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# The impact of retirement on physical activity

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***ABSTRACT***
Most adults do not achieve the levels of physical activity currently recommended for a healthy lifestyle. Population surveys suggest that there is a linear decline of activity levels with age, yet physical activity has many health benefits for older adults. If these are to be more widely adopted among older people, health policy and promotion require an understanding of the factors that influence decreasing activity with age. This study examined the patterns of physical activity of 699 participants in the *West of Scotland Twenty-07 Study* who were aged 60 years when interviewed in 1991 and followed up four to five years later. It examined the factors that influenced whether or not the subjects achieved currently recommended levels of activity, by applying random effects models with a seasonal adjustment. It was found that higher levels of physical activity associated with a healthier lifestyle, and that socio-economic factors played a minor role in determining the level of physical activity. A substantial amount of physical activity occurred at work but was lost by those who had retired, for while those who were not working were more physically active at home or at leisure than those in work, the majority of the sample did too little physical activity outside work to compensate for the loss of work-based activity. One conclusion is that health promotion initiatives that encourage people to become more physically active should be targeted at those who are about to retire.

***KEY WORDS*** – physical activity, retirement, *Twenty-07 study*, health promotion, lifestyle, older adults.

## Introduction

There is growing recognition of the role that activity and exercise can play in promoting healthy ageing and in reducing the functional declines that accompany ageing. For example, the *American College of Sports Medicine* (ACSM) (Mazzeo *et al.* 1998) has suggested that regular activity for older adults is associated with maintenance and improvement of cardiovascular function, reduction in risk factors for several diseases states, increased life

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expectancy, improved bone health and muscle strength and a reduced risk of falling (Health Education Authority 1999). In addition, Boutcher (2000) concluded that fitter older adults have better cognitive function than less fit counterparts and that there may be improvements in cognitive function as a result of increasing fitness for older adults. In terms of public health, the benefits of increasing activity levels and maintaining functional abilities are enormous (Mazzeo *et al.* 1998). Cassell even suggested that activity, including physical activity, may be 'the best treatment for aging' (Cassell 2002).

Recommendations about how much physical activity is required to achieve health benefits have changed over the years. It became customary for the recommendations to aim for enhanced muscular endurance and cardio-respiratory fitness. The original ACSM guidelines, which we shall refer to as the 'fitness' guidelines, suggested that a minimum of 20 minutes of continuous activity at a 'moderate' to 'vigorous' level of intensity at least three times each week was required to enhance cardio-respiratory fitness (Pate *et al.* 1995). In 1995, in conjunction with the United States *Centres for Disease Control and Prevention* (CDC), the ACSM augmented the established recommendations with guidelines that were specifically designed to enhance health. These suggested that, 'every … adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week' (1995: 404). This supplementary recommendation, which we shall refer to as the 'active living' guideline, emphasised the benefits of short bouts of moderate-intensity physical activity that are designed to encourage 'active living'. The recommended 30 minutes of activity per day can be accumulated from walking, gardening, housework and 'do it yourself' (DIY) home maintenance and improvement, as long as the intensity corresponds to that of brisk walking. McMurdo (2000) has recently argued that the 'active living' approach is particularly appropriate for older adults.

Only one-third of the adult population in Scotland currently achieves the recommendations for 'active living' or 'fitness', and the lowest levels of participation (about 25 %) are found among those aged 60 or more years (Scottish Office 2000). A similar pattern of low activity levels and of least participation among older adults has been found in Europe and North America (Kearney *et al.* 1999; US Department of Health and Human Services 1996). The reasons for the very low participation by older adults are complex and may include declining physical abilities, cultural expectations and norms about the activities appropriate to old age, low motivation and barriers to activity. Much research is now taking place to find effective ways to promote increased physical activity levels in the population (and therefore to gain a public health benefit) (Kahn *et al.* 2002), but

very little of this research effort has been directed at older adults. A recent review has suggested that further research is needed to recruit older adults into physical activity interventions and has noted that sedentary older people comprise the largest component of the inactive population (Hillsdon *el al.* 2004). To deliver effective health policy and promotion for this age group, it is important to understand the factors that lead to decreasing activity with age.

Many studies of physical activity levels only examine leisure time activity (Stephens and Caspersen 1994), but if we wish to promote the 'active living' approach, which encourages the accumulation of activity from many settings such as work, home and leisure, then a measure of physical activity that includes other activities is required. For some people, paid work involves a substantial amount of their physical activity, but this is lost on retirement. Ruchlin and Lachs (1999) examined only leisure time physical activity and found that for those aged 55 or more years, being employed decreased the likelihood of walking for exercise or playing sports, but they did not mention the beneficial effects of physical activity in the course of work. In a mid-life sample, Phillips and co-workers (2001) showed that working class people were more likely than middle class people to be physically active when employed but were less active when not employed, thus showing that physical activity at work might help people to achieve the 'active living' recommendations. The relationship between the work and leisure elements of physical activity is complex and prompts several hypotheses. One suggests that if people are active at work they are more likely to be active in leisure time; another that people compensate for high activity levels at work with low activity levels in leisure time; and a third suggests that the levels of physical activity in these two settings are totally independent (Wu and Porell 2000).

Retirement is an important transition in people's lives and, by reducing the demands on a person's time, might be assumed to decrease the level of physical activity. Evenson and colleagues (2002) examined prospectively the influence of the transition to retirement on leisure time physical activity in a large cohort of American participants, and showed an increased level of activity. They recognised that the data could not determine if the increased physical activity compensated for lost activity at work, since the latter was not measured.

Very few studies have examined the levels of achievement of the recommended levels of physical activity, and most have used other (and simpler) criteria to categorise participants as 'active', such as 'one occasion of physical activity over the last month' (Phillips *et al.* 2001). We concluded that that there was a need to examine the factors that influence the level of achievement of the 'active living' recommendations among

older adults, and that to do this would require measures of the physical activity undertaken outside of leisure time. Accordingly, the aim of the research was to describe and analyse the patterns of physical activity for adults in the West of Scotland as they reached and passed retirement age. The study design had the advantages of collecting detailed information on a wide range of physical activities, including those at work, at home and at leisure. The adopted definition of an active lifestyle is based on the 'active living' and 'fitness' recommendations. The data are fully longitudinal and so incorporate the effects of changing circumstances, *e.g.* changes in employment status. The focus on retirement affords a clear target for public health initiatives.

## Methods

### *The study sample*

The data originate from the *West of Scotland Twenty-07* '*Health in the Community*' study (Macintyre *et al.* 1989) and comprise three age cohorts aged respectively 15, 35 and 55 years at first contact in 1987/88. Each of the three had around 1,000 people. They were drawn as clustered random samples from the Central Clydeside conurbation, the metropolitan area centred on the City of Glasgow. Comparison with data from the 1991 population census showed the achieved samples to be broadly representative of the populations from which they were drawn (Der 1998). The participants are being regularly followed up using face-to-face interviews and postal questionnaires. The interviews are conducted by trained nurse interviewers, usually in the participants' homes. Here we use data from two interview waves that were conducted in 1991 and 1995/96, and focus on the oldest cohort, aged at the successive dates around 60 and 64 years. There is full information on physical activity for the two waves for 699 individuals.

## Measures

### *Physical activity*

During the interviews the participants gave information about various types of physical activity and whether they took place at work, at home or during leisure. Activity at work was indicated by: the time spent on physically-hard work; the number of stairs climbed daily; episodes of vigorous work activity of at least 20 minutes; and the number of working days per week. Activity at home was indicated by housework, DIY and gardening. Leisure activity included sports, games and other exercises.

For each of these activities, self-reports of frequency, duration and intensity were collected. For sports, the intensity was also indicated by the 'metabolic equivalent value' of the type of exercise (Katch and McCardle 1993). Walks of two or more miles and cycle rides of at least 20 minutes were separately recorded. From these different measures, we estimated the total number of weekly occasions of moderate activity that lasted at least 30 minutes, and of vigorous activity lasting at least 20 minutes. An 'active lifestyle' was then defined as one which achieved *either* of the recommendations mentioned above, *i.e.* three occasions of vigorous activity lasting 20 minutes per week, or five occasions of moderate activity lasting 30 minutes.

*Employment status*

Employment status was dichotomised as paid employment (full- or part-time) or not. Although some of those not in work did not regard themselves as formally retired, we treated them as *de facto* retired because the probability of a return to work was very low.

*Disability and health*

Participants were asked whether they were able to walk a quarter of a mile without difficulty: this indicator was used as a measure of disability. Self-rated health over the last year was dichotomised into 'excellent/good' as against 'fair/poor'.

*Socio-demographic variables*

The head of household's social class was derived using the 1981 UK 'official' classification (OPCS 1980) and dichotomised into manual and non-manual. Car-ownership indicated whether the household had the use of a car or van. The qualifications variable was derived from the highest vocational qualification of the respondent. Vocational qualifications were used because fewer than 25 per cent of the respondents had formal academic qualifications. The Carstairs-Morris area deprivation score for the postcode sector of the respondent's home address was included (Carstairs and Morris 1991; McLoone 2000). Negative values indicate that an area is more affluent than average, while positive values indicate more deprived areas.

*Lifestyle variables*

Tobacco smoking was binary coded to distinguish non-smokers and light smokers from moderate and heavy smokers, *i.e.* those smoking 10 or

more cigarettes a day or an equivalent amount of tobacco. The self-rated healthiness of the respondent's diet was coded into three categories: unhealthy, normal and very healthy. Although those who rated their diet as healthy tended to have a more varied and hence more nutritionally adequate diet (Ebrahimi-Mameghani 2002; Hodgson *et al.* 1993), the rating is also likely to reflect their attitude towards a healthy lifestyle. Copies of the interview schedules and further details on the derivation of the measures are available from the corresponding author.

## Analysis

All variables, both predictors and outcomes, were measured in both 1991 and 1995/6, and each respondent provided the two observations for the analysis. Random effects were included in the models to allow for the correlation between these repeated measures (Diggle *et al.* 2002). The multivariate analysis of the data was performed using a Bayesian hierarchical modelling framework. The analysis had two parts, each generating a binary outcome variable that indicated whether a person had achieved an active lifestyle, *i.e.* whether either the 'fitness' or the 'active living' recommendation was met. Total activity was analysed first, and then non-work activity. Because many of the questions on physical activity referred to recent behaviour, and data collection lasted several months, all models were seasonally adjusted. The seasonal effect is modelled as a second-order random walk (Fahrmeir and Tutz 2001), which produces a smooth-effect function over the calendar months. Model parameters were estimated by Markov chain Monte Carlo sampling (Fahrmeir and Lang 2001) using the *BayesX* programme (Lang and Brezger 2001).

The initial model of total life activity included all main effects, and variables were then excluded (removed) step-by-step if a 95 per cent credibility interval of the odds ratio criterion included one. In addition, the interactions between each variable and gender, age, time of the interview and social class were examined for significance, using the 95 per cent credibility interval, and were included if the criterion was satisfied. The second analysis examined the effect of work and work activity on home and leisure activity. Stepwise model selection was again employed, starting with a model that included all main effects for all predictors. At the final step, we included a binary variable, 'work activity', that indicated whether or not the respondent achieved the recommended activity levels at work.

TABLE 1. *Percentages of older adult respondents who met one of the physical activity recommendations by setting*

| Type of activity by which achieved | 1991 | 1995/96 |
|---|---|---|
| Total life activity | 32.2 | 24.3 |
| Non-work activity only: | 17.5 | 16.9 |
| Leisure activity only | 14.9 | 15.0 |
| Home activity only | 3.0 | 2.6 |
| Work activity only | 14.6 | 4.3 |

*Note*: Because a respondent could meet the recommendations in a single setting, in more than one setting, or in a combination of settings, the percentages are not additive.

## Results

Table 1 shows the percentages of the respondents that met either of the physical activity recommendations at the two interviews. Total life activity decreased from 32.2 per cent when the respondents were aged around 60 years, to less than 25 per cent four years later. The percentage who achieved either of the recommendations outside work decreased only slightly, and leisure activity stayed around 15 per cent. In contrast, the percentage who met the recommendations at work (work activity only) decreased markedly over the four years, as many of the respondents who were working in 1991 had retired by 1995/96.

Table 2 gives the breakdown of the sample by each of the predictors for both interviews and the percentages who achieved the physical activity recommendations overall and outside work. The employed proportion declined from one-half to around one-fifth, almost entirely through people leaving the workforce. Whereas 60 per cent of those who were working in 1991 had stopped work by 1995/96, only 2.3 per cent (N = 8) of those not working in 1991 reported paid-work at the later date. The proportion in work differed by gender: 61 per cent of men were employed in 1991 and 30 per cent in 1995/96, while for women the equivalent percentages were 40 in 1991 and 15 in 1995/96.

It was found clearly that people in work were far more likely to achieve the recommended overall levels of physical activity. On retirement, increasing levels of activity in other settings are needed to maintain overall activity, but the data showed only a marginal increase in home or leisure activity for those who stopped work between 1991 and 1995/96 – and only a few showed such an increase. Table 2 also illustrates the dramatic impact of disability on physical activity. Those unable to walk a quarter-mile without difficulty were very unlikely to achieve the recommended levels

TABLE 2. *Respondents who met the physical activity recommendations through total life activity and outside work activity by socio-demographic attributes*

| | | Distribution (percentages) | | Achievers (percentages) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Total life PA | | Non-work PA | |
| Variable | Categories | 1991 | 1995/6 | 1991 | 1995/6 | 1991 | 1995/6 |
| Employment | Non-employed (0) | | | 18.1 | 19.5 | 18.1 | 19.5 |
| | Employed (1) | 49.5 | 21.6 | 46.5 | 41.7 | 20.2 | 21.9 |
| Disability | Able to walk (0) | | | 36.8 | 30.2 | 22.1 | 24.7 |
| | Unable to walk (1) | 15.2 | 21.9 | 6.6 | 3.3 | 2.8 | 3.3 |
| Gender | Male (0) | | | 39.0 | 28.9 | 20.8 | 21.7 |
| | Female (1) | 54.5 | 54.5 | 26.5 | 20.5 | 17.8 | 18.6 |
| Social class | Non-manual (0) | | | 35.9 | 27.1 | 24.0 | 24.5 |
| | Manual (1) | 55.4 | 56.2 | 29.2 | 22.1 | 15.2 | 16.5 |
| Car ownership | Yes (0) | | | 37.1 | 28.0 | 22.1 | 22.6 |
| | No (1) | 35.9 | 39.8 | 23.5 | 18.7 | 13.9 | 16.2 |
| Qualifications | None (0) | | | 28.4 | 19.0 | 15.7 | 15.4 |
| | Some (1) | 48.1 | 48.1 | 36.3 | 30.1 | 22.9 | 25.0 |
| Area deprivation | $\leqslant 0$ | | | 39.4 | 32.9 | 25.6 | 26.9 |
| | $>0$ | 60.4 | 59.5 | 27.5 | 18.5 | 14.9 | 15.4 |
| Smoking | $<10$ cig./day (0) | | | 35.4 | 27.9 | 21.5 | 23.5 |
| | $\geqslant 10$ cig./day (1) | 32.3 | 25.2 | 25.3 | 13.6 | 14.2 | 9.7 |
| Healthiness of diet | Unhealthy ($-1$) | 8.9 | 8.2 | 14.5 | 17.5 | 8.1 | 15.8 |
| | Normal (0) | | | 32.7 | 23.3 | 18.7 | 19.0 |
| | Very healthy (1) | 14.6 | 13.7 | 40.2 | 34.4 | 28.4 | 28.1 |
| Self-rated health | Good/excellent (0) | | | 39.8 | 34.1 | 24.3 | 27.9 |
| | Fair/poor (1) | 36.3 | 42.1 | 18.9 | 10.9 | 10.2 | 9.2 |

*Notes*: PA: physical activity. cig. = cigarettes. The coding used in the models is given in parentheses. For further explanation, see text.

of physical activity. Women were less active than men, and there also appeared to be associations with the other socio-economic, lifestyle and health-related variables.

Table 3 presents the results for two models of total life activity. Model PA-1 includes all main effects, while the reduced Model PA-2 includes only statistically relevant effects and interactions. After adjustment, employment still had a large positive effect on physical activity. Social class interacted with employment status, as manual occupations were more physically demanding. Among those not in paid employment, however, the manual social classes were less active. People with a healthier lifestyle were more likely to be active; moderate and heavy smokers were less active; while respondents who reported a healthy diet were more active. As expected, those in poor health were much less likely to be active independently of the very substantial effect of disability. In addition, age had

TABLE 3. *The model of total life physical activity*

| | Main effects model PA1 | | Selected effects model PA2 | |
|---|---|---|---|---|
| Variable | Odds ratio | Conf. interval | Odds ratio | Conf. interval |
| Constant | 0.54 | (0.29, 1.03) | 0.79 | (0.45, 1.39) |
| Interview | 0.59 | (0.35, 0.94) | 0.60 | (0.38, 0.92) |
| Disability | 0.14 | (0.06, 0.29) | 0.14 | (0.06, 0.29) |
| Gender | 0.58 | (0.37, 0.88) | 0.54 | (0.37, 0.80) |
| Employment status | 2.72 | (1.88, 3.97) | 1.58 | (0.94, 2.64) |
| Social class | 1.13 | (0.76, 1.72) | 0.63 | (0.39, 1.03) |
| Employ by social class[1] | | | 2.80 | (1.43, 5.70) |
| Car-ownership | 0.92 | (0.62, 1.43) | | |
| Qualifications | 1.13 | (0.74, 1.72) | | |
| Deprivation score | 0.97 | (0.92, 1.01) | | |
| Tobacco smoking | 0.62 | (0.41, 0.95) | 0.58 | (0.38, 0.87) |
| Healthiness of diet | 1.48 | (0.99, 2.12) | 1.49 | (1.04, 2.16) |
| Self-rated health | 0.41 | (0.27, 0.63) | 0.43 | (0.29, 0.64) |
| Random effect | 2.05 | (SE 0.56) | 1.74 | (SE 0.59) |

*Notes*: For definitions of the variables and categories see text and Table 2. Conf. interval is the 95 per cent interval (from 2.5 to 97.5 %). SE: standard error of the estimate. Interview: 1991 coded 0; 1995/6 coded 1.

[1] Interaction effect.

an effect that was not explained by changes in the other variables. The models also confirmed a gender effect, with females being less likely to have met the physical activity recommendations. Car-ownership, qualifications and the area deprivation score played a minor role when adjusted for other predictors. Their effects were still very small when social class was not included in the model. As a result, all three variables were excluded from the selected model.

Table 3 also gives the random effects for each of the models. These indicate that there was substantial individual variation in the level of activity, which was not accounted for by the predictors in Model PA1. A small part of the heterogeneity was explained in Model PA2, where the variance was slightly reduced. The function that described the seasonal effect is presented in Figure 1 and shows that physical activity was greater during the summer months. We checked for interactions with gender, age or time: in all cases, the 95 per cent credibility intervals of the odds ratios included one, indicating no significant interaction effects. As regards employment status, the absence of an interaction with time meant that no differences in activity could be found between those who had already stopped working by 1991 and those who ceased between 1991 and 1995–96. Hence, only the interaction of employment and social class was included in the final Model PA2.

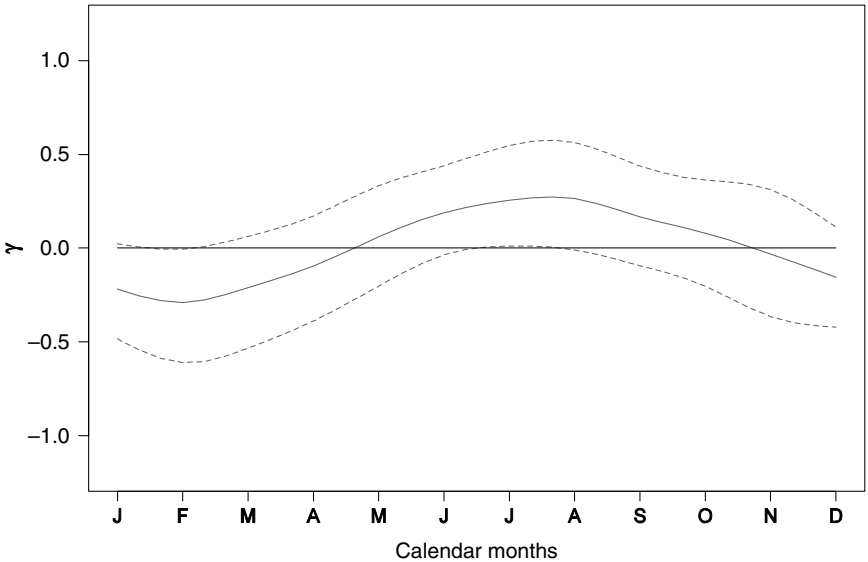


Figure 1. Seasonal effect of Model PA2 (solid line) and the lower and upper bounds of the 95% credibility band (dashed lines). For reference the zero line is plotted.

Table 4 presents the model for the achievement of an active lifestyle from activity outside paid employment, *i.e.* domestic and leisure activities. As before, only the model that includes all the main effects, Model NW1, and the finally selected Model, NW2, are reported. In these models, employment had a clear *negative* impact on non-work activity, *i.e.* those in work had less domestic or leisure physical activity. It was seen earlier in Model PA2 that among those not in work, the manual social classes were less active than the non-manual. Likewise, in Model NW1, non-work activity tended to be lower for manual than non-manual respondents, although in this case the effect was not significant. Nor was there any interaction between employment status and social class. As with total life activity, the likelihood of achieving the physical activity recommendations through home and leisure activity was little affected by car ownership, qualifications and area deprivation. But health- and lifestyle-related factors, such as smoking, healthiness of diet and self-assessed health, showed even stronger effects on non-work activity. The gender effect was weaker and age was no longer significant. No interactions with gender or age at the time of interview were found.

In the selected effects model, NW2, all covariates that showed no significant effect were excluded and, in a final step, the binary covariate work-activity was included. This shows that, for those who were working,

TABLE 4. *The model of non-work physical activity*

| | Main effects model NW1 | | Selected effects model NW2 | |
|---|---|---|---|---|
| Variable | Odds ratio | Conf. interval | Odds ratio | Conf. interval |
| Constant | 0.51 | (0.27, 0.93) | 0.65 | (0.39, 0.97) |
| Interview | 0.72 | (0.45, 1.13) | 0.73 | (0.49, 1.08) |
| Disability | 0.12 | (0.05, 0.26) | 0.13 | (0.05, 0.28) |
| Gender | 0.73 | (0.50, 1.06) | 0.70 | (0.50, 0.92) |
| Employment status | 0.59 | (0.40, 0.86) | 0.72 | (0.51, 1.04) |
| Work activity | | | 0.56 | (0.30, 1.00) |
| Social class | 0.83 | (0.56, 1.24) | | |
| Car-ownership | 1.02 | (0.69, 1.53) | | |
| Qualifications | 1.36 | (0.91, 1.99) | | |
| Deprivation score | 0.97 | (0.93, 1.02) | | |
| Tobacco smoking | 0.59 | (0.38, 0.88) | 0.57 | (0.39, 0.81) |
| Healthiness of diet | 1.53 | (1.05, 2.24) | 1.52 | (1.09, 2.16) |
| Self-rated health | 0.42 | (0.27, 0.62) | 0.42 | (0.29, 0.62) |
| Random effect | 1.15 | (SE 0.54) | 0.28 | (SE 0.57) |

*Notes*: For definitions of the variables and categories see text and Table 2. Conf. Interval is the 95 per cent interval (from 2.5 to 97.5 %). SE: standard error of the estimate. Interview: 1991 coded 0; 1995/6 coded 1.

the likelihood of achieving the recommendations outside work was lower if they were active at work. The seasonal effect of Model NW2 was indistinguishable from the seasonal effect of Model PA2 and therefore not plotted.

## Discussion

Physical activity encompasses a complex set of behaviours that may occur in many different settings, in different modes, and at varying frequencies and intensities. This complexity makes it difficult to measure in a general-purpose social survey. The data reported here were collected in interviews which asked about physical activity in great detail. This allowed us to estimate whether or not the respondents met either of the currently applied recommendations for the level of physical activity required to obtain a health benefit. There is one limitation to this study: it was impossible to determine whether respondents *accumulated* 30 minutes of moderate activity during a day from episodes of short duration. It is possible, therefore, that the percentage who met the recommendations has been underestimated, but this is not expected to affect the main findings. On the other hand, a strength of the study is that the analysis capitalised upon the longitudinal attributes of the data. The outcome 'physical activity' and its

predictors were both measured on two occasions and the analysis used information on changes over time. The models were seasonally adjusted to allow for the higher levels of activity during the summer months. The age of the cohort and the timing of the interviews enabled the effects of the transition to retirement to be assessed.

Physical activity levels declined in this sample over the five years, mostly as a result of the loss of activity from paid employment. Levels of physical activity gained in leisure time remained more or less constant over the same period. Since a lack of time is the most frequently cited barrier to taking part in physical activity, retirement might be expected to provide more time for leisure pursuits and therefore for increased physical activity (The Sports Council and Health Education Authority 1992). This cohort of older adults showed, however, very little increase in non-work activity after retirement, and not nearly enough to compensate for the lost physical activity through work. This finding suggests that Evenson and colleagues' (2002) conclusion that the transition to retirement associates with an increase in leisure time activity may be misleading – because work-related physical activity may decline more than the increase in leisure activity. This observation underlines the need to measure activity in all settings and not just in leisure time.

It was also found that being employed reduced the likelihood of being active outside work and that the more physically demanding the work, the less activity was achieved outside work. When the workers in the more physically-active occupations retired, they were less likely to have had the experience of active leisure from which to build: this group may need more support to find appropriate opportunities for substitute physical activity. These findings support the notion that people compensate for high levels of activity at work with lower levels of activity outside work, which is counter to Wu and Porrel's (2000) finding that older blue-collar workers (who reported more physically demanding jobs) tended to do more vigorous physical activity in leisure time than their counterparts with less physically-demanding jobs. It may be that different segments of the population generate different relationships between work and leisure activity: these complex relationships deserves further investigation.

Another reason for declining physical activity with age may be cultural expectations and norms (*e.g.* for people to take life more easily on retirement) and a lack of awareness of the benefits of increasing activity levels among older people. McMurdo (2000) declared that such cultural and ageist expectations must be challenged if the health benefits of regular activity in later life are to be realised. Retirement from paid employment is therefore shown to be a key transition in terms of its physical activity outcomes. Fewer women than men achieved the currently recommended level

of physical activity and, indeed, women of all ages are a target group for physical activity promotion. Not surprisingly, it was found that people who were unable to walk a quarter-mile were very unlikely to achieve the recommendations: this group may need specially targeted services to help them achieve the recommended standards, as through swimming or chair-based exercises.

Among those around the normal retirement ages, the conventional socio-economic attributes of education, car ownership and deprivation were not strong independent predictors of whether or not people achieved the currently recommended levels of physical activity to achieve health benefits. Instead, other lifestyle factors, such as not smoking and adherence to a healthy diet, predicted the achievement of the physical activity recommendations. This suggests that the focus of promotional activities should emphasise the place of physical activity as part of a healthy lifestyle. Our findings suggest that, for those about to retire, there is a need for appropriate education to raise awareness about the benefits of physical activity and the levels required. Very little research is available on whether or not such health promotion activities, as part of a retirement package, can produce health behaviour changes. The only randomised controlled trial that has been found showed that *Bank of America* retirees who participated in a 12-month comprehensive, self-help health promotion programme delivered through the mail showed positive health-habit changes and reduced medical fees in comparison with a control group who received no additional support on retirement (Fries *et al.* 1993). Future research should address the effectiveness of various ways of promoting physical activity and the associated behaviour change on retirement.

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