Family Practice
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Vol. 16, No. 2
Printed in Great Britain

The vagaries of self-reports of physical activity: a problem revisited and addressed in a study of exercise promotion in the over 65s in general practice

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Sims J, Smith F, Duffy A and Hilton S. The vagaries of self-reports of physical activity: a problem revisited and addressed in a study of exercise promotion in the over 65s in general practice. *Family Practice* 1999; **16:** 152–157.

Background. The assessment of levels of physical activity relies upon suitable measurement tools.

Objective. We aimed to investigate whether a practice nurse, using a motivational interview technique, could encourage older patients to increase their physical activity.

Methods. Health and well-being were monitored at baseline and 8 weeks following intervention. Physical activity levels were ascertained using both a self-report measure and ambulatory heart-rate monitoring.

Results. Whilst patients reported higher levels of physical activity at follow-up, this finding was not confirmed by the heart-rate data.

Conclusion. The study concludes that patients tend to overestimate the amount of physical activity undertaken and that ambulatory heart-rate monitoring may be more useful for verifying actual behaviour.

Keywords. Exercise promotion, general practice, methodology, physical activity, practice nurse.

Background

In health promotion activities, health professionals rely on the patient to provide details of his or her daily lifestyle and use this information to develop and negotiate plans for future healthy living. In clinical practice, any reporting bias tends to be offset by the benefits of continuity of care and the growth of trust between patient and practitioner. In research studies, however, inaccurate reporting can have serious implications for the interpretation of intervention outcomes. There is a wealth of scientific literature demonstrating the limitations of self-report data,[1–4] yet researchers continue to use such measures as the sole assessment tool.[5] A well-validated questionnaire may prove most pragmatic when weighed against more resource-intensive observational techniques[6] to gather objective data, but there are areas where the use of alternative methods of assessing behaviour should be considered. During a small-scale pilot study, we obtained information about activity levels from patients and triangulated the data with direct measurement of physical activity using ambulatory heart-rate monitors. This paper reports on the degree of concordance achieved between the data sets and discusses the findings in relation to the literature and the implications for future research.

The context for the research was the increasing recognition of the benefits of physical activity, particularly for older patients.[7] Despite this, there have been relatively few interventions in this age group.[8] The overall purpose of the study was to assess the feasibility of conducting a practice-nurse-led intervention to promote moderate-intensity physical activity in older patients.

Received 5 December 1997; Revised 19 May 1998; Accepted 19 November 1998.

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Method

Recruitment

Ethical approval for the study was obtained. Patient recruitment occurred in one suburban, eight-partner

1. I am inactive and I don't want to change	*Pre-contemplation*
2. I am inactive but I am wondering whether I should be more active	*Contemplation*
3. I am inactive but I would like to be more active	*Preparation*
4. I am trying to be moderately active	*Action*
5. I am now moderately active, although sometimes it can be difficult to keep up	*Maintenance*
6. I was moderately active but I have let it slip to very little if anything	*Relapse*

FIGURE 1 *Stages of change statements (from* "Helping People Change" *London: HEA)*

practice during November and December 1996. The practice nurse received training about the transtheoretical model of change[9,10] and its use in motivational interviewing. Patients were recruited opportunistically and randomly allocated to either the control or intervention group. Patients were excluded if they had poorly controlled angina, heart failure, uncontrolled BP (>220/120) or any significant or progressive disabling condition, e.g. active neoplasia. The Physical Activity Readiness Questionnaire (PAR-Q) was used to assess fitness to participate.[11] Demographic details, medical history and physical measurements—height, weight, casual heart rate and blood pressure—were recorded following recruitment in a baseline assessment.

Intervention

The overall aim was to encourage the patient to take part in five 30-minute sessions of moderate exercise per week, in line with current recommendations and Health Education Authority (HEA) policy.[12–14] In the intervention group, the nurse and patient developed an individualized, planned activity schedule as part of a motivational interview. Personal preferences and local facilities were considered. The intervention design incorporated criteria found to be successful elsewhere:[15] home-based, unsupervised, informal exercise, supported by professional contact. The nurse telephoned the patient at 2 and 6 weeks: the plan was discussed, along with barriers to exercise and how these might be overcome. In contrast, the control group received standard advice about the benefits and types of recommended activity from the nurse. Both groups were asked to attend again in 8 weeks, when a second assessment occurred.

Assessment tools

The GHQ-28,[16] the Dartmouth COOP scales,[17] the Tokyo Social Competence Index (TSC)[18] and the SF-36[19] were used to measure mental, physical and social health. Current leisure time activity levels were also noted using the revised Godin and Shephard form.[20] This measure asks for the number of 15-minute periods during the previous week spent in strenuous, moderate and mild activities, respectively. Current level of participation in physical activity was classified according to a social cognition model, the 'Stages of Change' model[9,10] (Fig. 1). Two other social cognition constructs, self-efficacy and decisional balance, were also measured.[21] Beliefs and attitudes about exercise and health were elicited using the Health as a Value scale.[22]

In order to obtain an objective assessment of activity levels for all patients, ambulatory heart-rate monitoring was conducted for 8 hours a day over a 3-day period at the beginning and end of the study. Polar© watch monitors were worn on which to collect the data.[23] Patients were requested to keep a concurrent physical activity diary. The diary was based on that recommended by the HEA,[24] adapted for use with older patients. For each patient, heart-rate data were summarized to obtain an average value across the three monitoring periods (mean ambulatory heart rate). Since ambulatory heart rate was averaged across periods which include both resting and activity, two measures which more closely reflected exertion were derived from the data. The first was simply the percentage time spent with a heart rate above 100 beats per minute (b.p.m.). Secondly, age–sex nomograms were used to determine each individual's maximum heart rate. From this, the number of continuous 15-minute periods at levels greater than 70% maximum heart rate was noted.

A semi-structured interview was conducted at the end of the study with six patients (three from each group) and the nurse.[25] Notes made contemporaneously were subjected to a simple content analysis. The aim was to assess the acceptability of the instruments, the intervention and health beliefs about exercise. These details were to supplement the study's findings and to assist the development of a major intervention.

Analyses

Analyses of baseline differences between groups were conducted for all measures using chi-square and *t*-tests as appropriate. Changes across time were assessed within groups using Wilcoxon or paired *t*-tests. Differences from baseline were compared between groups, again using chi-square and *t*-tests as appropriate.

TABLE 1 *Scores on health and well-being measures: all patients*

Measure[a]	Baseline score, mean (SD)	8-week assessment score, mean (SD)
COOP	13.3 (2.6)	13.5 (3.3)
SF-36 scales:		
Physical function	75.2 (17.7)	74.5 (21.8)
Physical role limitation	71.2 (38.3)	68.4 (38.0)
Mental role limitation	76.7 (32.6)	78.9 (35.5)
Pain	67.4 (25.2)	68.7 (21.7)
Mental health	75.8 (14.3)	75.3 (15.8)
Vitality	62.2 (20.7)	62.4 (15.4)
General health	67.4 (15.5)	69.1 (20.8)
Social function	88.1 (16.5)	90.3 (17.9)
GHQ	1.3 (2.3)	1.6 (2.9)
TSC	11.7 (1.4)	11.8 (1.7)

[a] COOP best possible score is 6; SF-36 maximum score possible is 100; GHQ maximum score is 28; TSC maximum score is 13.

TABLE 2 *Self-reported physical activity: all patients*

Level of activity (from Godin & Shephard form)	Median number of 15-minute periods/week Baseline assess.	Median number of 15-minute periods/week 8-week assess.
Mild	6.5	7.0
Moderate	2.5	6.0
Strenuous	0	0

Results

The results here represent data from 20 patients: all were retired Caucasians. Their mean age was 72.2 years (SD 4.26); males (n = 13) tended to be older than females.

Health and social function data

Baseline scores on the measures of physical and mental health status were generally good (Table 1). There were no significant between-group differences. Comparing baseline and second assessment, there was no significant change in mean GHQ score, TSC, COOP and SF-36 scores over time nor between groups.

Physical activity: beliefs and behaviour

Most patients acknowledged a relationship between exercise and health (median score 1.5, where 1 = 'strongly agree' on a 5-point Likert scale). Patients had positive attitudes to health; scores on the 'Health as a Value' scale were relatively high (median score 19, where the maximum possible score was 28). When asked how much they wanted to start taking regular exercise, many expressed a strong intention to do so (median score 4, where 5 = 'very much intend to'). This probably reflects the fact that they had agreed to participate in the study. The majority also agreed with the statement 'If I don't start taking regular exercise I know I'll regret it' (median score 2, where 1 = 'strongly agree'). On the self-efficacy items, patients were somewhat confident that they would find time to exercise and exercise even in adverse circumstances—when sad or stressed or when family and social demands are great (median score 10, where 'extremely confident' scored 15). Self-efficacy and desire to exercise were moderately correlated (r = 0.5, P = 0.02). The median decisional balance score was 10 (where the maximum possible score was 24).

Physical activity: self-report

Most patients were classified as being in the preparation stage at baseline and the action stage at 8 weeks (see Fig. 1). At baseline, the median number of 15-minute periods of mild exercise per week was 6.5, with somewhat fewer periods at moderate levels and none at a strenuous level. At 8 weeks, levels of mild and strenuous activity were similar to baseline, whilst moderate activity increased (Table 2).

For all patients there was a trend for reporting more activity at the second assessment. The reported increase in moderate activity was significant (means at baseline and 8 weeks were 3.05 and 5.0, respectively, P = 0.015) but there was no between-groups difference. There was no significant association between the stages of change classification and self-reported physical activity levels (r = 0 to 0.2, n.s). Overall, activity diaries tended to be incomplete and so were not subjected to formal analyses.

Physical activity: objective data

The heart-rate variables for the two groups are displayed in Table 3. Clinic and ambulatory heart rates showed close concordance (r = 0.74, P = 0.01). Where diary data were available, they reflected the ambulatory heart-rate activity. At the 8-week assessment, the intervention group tended to be more active than the controls, spending more time with heart rates above 100 b.p.m. (P = 0.04). This is probably explained by the generally higher casual heart rates in the intervention group, a small sample heterogeneity effect, which obscures the true impact of the intervention (P = 0.2, n.s. following covariate adjustment). There were no within-group differences, which suggests that there was little real change in activity over time.

There was an inverse association between ambulatory heart rate and self-reported activity. The trend approached significance for reported periods of moderate activity. For example, the correlation with the number

TABLE 3 *Heart-rate data at baseline and 8-week assessment: intervention and controls*

Variable	Intervention Baseline assessment Mean (SD)	Intervention 8-week assessment Mean (SD)	Control Baseline assessment Mean (SD)	Control 8-week assessment Mean (SD)
Pulse (clinic)	78.4 (14.39)[c]	68.44 (7.86)	67.60 (10.57)[c]	65.80 (9.73)
Pulse (ambulatory)	84.27 (10.45)[b]	85.43 (10.11)	74.53 (10.67)[b]	73.74 (10.30)
No. periods @ >70% HR max	2.61 (3.61)[c]	2.47 (2.87)[c]	0.33 (0.67)[c]	0.15 (0.24)[c]
Percentage time with HR >100 b.p.m.	17.53 (15.86)[b]	18.11(15.64)[a]	5.46 (8.68)[b]	3.21 (3.43)[a]

For between group analyses, the following significance levels were obtained:
[a] $P = 0.04$; [b] $P = 0.06$; [c] $0.07 \leq P \leq 0.08$.

of continuous 15-minute periods at levels greater than 70% maximum heart rate at 8-weeks assessment was –0.4 ($P = 0.1$).

Discussion

Health and social functioning scores remained consistent across the 8-week period. The reported amount of moderate activity was higher at the second assessment. In contrast, the objective heart-rate outcomes indicate low amounts of physical activity actually being performed. Further, neither set of patients markedly increased their activity from baseline. The general activity levels are similar to those reported in the literature for this age group.[14,24,26] This discrepancy between subjective, self-reported data and objective heart-rate data may well reflect a response bias in the intervention group or an overall Hawthorne effect.[27] As reported elsewhere,[1,28] patients tended to overestimate the amount of activity they did. (For example, Klesges *et al.*[1] demonstrated a 300% overestimation of aerobic activity in a small sample of students.)

One reason for the discordance may be the lack of specificity of the self-reporting tool. Others have demonstrated greater consistency where patients took part in a walking programme and reported progress on a walking-specific measure.[29] Such an approach detracts from the philosophy of providing an activity plan tailored to the individual's exercise preferences, which is why we chose a mode of intervention where the type of exercise was not uniform across all participants. However, amongst the older generations, walking seems to be the most popular means of taking exercise.[30]

A questionnaire designed specifically for use with older patients may also prove beneficial. Researchers have validated such measures against Caltrac accelerometer and pedometer data, respectively.[31,32] However, the sensitivity of these questionnaires to activity change has yet to be verified. Cauley *et al.*[33] recommends that a variety of instruments be used to measure physical activity, not solely for triangulation purposes but because different instruments reflect different activity patterns.

The objective heart-rate activity measurements used here failed to verify self-reported data but were also potentially flawed for a number of reasons. Heart-rate monitoring does not wholly reflect physical exertion, and alternative means of determining physical activity levels may be needed. For example, heart rate may be elevated due to emotional challenge. However, there is no reason to believe that the groups would differ in this respect. The potentially confounding effect of prescribed drugs upon heart-rate level was not analysed due to the small sample size. Since the follow-up period was only 8 weeks, it is unlikely that heart-rate measures would be influenced by a training effect, which could result in lowering of heart rate.

Findings may have been contaminated due to constraints on this pilot study. For practical reasons, heart-rate monitors were given to patients following their interview with the nurse. The baseline readings could therefore reflect activity motivated by the interview, rather than a true baseline. If initial readings were raised, then a ceiling effect could have made it difficult to detect any further increase in activity at the second time point. Secondly, because the control group received some input regarding exercise, the study's power to detect group differences in outcome is likely to have been reduced. Thirdly, in this preliminary study, the practice nurse dealt with all patients, so confounding across groups may have occurred, even though the training protocol warned against this. A future study will randomize by practice in order to avoid this latter source of contamination.

There was little observable impact from the intervention in this pilot study. Other studies in the primary care setting have had some success in promoting physical activity,[5,29,34,35] albeit with younger subjects.

It may be that the patients—and perhaps the nurses—had unrealistic expectations of what could be achieved. Barriers to making lifestyle changes are the most reliable predictors of actual behaviour.[36] There was some discordance between the generally positive views on health benefits of exercise and actually carrying out physical activity, as reflected by the patients' decisional balance scores. Although the pros of exercising outweighed the cons, all patients having positive scores, the scores were not very high.

Research on adherence has indicated that setting impractical goals is strongly predictive of failure to adhere to an exercise programme.[12,37–39] We have evidence that whilst the group were well intentioned, their plans did not materialize in the form of raised activity levels. Social cognitions certainly influence health behaviour and serve to mediate socio-economic and cultural influences on health behaviour.[40,41] Although socio-cultural constraints were not assessed in this pilot study, with a larger sample size these associations could be studied more closely.

From the post-intervention interviews we determined that intentions to increase physical activity were, in reality, hindered by factors such as poor health, bad weather and altered domestic circumstances. Such barriers have been noted elsewhere.[42] The current intervention occurred during the winter and since many chose walking as their activity, the opportunities for taking exercise were limited. Factors such as social support and other important motivators to exercise[43] appeared to be limited. For example, it is hypothesized that the presence of a close companion who exercises might encourage an individual to exercise: only a quarter of the group had such a companion. Further, some individuals might be motivated to exercise for specific health gains, but only three of this sample professed to having a health problem that might be related to lack of exercise.

Table 2 demonstrates that despite the reported increase in activity, in general the amounts were low. This trend reflects those that were reported in the population-based Allied Dunbar study.[44] In a review of randomized controlled trials of activity promotion, Hillsdon *et al.*[12] noted that improvements in aerobic capacity in community-based studies were smaller than in laboratory-based studies. However, Hillsdon and colleagues highlighted successes in health gain from similarly constructed projects: the potential remains, given more optimal circumstances.

The heart-rate monitors proved straightforward to use. This is encouraging, as they have previously only been used in a sports-exercise setting (Polar©, personal communication). To our knowledge, this is the first study to include ambulatory assessment of exercise in the elderly with this equipment. Despite some technical problems,[23] the heart-rate monitors appear more versatile than Caltrac accelerometers, which can only monitor a restricted range of movements.[6]

Previous studies have used physiological measurement, usually to assess fitness or movement rather than to verify self-report measures. Conducting laboratory-based exercise tolerance testing using treadmills and bicycle ergometers[45–47] can be rather costly and cumbersome. Whilst the elderly are not precluded from this type of approach,[48] ambulatory monitoring is preferable in a primary care setting. King and Frederiksen[37] monitored the distance subjects walked in 12 minutes (the Cooper test) to assess aerobic capacity. Others have used a 6-minute walking test to assess exercise capacity.[49] For the older person, it may be more relevant to demonstrate that increasing activity improves the individual's capability to carry out activities of daily living, rather than assessing aerobic fitness.[48] As Guralnik stated in an overview of physical performance measures: "from the perspective of older individuals themselves, quality of life is judged more by their level of functioning and ability to remain independent than by the specific diseases diagnosed by their physician".[50] Functionality at two or more time points could be assessed and evaluated against standardized criteria.[51–53]

Conclusions

There are distinct advantages to using objective physical performance measures rather than relying upon self-reporting. The results demonstrate that it is important to validate self-reports because individuals tend to overestimate the amount of physical activity that they do. Ambulatory heart-rate monitoring proved acceptable for use with older patients and can be useful in verifying questionnaire and diary data. The application of age- and task-specific tools sensitive to clinically significant changes in activity is recommended for future research studies.

Acknowledgements

Thanks are due to the staff and patients who participated in this pilot study. We would also like to thank the reviewers and our colleague Elizabeth Rink for their comments on an earlier draft of this paper.

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