differences in physical activity and walking among older adults. *J Women Aging.* 2005;17(1-2):55-70.
31. Lim K, Taylor L. Factors associated with physical activity among older people—a population-based study. *Prev Med.* 2005;40(1):33-40.