Perceived barriers to walking in the neighbourhood environment and change in physical activity levels over 12 months

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Objectives: To investigate whether, and to what extent, perceived barriers to neighbourhood walking (BTNW) may be associated with physical activity levels.

Design: Prospective survey with 12-month follow-up.

Subjects and methods: 750 people attending walking schemes throughout England and Scotland; 551 completed the follow-up. Independent variables were demographic characteristics, examples of possible "external" barriers to walking—for example, "worries about personal safety", and one item concerning ill health. The main outcome measures were "metabolic equivalent" (MET) hours' walking and overall physical activity in the preceding week.

Results: Baseline and follow-up demographic characteristics were similar and physical activity levels generally high. Leisure walking changed little over 12 months, while total physical activity levels reduced significantly from a mean (SD) of 71.26 (78.14) MET hours per week at baseline to 59.57 (181.40) at the 12-month follow-up ($p < 0.001$). External BTNW cited between baseline and 12 months increased significantly from a mean (SD) of 1.24 (1.61) at baseline to 1.43 (1.72) at the 12-month follow-up ($p < 0.001$); only "worries about personal safety" reduced. A significant association was found between citing a health-related BTNW and the total number of external BTNW that were reported at baseline. The strength of this association increased over 12 months. Neither changes in reporting external BTNW that occurred over 12 months (increased vs decreased, vs unchanged) nor changes in the presence of a health-related BTNW were significantly related to levels of leisure walking and overall physical activity (MET hours in the preceding week) over the same period.

Conclusion: Among older people who attended walking schemes, having a health problem that restricted walking had a detrimental influence on people's perceptions about external BTNW, which increased over time. Actual levels of walking and overall physical activity levels did not appear to be significantly affected by this.

Undertaking regular moderate-intensity physical activity (eg, cycling, brisk walking and some forms of housework and gardening) reduces the risk of chronic ill health¹ and leads to other physical and psychological benefits in all age groups.^{2–15} A relatively small amount of regular physical activity is needed for there to be a measurable effect on peoples' health status and disease risk.^{16–18} Adults are recommended to undertake at least 30 minutes of moderate intensity physical activity (which includes brisk walking) on at least 5 days of the week.^{19–23} In England, about three-fifths of men and three-quarters of women do not achieve this level of activity,²⁴ and levels generally decrease with increasing age, so older adults tend to be particularly inactive.²⁵

Brisk walking represents the activity most amenable to change in a sedentary population.²² Nevertheless, UK adults generally report low levels of (both the amount and intensity) walking.²⁴ The reasons for this are not understood, and are probably multifactorial, but need clarification in order to inform public health initiatives. A number of studies have recently highlighted the importance of peoples' perceptions about environmental attributes as an influence on their walking behaviour^{26–27} and physical activity levels more generally.^{28–29}

Based on a large longitudinal survey of people attending national walking schemes, the main aims of this paper are (a) to investigate whether, and to what extent, reported perceived disincentives ("barriers") to neighbourhood walking (BTNW),

at baseline, continued to be reported 12 months later; and (b) to examine associations between perceived BTNW and physical activity levels—in particular, whether any changes in such perceptions were associated with reduced walking or overall physical activity levels over time.

METHODS

The study was approved by the Oxford Brookes University, School of Health and Social Care Research Ethics Committee.

Study setting and sample

The study sample was recruited from two walking schemes: the majority via "Walking the Way to Health" initiative (WHI) ($n = 601$)^a, with additional participants ($n = 149$) recruited from the "Paths to Health" (PTH) project, based in Scotland. These schemes aim to encourage sedentary adults to become more active by attending "Health Walks" which generally have trained walk leaders, assisted by volunteers. (Walking the Way to Health' (WHI) is a joint initiative of the British Heart Foundation (charity) with the Countryside Agency (<http://www.whi.org.uk>, accessed 18 June 2007) that began in October 2000, in England. The "Paths to Health" (PTH) project has close links with the WHI.)

Abbreviations: BTNW, barrier(s) to neighbourhood walking; IMD, Index of Multiple Deprivation; PTH, "Paths to Health" project; WHI, "Walking the Way to Health" initiative

It was envisaged that between 60 and 70 local (led) health walks schemes would be set up annually from the summer of 2001 onwards. The study aimed at recruiting a representative sample of people attending these schemes in England and Scotland. Information from earlier demonstration WHI projects suggested that around half of the projects would be large (≥ 20 walkers), and half small (averaging 10). The study aimed at recruiting all people attending individual walks representing a similar proportion of large and small schemes, with good geographical spread, during a 2-year period. This produced a projected sample size of 720 study participants. Results based on this sample size would have a precision (95% CI) of about $\pm 4\%$. The study would also have sufficient power (approximately 80%) to detect, at $p < 0.05$, a 10% difference in proportions between two groups, and a small effect size of 0.2.

The research officer was informed about newly funded schemes up to 3 months ahead of their initiation. The decision to include a particular walk in the study depended upon the characteristics of that scheme/walk—namely, its size, the season, urban versus rural characteristics and geographical region—compared with characteristics of all walks recruited to

date. In this way efforts were made to maintain balance and diversity within the sample.

Data were obtained by self-completed questionnaires distributed by the research officer as each walk ended. Most people ($\sim 95\%$) chose to complete their questionnaire at home, returning it in a pre-paid envelope, the rest completing it then and there. An estimate of the baseline response rate was in excess of 75% (based upon the number of questionnaires distributed vs completed returns). A questionnaire containing identical items was sent out to participants 12 months after their baseline recruitment date, together with a pre-paid envelope.

Study questionnaire

The study questionnaires contained the British Heart Foundation's "Daily Activities Questionnaire", which is adapted from a validated American measure³⁰ and measures the amount of physical activity that a person has engaged in during the previous 7 days. Studies have shown that people can recall levels of physical activity within the previous 7 days with an acceptable degree of accuracy.^{31–33} Participants were asked to

Table 1 Respondent characteristics comparing baseline (n=750) and 12-month (n=551) follow-up samples

Characteristics	Baseline sample No (%)	12-Month follow-up*		χ^2 (p value)
		Completed No (%)	Not competed No (%)	
<i>Country</i>				
England	601 (80.1)	446 (80.9)	155 (77.9)	0.355
<i>Sex</i>				
Female	544 (72.5)	397 (72.1)	147 (73.9)	0.622
<i>Age group</i>				
<65	323 (43.1)	233 (42.4)	90 (46.4)	0.180
65–74	323 (43.1)	237 (43.2)	86 (44.3)	
75+	97 (13.9)	79 (14.4)	18 (9.3)	
<i>Ethnic origin</i>				
White	710 (95.3)	522 (95.6)	188 (94.5)	0.518
<i>Marital status</i>				
Single (never married)	56 (7.6)	39 (7.2)	17 (8.8)	0.724
Married/living as married	404 (54.9)	301 (55.5)	103 (53.1)	
Widowed/divorced/separated	276 (37.5)	202 (37.3)	74 (38.1)	
<i>Education</i>				
Degree or equivalent	156 (22.1)	117 (22.4)	39 (21.3)	0.947
Some qualifications	87 (12.3)	189 (36.2)	68 (37.2)	
No qualifications	292 (41.4)	216 (41.4)	76 (41.5)	
<i>Employment status</i>				
Full time (30+ hours)	40 (5.4)	25 (4.6)	15 (7.7)	0.075
Part time	110 (14.8)	89 (16.2)	21 (10.7)	
Retired	524 (70.3)	387 (70.5)	137 (69.9)	
Other	71 (9.6)	48 (8.7)	23 (11.7)	
<i>Accommodation</i>				
Own home (including mortgage)	617 (84.6)	461 (86.0)	156 (80.8)	0.087
Rented/other	112 (15.4)	75 (14.0)	37 (19.2)	
<i>Deprivation index</i>				
Most affluent				0.770
Quintile 1	148 (20.1)	113 (20.7)	35 (18.2)	
Quintile 2	148 (20.1)	110 (20.2)	38 (19.8)	
Quintile 3	147 (19.9)	112 (20.6)	35 (18.2)	
Quintile 4	148 (21.1)	106 (19.4)	42 (21.9)	
Most deprived				
Quintile 5	146 (19.8)	104 (19.1)	42 (21.9)	

*Note that the denominator varies with each variable (to a small extent) owing to variable numbers of missing responses to individual questionnaire items.

recall the frequency, duration and intensity of 53 physical activities in 10 categories: travel to work by cycle, or by walking; activity at work, at home (types of housework), in the garden, other activities around the home (types of DIY), walking for leisure, outdoor cycling for leisure, stair climbing, sports and recreation. Each activity was assigned a "metabolic equivalent" (MET) value using published tables.³⁴ One MET is the rate at which adults expend 1 kcal at rest; this is approximately 1 kcal per kilogram of body weight per hour (expressed as 1 kcal/kg/h). Two METs indicate that the energy expended is twice that at rest, and so on. Thus, METs are a measure of the absolute intensity of a physical activity. For each activity, MET hours per week were calculated by combining the frequency, duration and intensity of the activity. (METs based recommendations for physical activity advise that adults undertake at least 30 minutes of moderate-intensity physical activity (ie, an activity with an energy expenditure of between 3 and 6 METs) on at least 5 days of the week. Examples of MET values are moderate intensity (3–4 METs): walking at a brisk pace (1 mile in ~20 minutes), playing golf. Vigorous intensity activities (>6–10 METs): running, swimming laps moderately fast to fast, cycling 10–16 mph.)

A final section asked respondents about barriers to walking around their neighbourhood. Each of the items in this section was preceded by the words: "I would walk more around my neighbourhood, but....." A list of possible reasons was then provided, together with "yes/no" response options.

In addition to these sections, the baseline questionnaire included demographic items. Respondents were also asked to give additional contact details in case their address changed in the interim. The follow-up questionnaire asked respondents if they had moved house since the previous contact.

Deprivation and postcodes data

We obtained an Index of Multiple Deprivation (IMD 2004) rating for study participants, based upon their individual postcodes. The IMD 2004 represents the most recent and comprehensive index³⁵ and is conceptualised as a weighted area level aggregation of several dimensions of deprivation. IMD 2004 ratings were grouped into five quintiles, where quintile 1 represented the most affluent quintile and 5, the most deprived. (Scotland produces a similar—but not identical—index to the rest of the UK, which we obtained and applied to the postcodes of Scottish participants in the study. It was then possible to

map one system onto the other and produce five equivalent groupings (quintiles) for the whole sample.)

Questionnaire data were entered directly into SPSS (v 11.5) statistical analysis software. Ten per cent of data were re-entered and checked for accuracy.

Statistical analysis

We examined the association of various sociodemographic characteristics with completion or not of the 12-month follow-up questionnaire using Pearson's χ^2 test.

Changes in leisure walking and overall physical activity levels (MET hours per week (METs)) were calculated by subtracting relevant MET totals reported at baseline from equivalent totals obtained at the 12-month follow-up. Resulting change variables produced positive values where physical activity had increased over time. The distribution of these change variables was slightly, but not significantly, skewed (Fisher's measure of skewness (± 1.95 is significant): walking change = 1.88; overall physical activity = 1.79). Analyses incorporating these variables were therefore conducted using both parametric and equivalent non-parametric statistics, with only the parametric results presented where results proved similar. The significance of changes in physical activity levels over time was tested using paired t tests.

McNemar's test of significance was used to examine changes in reports of individual perceived external BTNW over time. This is an adaptation of the χ^2 formula used for the comparison of proportions where data are paired.³⁶

To examine the existence of any relationship between changes in respondents' perceived external barriers to walking around their neighbourhood (BTNW) over 12 months and changes in their physical activity levels (METs), respondents were grouped according to changes in the number of examples of different perceived BTNW that they cited on their 12-month follow-up questionnaire by comparison with their equivalent responses at baseline. Three groups were created according to whether respondent's cited (a) more barriers at the follow-up stage than at baseline; (b) fewer barriers at the follow-up stage; or (c) the same number (including none) on both occasions. People who did not respond (as opposed to ticking "no") on either occasion were excluded from these groupings. These three groups were compared for any mean changes in MET hours per week leisure walking and overall physical activity, over 12 months, using analysis of variance.

Table 2 MET hours per week (METs) leisure walking and total physical activity levels: baseline, 12 months follow-up and change shown separately for men and women

Sex	Leisure walking*			Total METs		
	Baseline	12 Months	Change	Baseline	12 Months	Change
<i>Female</i>						
No	542	390	390	539	361	361
Mean	21.72	20.17	-3.70	69.48	47.47	-28.73
SD	38.34	28.95	45.34	82.59	54.58	86.51
Median	10.50	12.38	0.00	46.00	31.50	-17.17
<i>Male</i>						
No	206	153	152	202	142	141
Mean	20.39	27.15	0.31	75.98	90.32	-22.87
SD	23.56	69.54	35.94	64.74	328.97	68.98
Median	12.00	14.00	0.00	61.67	42.46	-17.17
<i>Total</i>						
No	748	543	542	741	503	502
Mean	21.36	22.13	-2.59	71.26	59.57	-27.08
SD	34.90	44.36	42.94	78.14	181.40	81.94
Median	10.67	12.67	0.00	49.42	33.50	-17.17

*Leisure walking only includes walking at an intensity of 3 METs or more (ie, excludes "slow" walking).

Table 3 Perceived barriers to walking around the neighbourhood: comparing the numbers of people who cited barriers at baseline and 12 months later, among those who completed the follow-up stage

Barriers	Number at baseline/ follow-up*	Baseline participants		12-Month follow-up No (%)	McNemar test (p value)
		All No (%)	Those who completed 12-month follow-up No (%)		
<i>I would walk more around my neighbourhood, but....</i>					
I have problems with my health (eg, breathlessness, dizziness or painful joints)	655/482	129 (19.7)	81 (18.5)	90 (20.5)	0.306
There is no one to go walking with me around where I live	661/482	168 (25.4)	101 (23.0)	90 (20.5)	0.390
There is nowhere green/pleasant to walk near my home.	653/481	52 (8.0)	17 (6.2)	51 (11.7)	0.002
There are no pavements around where I live	656/482	10 (1.5)	3 (0.7)	40 (9.1)	<0.001
There is nowhere to go around where I live (eg, shops, pub, church, park)	657/482	23 (3.5)	12 (2.7)	41 (9.3)	<0.001
I worry about my personal safety around where I live (eg, being attacked)	659/483	201 (30.5)	122 (27.8)	84 (19.1)	<0.001
I worry about being knocked down by a cyclist riding on the pavement	655/484	71 (10.8)	40 (9.2)	74 (17.0)	<0.001
I worry about tripping over broken paving stones	655/484	117 (17.9)	73 (16.7)	103 (23.5)	0.001
There is too much traffic on the roads around where I live	660/484	116 (17.6)	69 (15.6)	98 (22.1)	0.003
There is too much pollution around where I live	652/483	72 (11.0)	44 (10.1)	54 (12.4)	0.220

*Where both baseline and follow-up responses to the equivalent question have been compared, denominators reduce slightly, as not all respondents suggested by the follow-up denominator will have responded to the question on both occasions.

The significance level was set at two-sided $p < 0.05$ throughout. Analyses were conducted using SPSS, version 11.5 analytical software (SPSS Inc, Illinois, USA).

RESULTS

The study recruited 750 adult respondents, with a median age of 66 years (mean (SD) 64.4 (10.35), range 23–93). Twelve-month follow-up questionnaires were completed and returned by 551 respondents, yielding a response rate of 73.5%. Table 1 compares details of the demographic characteristics of the baseline and 12-month follow-up samples. Results show that there were no significant differences in demographic characteristics between these two groups.

Physical activity levels

Table 2 shows details of participants' baseline and 12-month follow-up leisure walking and overall physical activity levels (MET hours per week) for the previous 7 days, for the sample as a whole and separately for men and women. Change in

physical activity levels (time 2 minus time 1 MET hours per week) are also shown.

Overall, reported levels of leisure walking changed little over 12 months (MET hours per week: baseline mean (SD) 21.36 (34.90) vs 12-month follow-up of 22.13 (44.36), paired t test, $t = 1.41$, $p = 0.160$). By contrast, reported total physical activity levels reduced significantly (MET hours per week: baseline mean (SD) 71.26 (78.14) vs 12-month follow-up mean 59.57 (181.40), paired t test, $t = -7.41$, $p < 0.001$).

Barriers to neighbourhood walking (BTNW)

The vast majority of respondents answered questions concerned with perceived BTNW at both stages of the survey (baseline 670/750 (89.3%) vs 12 months follow-up 486/551 (88.2%)) and more than half cited at least one barrier, out of nine named "external" barriers (ie, excludes ill health), on each occasion (baseline 369/670 (55.1%) vs 12-month follow-up 289/486 (59.5%)). Table 3 provides details of the types of barriers that were reported at baseline and at follow-up; the significance of any change in reporting individual barriers is also reported.

Over 12 months, the proportion of people who cited particular BTNW rose significantly in most cases. Only the proportion citing "worry about personal safety" significantly reduced (baseline: 122/439 (27.8%) vs follow-up: 84/355 (23.7%); $p < 0.001$).

The mean (SD) number of external barriers cited at baseline was 1.24 (1.61), median 1.0, range 0–9, while at 12 months the mean (SD) number was 1.43 (1.72), median 1.0, range 0–7). This represented a significant increase over time (mean change 0.34, 95% CI 0.18 to 0.50, $t = 4.2$, $p < 0.001$).

Participants were grouped according to whether the total number of external BTNW that they cited increased (165/446 (37.0%)), decreased (106/446 (23.8%)) or remained unchanged (175/446 (39.2%)) over 12 months. Just 12 respondents (2.3%) reported a change of address at the follow-up stage, with only five (41.7%) of them reporting an increase in external BTNW.

There were no significant differences in reporting increased, decreased or unchanged numbers of external barriers to walking over 12 months, according to peoples' gender ($p = 0.50$) or age group ($p = 0.25$).

We examined whether there was any relationship between reporting external barriers versus health-related BTNW. At baseline, a significant association was found between citing a

Table 4 Associations (Spearman correlation) between total number of external barriers to neighbourhood walking (BTNW) cited at baseline and levels of leisure walking and overall physical activity (MET hours per week)

Activity levels (MET hours/week)	Number of external barriers cited at baseline	
	Spearman's r_s	p Value
<i>Baseline*</i>		
Leisure walking (n = 669)	-0.12	0.002
Total physical activity (n = 661)	-0.05	0.212
<i>12 Months later†</i>		
Leisure walking (n = 485)	-0.06	0.220
Total physical activity (n = 450)	-0.03	0.601
<i>Change over 12 months‡</i>		
Leisure walking (n = 489)	0.08	0.093
Total physical activity (n = 449)	-0.001	0.989

*Cross-sectional (all baseline) comparison.

†Baseline number of BTNW cited in relation to physical activity levels 12 months later.

‡Baseline number of BTNW cited in relation to change in physical activity levels over 12 months.

Table 5 Change in the number of external barriers to neighbourhood walking that people cited in relation to changes (MET hours per week) in physical activity levels over 12-month period

Activity levels (MET hours/week)	Barriers increased	Barriers decreased	No change	ANOVA	
				F	p Value
Leisure walking (n = 446)	-0.30* (-6.60 to 6.01) (n = 164)	-6.65 (-16.19 to 2.90) (n = 106)	0.51 (-5.26 to 6.28) (n = 175)	1.05	0.35
Total physical activity (n = 414)	-23.10 (-35.41 to -10.79) (n = 154)	-34.48 (-54.93 to -14.02) (n = 98)	-24.81 (-35.44 to -14.17) (n = 162)	0.65	0.52

Results shown as mean change (95% CIs).

*Positive change in MET hours per week represents an increase in physical activity levels over 12 months.

health-related BTNW and the total number of external BTNW that were reported (number of external barriers cited among those who also cited a health-related barrier: mean (SD) 1.79 (2.06) vs 1.070 (1.40) among those not citing a health-related barrier, $t = -3.74$, $p < 0.001$). The strength of this association increased over the 12-month follow-up period (number of external barriers cited at 12 months among those who cited a health-related barrier at baseline: mean (SD) 2.19 (1.65) vs 1.25 (1.70) among those not citing a health-related barrier at baseline, $t = -4.48$, $p < 0.001$).

BTNW and physical activity levels

Table 4 shows the results of analyses of any association (Spearman's r_s) between the total number of external BTNW that people cited on their baseline questionnaire and the amount of leisure walking and overall physical activity levels (MET hours per week) that they reported at baseline, 12 months later, and in relation to change in physical activity levels over that period.

These results show that, although there appeared to be a statistically significant cross-sectional association between the baseline total number of external BTNW that people cited and their levels of leisure walking, the magnitude of that association ($r_s = -0.12$) was extremely small and thus of no importance. There were no other significant associations between any of these variables.

BTNW and change in physical activity levels

Table 5 shows the results of a comparison between groups of people according to whether they reported increased, decreased or unchanged numbers of perceived external BTNW over 12 months in relation to any changes that occurred in their levels of leisure walking and overall physical activity (MET hours in the preceding week) over the same period. The table shows that there were no significant associations.

Finally, we examined whether there was any association between changes in levels of leisure walking or overall physical activity in relation to changes in reporting a health-related barrier to walking. People were allocated to one of three groups: (a) no health problem barrier reported at baseline but one reported at 12 months—that is, a “new problem” (35/437 (8.0%)); (b) health problem reported at baseline but not at 12 months—that is, “problem resolved” (26/437 (5.9%)); and (c) either a health problem reported on both occasions or no health problem reported—that is, “no change” (376/437 (86.0%)). An analysis of variance to compare these three groups with changes in levels of leisure walking and overall physical activity over 12 months showed no significant associations (change in leisure walking (MET hours per week and 95% CIs)/new problem: mean change 5.38, -11.62 to 22.37; problem resolved: mean change -6.97, -25.00 to 11.06; no change: 0.58, -5.27 to 6.43; $F = 0.36$, $p = 0.70$; change in overall physical activity levels (MET hours per week and 95% CIs)/new problem: mean change -27.41, -69.60 to 14.78;

problem resolved: mean change -28.89, -49.47 to -8.30; no change: -25.97, -34.27 to -17.66; $F = 0.02$, $p = 0.98$).

DISCUSSION

This paper has reported results from a large longitudinal survey of people attending national walking schemes which attained a good response rate at 12 months. Most respondents were retired (70%) and their characteristics reflected this fact. Walking schemes will probably attract people who favour walking, and respondents' walking and overall physical activity levels would therefore be expected to be above average (compared with the general population). Our results confirmed this to be the case, with the average reported amount of walking (median 11.0 MET hours in the past 7 days) and overall physical activity levels (median 49.4 MET hours/week, well above the recommended minimum level of at least 2½ hours' moderate intensity walking (or equivalent level of activity) per week.^{19 20 22 23}

Although representing a generally physically active population who favoured walking, more than half of the study respondents (55%) nevertheless reported experiencing at least one external disincentive or “barrier” to walking around their neighbourhood at baseline, and this proportion had risen to nearly 60% 12 months later, with similar issues cited on each occasion. Worries about personal safety and the lack of anyone to walk with were the most commonly reported barriers.

Generally, where people cited any particular BTNW, more than one example was given, and the number of different external barriers to walking that was cited increased significantly over 12 months. This could not be explained by people moving to a new area, as only a tiny proportion (2%) of respondents moved during the course of the study. However, others have also reported that adults who walk more are more likely to report high numbers of environmental barriers in relation to walking than adults who walk less.³⁷ One exception to this observation was the reduction in peoples' fears and safety concerns when walking locally, among those who responded at baseline and 12 months. Although we are unable to provide an explanation for this observation, we can speculate that these changes might be promoted by walking within groups.

We examined whether there was any association between peoples' perceptions about BTNW and their levels of leisure walking and overall physical activity and found none of any note. We also examined whether any changes in peoples' perceptions about BTNW were associated with reduced levels of walking or overall physical activity levels during the course of 12 months, and found no evidence to suggest that they were. We finally examined whether changes related to citing a health problem as a BTNW were associated with reduced levels of walking or overall physical activity levels. This too disclosed no significant association.

The role that environmental influences have in relation to peoples' physical activity levels is known to be important, but

What is already known on this topic?

- Perceptions of environmental attributes can influence physical activity.
- Barriers to physical activity may differ between young and older people: poor health assuming increasing importance over time.

What this study adds

- Among older adults attending walking schemes, increased health-related barriers to walking influenced people's perceptions about environmental barriers.
- Actual levels of physical activity were unaffected.

poorly understood²⁸ and, until recently, most research in this area has focused on younger people, or men.^{38–39} There is, in particular, a dearth of relevant research based on longitudinal studies.

Research specifically concerned with the neighbourhood environment and health have emphasised the importance of aesthetic qualities (eg, graffiti and greenery) associated with an area, and the effect that these can have on health behaviours—such as smoking and physical activity levels²⁹—with one prospective study of men³⁷ recently reporting an increase in neighbourhood walking associated with positive perceptions of changes in the aesthetic qualities of their neighbourhood.

A few recent studies (conducted in the USA and Australia) have reported that predictors of (or barriers to) physical activity seem to differ between young and older age groups, with poor health assuming increasing importance (as one barrier) with increasing age.^{39–42} In our own analysis, based on a UK sample of older adults, changes in reporting the presence of a health-related BTNW over 12 months did not seem to be associated with changes in levels of leisure walking and overall physical activity over the same period.

That findings in this study appear to run counter to those from some other studies is curious, but may relate to the specific characteristics of our study group. In the first instance, most other studies have focused on groups that were more representative of the general population, while our own study had a sample that was highly skewed towards older age groups. The lack of representativeness of the study sample represents its main limitation for making any general statements, and there are other ways in which the sample characteristics differed from those of the general population. Thus, respondents were also relatively affluent, with at least 85% of people owning their home, which is higher than average for the general population.^{43–44} However, home ownership is highest among those above pensionable age, so the high level of home ownership reflected the older age profile of the study group. In addition to having skewed demographic characteristics, the study sample exhibited other features that reduced the generalisability of any findings. Thus the sample was already quite active and obviously highly motivated—as shown by the low attrition rate over the 12-month study period. We might speculate that people with these characteristics might be more likely to respond to the presence or occurrence of a health problem (which did not itself prevent walking) by using physical activity as a means of ameliorating or coping with their health problem. Clearly, walking schemes represent a very

positive way of encouraging such behaviour in a social and supportive context.

Our main conclusion is that, among older people who attended walking schemes, increased awareness of having a health problem that restricted walking seemed to have a detrimental influence on people's perceptions about external barriers to walking in their neighbourhood, which increased over time. Actual levels of walking and overall physical activity levels did not, however, appear to be significantly affected by this.

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REFERENCES

- 1 Halbert JA, Silagy CA, Finucane P, *et al*. The effectiveness of exercise training in lowering blood pressure: a meta-analysis of randomised controlled trials of 4 weeks or longer. *J Hum Hypertens* 1997;11:641–9.
- 2 Powell KE, Thompson PD, Caspersen CJ, *et al*. Physical activity and the incidence of coronary heart disease. *Annu Rev Public Health* 1987;8:253–87.
- 3 Berlin JA, Colditz GA. A meta-analysis of physical activity in the prevention of coronary heart disease. *Am J Epidemiol* 1990;132:639–46.
- 4 Hayashi T, Tsumura K, Suematsu C, *et al*. Walking to work and the risk for hypertension in men: the Osaka Health Survey. *Ann Intern Med* 1999;130:21–6.
- 5 Haapanen N, Mäkelä S, Vuori I, *et al*. Association of leisure time physical activity with the risk of coronary heart disease, hypertension and diabetes in middle-aged men and women. *Int J Epidemiol* 1997;26:739–47.
- 6 Ford ES, Herman WH. Leisure time physical activity patterns in the US diabetic population - findings from the 1990 national health interview survey. *Diabetes Care* 1995;18:27–33.
- 7 Thune I, Lund E. Physical activity and risk of colorectal cancer in men and women. *Br J Cancer* 1996;73:1134–40.
- 8 Thune I, Brenn T, Lund E, *et al*. Physical activity and the risk of breast cancer. *N Engl J Med* 1997;336:1269–75.
- 9 Schnohr P, Gronbaek M, Petersen L, *et al*. Physical activity in leisure-time and risk of cancer: 14-year follow-up of 28,000 Danish men and women. *Scand J Public Health* 2005;33:244–9.
- 10 Glenny AM, O'Meara S, Melville A, *et al*. The treatment and prevention of obesity: a systematic review of the literature. *Int J Obes Relat Metab Disord* 1997;21:715–37.
- 11 Ernst E. Exercise for female osteoporosis. A systematic review of randomised clinical trials. *Sports Med* 1998;25:359–68.
- 12 Dalsky GP. The role of exercise in the prevention of osteoporosis. *Compr Ther* 1989;15:30–7.
- 13 De Schryver AM, Keulemans YC, Peters HP, *et al*. Effects of regular physical activity on defecation pattern in middle-aged patients complaining of chronic constipation. *Scand J Gastroenterol* 2005;40:422–9.
- 14 Gunnarsson OT, Judge JO. Exercise at midlife: how and why to prescribe it for sedentary patients. *Geriatrics*. 1997;52: 71–2,77–80).
- 15 Morris JN, Hardman AE. Walking to health. *Sports Med* 1997;23:306–32.

- 16 **Hakim AA**, Petrovich CM, Burchfiel, et al. Effects of walking on mortality among nonsmoking retired men. *N Engl J Med* 1998;**338**:94–9.
- 17 **Elley CR**, Arroll B. Refining the exercise prescription for hypertension. *Lancet* 2005;**366**:1248–9.
- 18 **Trolle-Lagerros Y**, Mucci LA, Kumle M, et al. Physical activity as a determinant of mortality in women. *Epidemiology* 2005;**16**:780–5.
- 19 **Pate RR**, Pratt M, Blair SN, et al. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA* 1995;**273**:402–7.
- 20 **World Health Organization/International Federation of Sports Medicine**. Exercise for health. *Bull Health World Organ* 1995;**73**:135–6.
- 21 **Department of Health**. *Strategy statement on physical activity*. London: Department of Health, 1996.
- 22 **Hillsdon M**, Thorogood M. A systematic review of physical activity promotion strategies. *Br J Sports Med* 1996;**30**:84–9.
- 23 **Wannamethee SG**, Shaper AG. Physical activity and cardiovascular disease. *Semin Vasc Med* 2002;**2**:257–66.
- 24 **Department of Health**. *Health Survey for England: Risk factors for cardiovascular disease*, Vol 2. Norwich: The Stationery Office (TSO), Publications Centre, 2003.
- 25 **Crombie IK**, Irvine L, Williams B, et al. Why older people do not participate in leisure time physical activity: a survey of activity levels, beliefs and deterrents. *Age Ageing* 2004;**33**:287–92.
- 26 **Humpel N**, Owen N, Leslie E, et al. Associations of location and perceived environmental attributes with walking in neighbourhoods. *Am J Health Promot* 2004;**18**:239–42.
- 27 **Ball K**, Bauman A, Leslie E, et al. Perceived environmental aesthetics and convenience and company are associated with walking for exercise among Australian adults. *Prev Med* 2001;**33**:434–40.
- 28 **Humpel N**, Owen N, Leslie E. Environmental factors associated with adults' participation in physical activity. A review. *Am J Prev Med* 2002;**22**:188–99.
- 29 **Ellaway A**, Macintyre S, Bonnefoy X. Graffiti, greenery and obesity in adults: secondary analysis of European cross-sectional survey. *BMJ* 2005;**331**:611–2.
- 30 **Taylor HL**, Jacobs-DR J, Shucker B, et al. A questionnaire for the assessment of leisure time physical activities. *J Chronic Dis* 1978;**31**:741–55.
- 31 **Department of Health**. *Health Survey for England, 1998*. Norwich: The Stationery Office (TSO), Publications Centre, 2000.
- 32 **Timperio A**, Salmon J, Crawford D. Validity and reliability of a physical activity recall instrument among overweight and non-overweight men and women. *J Sci Med Sport* 2003;**6**:477–91.
- 33 **Craig CL**, Marshall AL, Sjostrom M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc* 2003;**35**:1381–95.
- 34 **Ainsworth BE**, Haskell WL, Leon AS, et al. Compendium of physical activities: classification of energy costs of human physical activities. *Med Sci Sports Exerc* 1993;**25**:71–80.
- 35 **Jordan H**, Roderick P, Martin D. The Index of Multiple Deprivation 2000 and accessibility effects on health. *J Epidemiol Community Health* 2004;**58**:250–7.
- 36 **Munro BH**. *Statistical methods for health care research*. Philadelphia: Lippincott Williams & Wilkins, 2005.
- 37 **Humpel N**, Marshall AL, Leslie E, et al. Changes in neighbourhood walking are related to changes in perceptions of environmental attributes. *Ann Behav Med* 2004;**27**:60–7.
- 38 **Carver A**, Salmon J, Campbell K, et al. How do perceptions of local neighbourhood relate to adolescents' walking and cycling? *Am J Health Promot* 2005;**20**:139–47.
- 39 **King AC**, Blair SN, Bild DE, et al. Determinants of physical activity and interventions in adults. *Med Sci Sports Exerc* 1992;**24**:S221–36.
- 40 **Chao D**, Foy CG, Farmer D. Exercise adherence among older adults: challenges and strategies. *Control Clin Trials* 2000;**21**:212–7S.
- 41 **Schutzer KA**, Graves BS. Barriers and motivations to exercise in older adults. *Prev Med* 2004;**39**:1056–61.
- 42 **Cohen-Mansfield J**, Marx MS, Guralnik JM. Motivators and barriers to exercise in an older community-dwelling population. *J Aging Phys Act* 2003;**11**:242–53.
- 43 **Office for National Statistics (ONS)**. *General Household Survey 2002*, 2005. Available at <http://www.statistics.gov.uk/liv2002/> (accessed 9 June 2007).
- 44 **General Register Office for Scotland**. *Scotland Census Results on line (SCRoL)*, 2006. Available at <http://www.scrol.gov.uk> (accessed 9 June 2007).

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