Adoption of Canada’s Physical Activity Guide and Handbook for Older Adults: Impact on Functional Fitness and Energy Expenditure

Xuesong Jiang¹, Juliette Cooper², Michelle M. Porter¹, and A. Elizabeth Ready¹

Catalogue Data

Key words: behaviour change, chair stand test, community residing, lifestyle activity
Mots-clés: modification de comportement, test de la chaise, logement en résidence, habitude de vie

Abstract/Résumé
This study investigated whether a behaviour change program, based on Canada’s Physical Activity Guide and Handbook to Healthy Active Living for Older Adults (Health Canada, 1999a), would elicit greater benefits than adoption of the guide and handbook alone. Fifteen older adults received the guide and accompanying handbook and completed the 8-week behaviour change program (mean age 73.2 ± 5.2 yrs), while 14 others received only the guide and handbook (mean age 76.8 ± 10.0 yrs). Functional fitness (lower body strength/endurance, flexibility, agility/dynamic balance) (Rikli and Jones, 1999), and estimated energy expenditure (DiPietro et al., 1993) were measured at baseline and after 8 weeks. Lower body strength/endurance and agility/dynamic balance differed between groups at baseline, p < 0.05. All three functional fitness tests improved in both groups over time, p < 0.05. Estimated energy expended in physical activity increased in both groups over time, p < 0.05; however, there was a significantly greater increase in the behaviour-change group (Group × Time interaction, p < 0.05). Participant response to using the guide and handbook was positive. These results indicate that introduction to Canada’s Physical Activity

¹Faculty of Physical Education and Recreation Studies, and ²School of Medical Rehabilitation, Faculty of Medicine, University of Manitoba, Winnipeg, MB, R3T 2N2.
Guide and Handbook to Healthy Active Living for Older Adults leads to benefits, whether or not accompanied by program supports. The group receiving the behaviour change program had a greater increase in energy expenditure, which suggests that such an intervention may ultimately lead to greater health benefits.

Cette étude se propose de vérifier si l’adoption d’un programme de modification de comportement fondé sur le Guide d’activité physique canadien pour une vie active saine pour les aînés (Santé Canada, 1999a) et son Cahier d’accompagnement donne de meilleurs résultats que la seule utilisation du Guide et son Cahier d’accompagnement. Quinze personnes âgées (73,2 ± 5,2 ans) ont reçu le Guide et le Cahier d’accompagnement puis ont participé à un programme de modification de comportement d’une durée de 8 semaines; 14 personnes âgées (76,8 ± 10,0 ans) n’ont reçu que le Guide et le Cahier. Au début et après les 8 semaines, les variables suivantes sont mesurées: la condition physique fonctionnelle (membres inférieurs: force et endurance, flexibilité et agilité/équilibre dynamique) (Rikli et Jones, 1999), et la dépense d’énergie estimée (DiPietro et coll., 1993). Au début, la force/endurance et l’agilité/équilibre dynamique diffèrent entre les groupes, p < 0,05. Chez les deux groupes, les trois tests de condition physique fonctionnelle donnent de meilleurs résultats au fil du temps, p < 0,05. La dépense d’énergie estimée au cours de l’activité physique augmente également au fil du temps chez les deux groupes, mais l’augmentation est plus forte chez le groupe expérimental (interaction Groupe × Temps, p < 0,05). Les participants ont répondu positivement concernant l’utilisation du Guide et du Cahier. Les résultats démontrent que l’utilisation du Guide qu’il soit ou non accompagné d’un programme complémentaire donne de bons résultats. La plus grande dépense énergétique dans le groupe participant au programme de modification de comportement nous amène à penser qu’un tel programme débouche sur de plus grands bénéfices pour la santé.

Introduction

Sedentary lifestyles contribute significantly to chronic disease, decreased functional performance, and loss of independent living in older adults (Lowenthal et al., 1994; Wagner et al., 1992). Although physical activity is related to many physical, functional, and psychosocial health benefits in this population (Mazzeo et al., 1998), few older adults are sufficiently active. Only 14% of Canadians age 65 years and over are classified as sufficiently active to achieve optimal health benefits, with a further 21% described as moderately active. Among those age 75 years and older, 10% are sufficiently active for health while an additional 16% are moderately active. Older women are less likely than older men to be physically active (Health Canada, 1999b).

Low participation rates in physical activity are related to the many additional barriers faced by older adults as compared to younger adults. Although perceived lack of time, energy, and motivation are barriers for all Canadians, older adults in particular are more likely to cite health concerns, injury, safety, and lack of skill as barriers to physical activity (Craig et al., 1998). Environmental barriers and misconceptions about the benefits of physical activity are also common in older adults, and further increase the challenge of promoting physical activity to the elderly (Brawley et al., 2003). The demographic, psychological, cultural and social, health, and environmental factors that support or inhibit participation must
be considered if we are to increase physical activity in this population (Brawley et al., 2003; Kaplan et al., 2001).

Epidemiological evidence indicates that 30 minutes of moderate physical activity, once or twice a week, yields health benefits in previously sedentary persons (Dunn et al., 1998; Haskell, 1994). For optimal health benefits, current guidelines recommend from 30 to 60 minutes of physical activity on most days of the week (Health Canada, 1998). It is increasingly recognized, however, that helping older adults meet these physical activity goals may require self-regulated behaviour change strategies, including goal setting, self-monitoring, feedback, self-evaluation, and corrective behaviour (Brawley et al., 2003). It has also been suggested that physical activity interventions be tailored to the needs of participants (King et al., 1998), both in terms of setting, e.g., home or community centre, and communication channel, e.g., instructor, print media (Brawley et al., 2003).

Although traditional centre-based physical activity programs led by an instructor are common (Brawley et al., 2003), they do not meet the needs of many older adults. Lifestyle physical activity is increasingly recognized as an accessible alternative to more structured physical activity among the elderly (Leaf and Reuben, 1996). Incorporating physical activity into daily life, a more realistic and feasible goal than taking part in traditional exercise programs for many, may also lead to health benefits (Pescatello, 2001).

Media interventions through print materials or the Internet are one cost-effective way of promoting physical activity to large numbers of people. Such interventions could include tools for behaviour change and be targeted to specific populations. The transtheoretical model and social cognitive theory form the framework for many print-based media interventions (Napolitano and Marcus, 2002). Although many studies have examined physical activity interventions in older adults, few have compared the addition of behavioural or educational interventions to the more traditional instructional approach (King et al., 1998; van der Bij et al., 2002).

To encourage older adults to incorporate physical activity into their daily lives, Health Canada and the Canadian Society for Exercise Physiology, in collaboration with the Active Living Coalition for Older Adults, developed Canada’s Physical Activity Guide to Healthy Active Living for Older Adults (Health Canada, 1999a). The 4-page guide and accompanying 21-page handbook (PAGH) was developed in consultation with more than 70 national organizations and a variety of scientific experts (Dampier and Adams, 1999) and followed the publication of Canada’s Physical Activity Guide in 1998 (Health Canada, 1998). The extent to which these resources facilitate increased physical activity participation is unknown. A recent study reported that only 1 of every 5 persons surveyed in Alberta was aware of Canada’s Physical Activity Guide, and that only 5.5% of those who were aware of the guide actually followed its recommendations (Spence et al., 2002).

Few studies have considered the impact of such targeted print materials, whether alone or when combined with educational programs and self-management skill training, on lifestyle physical activity or fitness levels.

The primary purpose of this study was to compare the effects of an 8-week behaviour-change intervention based on the Physical Activity Guide Handbook, and exposure to the Physical Activity Guide Handbook alone, on functional fitness and estimated daily energy expenditure in community-residing older adults. The
secondary purpose was to compare, in the two interventions noted above, the extent to which using the Physical Activity Guide Handbook increased motivation and facilitated physical activity. It was hypothesized that the behaviour-change program would result in greater improvements in functional fitness, energy expenditure, and motivation.

**Methods**

**PARTICIPANTS**

Community residing volunteers, 55 years of age or older, attended information/screening sessions held at a community seniors’ centre ($n = 19$), or a seniors’ apartment complex ($n = 25$). Medical history questionnaires were examined by a registered nurse to identify anyone for whom unsupervised physical activity might be inappropriate. Individuals were excluded if they were nonambulatory, had diagnosed respiratory, metabolic, or cardiovascular disease in an acute stage, had cardiac valvular or rhythm abnormalities or other unstable medical conditions, or required medical supervision during exercise. To qualify for the study, it was necessary that participants had not taken part in structured exercise programs for the preceding 6 months.

All volunteers who met the eligibility requirements were recruited into the PAGH + behaviour-change intervention group (PAGH+, $n = 18$) which comprised members of the community seniors’ centre, or the PAGH intervention group ($n = 16$) which comprised residents from three seniors’ apartment buildings. The seniors’ centre is a nonprofit organization of 600 members, dedicated to providing programs and services that encourage seniors to improve their quality of life and help them live independently. The seniors’ apartment buildings are owned by the provincial government and are available to independently living low-income seniors. The seniors’ centre and the apartment buildings are all located in the same older, middle/working class neighbourhood of the city. Members of the two groups had no contact with each other throughout the study. Written informed consent was obtained from all participants prior to the screening process, and the study was approved by the university’s research ethics board.

**DESIGN AND TESTING PROCEDURE**

The study employed a nonequivalent group design, with subjects recruited purposely to participate in each group. This allowed us to offer a group program at one site, thus strengthening cohesion among members of the PAGH+ group and reducing the likelihood of contamination. All participants underwent pre- and posttests at the beginning and end of the study. The time frame differed slightly between the PAGH+ group (from early February to mid-April) and the PAGH group (late February to early May), due to recruitment and assessment logistics. After the pretest, members of the PAGH+ group attended an 8-week behaviour change program, which was designed based on the Physical Activity Guide Handbook to facilitate an increase in physical activity level. Members of the second group were given the Physical Activity Guide Handbook at the pretest.

Tests were conducted at the seniors’ centre for the PAGH+ group, or at one of three seniors’ apartment complexes for the PAGH group.
**Functional Fitness.** Lower body strength/endurance, lower body flexibility, and agility/dynamic balance were measured using three tests designed for community-residing older adults (Rikli and Jones, 1999). These tests have been found to have acceptable test-retest reliability and to significantly discriminate between regular exercisers and nonexercisers (Rikli and Jones, 1999). The principal investigator conducted all tests. A 5-minute warm-up of walking and gentle stretching exercises preceded each test. The tester demonstrated the proper technique, and participants were encouraged to take one or two practice trials before each test. Standard straight-backed chairs were used for both the chair stand and the chair sit-and-reach tests.

**30-s Chair Stand Test.** This test was used to assess lower body strength/endurance. The number(s) of full stands that the participant could perform in 30 seconds, rising from a fully seated position with arms crossed against the chest, was recorded. Subjects performed only one trial.

**Chair Sit-and-Reach.** This test was used to assess lower body flexibility. Participants were asked to sit at the front edge of a chair, with one leg bent and the foot flat on the floor. The other leg, the preferred leg as determined from the practice trails, extended straight from the hip with the foot flexed and the heel on the floor. The distance from the toes to the middle fingertip was measured as the participant slowly bent forward at the hip joints, sliding the hands down the extended leg in an attempt to touch the toes. The reach had to be held for 2 seconds to be counted. The score was recorded in centimeters (minus score for reaching short of toes, plus score for reaching beyond toes). The best score from two test trials was used to evaluate performance.

**8-Foot Up-and-Go Timed Test.** This test was used to measure agility/dynamic balance. The time (in seconds) to rise from a fully seated position, to walk around a cone placed 8 feet away, and to return to the starting seated position was recorded. Participants were instructed not to use their hands to push up from the chair. They were also told that this was a timed test and that the objective was to walk as quickly as possible. The final score was the average time of two trials.

**Energy Expenditure.** The YALE Physical Activity Survey (YPAS) (DiPietro et al., 1993) was used to estimate each participant’s energy expenditure at the pre- and posttest. It was administered on a one-on-one basis by the principal investigator, who gave basic explanations and was available to answer questions. The YPAS estimates total energy expenditure from the sum of energy expended in 5 classes of activities: work (e.g., shopping, stair climbing, housework); yard work (e.g., gardening, clearing driveway); care-taking (e.g., of older person, childcare); exercise (e.g., brisk walking, exercise class, cycling); and recreational activities (e.g., leisurely walking, dancing, bowling) in a typical week in the prior month. Total time spent in each activity, to the nearest 1/4 hour, was multiplied by the appropriate intensity code and then summed to calculate total energy expenditure, expressed as kcal·wk⁻¹. The intensity codes are defined in terms of resting metabolic rate and hence are independent of body weight. Estimated average daily energy expenditure was calculated from the energy expenditure per week divided by 7 days. The estimated daily energy expenditure for each of the 5 activity classes was calculated in the same way.
The YPAS has been found to have adequate repeatability, with test-retest Pearson product moment correlations of 0.57 for total time, 0.58 for energy expenditure, and 0.65 for activity dimensions (DiPietro et al., 1993). It has also been found to be sensitive to change after a 3-month exercise intervention in older adults (Young et al., 1999). Validity is good when compared to energy expenditure measured using doubly labeled water (Starling et al., 1999).

**Physical Activity Guide Survey.** A modified Physical Activity Guide Survey (Wheeler, 2000) was used to explore the response of each group to the PAGH. Five questions were selected to determine the likelihood that using the PAGH would increase motivation and facilitate physical activity. The survey was given to each participant at the posttest session after the energy-expenditure questionnaire interview. Participants were asked whether they agreed or disagreed with each question based on their experience with the PAGH during the study.

**INTERVENTIONS**

*Physical Activity Guide Handbook.* The 21-page *Physical Activity Guide Handbook* and the 4-page pullout guide provide guidelines for older adults to achieve health benefits by increasing their level of physical activity. It was designed both for those who are currently inactive and for those who have already begun to get active (Ketchum, 1998). Members of the PAGH group were given the guide and handbook at the pretest and were individually encouraged to use the enclosed behaviour-change tools and to incorporate the physical activity recommendations into their daily life. These participants did not meet with study personnel again until the posttest session.

*Behaviour Change-Program + PAGH.* Members of the PAGH+ group received the *Physical Activity Guide Handbook*, and the pull-out guide, in the first week of the behaviour-change program. They met as a group with the principal investigator once a week throughout the study for a 45-min instructional session. Each session included educational and physical activity components with an emphasis on behaviour change (Table 1). Session goals were based on theories and techniques for promoting physical activity behaviours, including the health belief model, protection motivation theory, reasoned action, and planned behaviour (Marcus et al., 1996). The physical activity component of each session introduced a wide variety of practical experiences to the participants. Activities were compatible with that week’s educational content and were also designed to encourage group interaction and to increase motivation. A variety of behaviour-change tools were used to motivate participants to make lifestyle changes and to adhere to those changes. Many behaviour-change sessions were based on the *Physical Activity Guide Handbook* and included pen-and-paper exercises as well as discussion of case studies.

**DATA ANALYSIS**

All data were analyzed using SPSS Version 9.0 for Windows. The nonparametric Kruskal Wallis test was used to determine whether the prevalence of certain diseases differed between groups. Unpaired *t*-tests were used to determine whether
there were significant differences in age, estimated daily energy expenditure, medications, and functional fitness measures between groups at baseline. To determine the significance of differences between and within groups over time, we used a two-way analysis of variance with repeated measures. Alpha was set at 0.05 for all significance tests. Age and some functional fitness scores differed between groups at baseline, thus we conducted Pearson correlations to better examine the possible confounding effects of age and initial score on changes in functional fitness and estimated energy expenditure. As there were no significant relationships for almost all of these variables, except for age and change in flexibility, we have not reported these results. Chi-square tests were used to determine whether responses to the Physical Activity Guide Survey differed significantly between groups.

Results

PARTICIPANT CHARACTERISTICS

Results are reported for those participants who completed the study. Members of the PAGH+ intervention group were significantly younger than the PAGH intervention group, \( p < 0.05 \), although mean age differed by just over 3 years (Table 2). The only other differences documented were the type of residence and the inclusion of males in the PAGH+ group but not in the PAGH group. There was a slightly greater prevalence of arthritis in the PAGH group, but this was not statistically significant.

In the PAGH+ intervention group, one male participant left the study in the first week because of lack of interest, and two women did not attend the posttest session due to long-term depression and to an injury from a fall away from the seniors’ center. Two members of the PAGH intervention group dropped out in the middle of the study, due to hospitalization. Those who dropped out were slightly older, and had a greater incidence of hypertension and arthritis, than those who completed the study. Small numbers preclude a statistical analysis of these findings.
Participants in the PAGH+ intervention group attended an average of 6.3 ± 2.0 of a possible 8 sessions, ranging from 4 to 8 sessions, individually. Overall, the average weekly attendance rate was 75.4%.

**EFFECT OF INTERVENTION PROGRAMS**

Lower body strength/endurance and agility/dynamic balance, as measured by the chair stand and 8-foot up-and-go tests, were greater in the PAGH+ group than in the PAGH group at baseline, \(p < 0.05\). While this difference remained after the 8-week period of the study, significant improvements were seen in both groups over time (Table 3). Lower body flexibility also increased significantly over time within each group. The change in flexibility was correlated with age (–0.37, \(p < 0.05\)); however, this was due to the extreme score of one subject, whose flexibility score changed by 9 cm more than that of any other subject. The correlation was no longer significant when this participant’s data was removed from the analysis.

Estimated total daily energy expenditure due to physical activity did not differ between groups at the pretest, nor did energy expended in any of the activity classes (Figure 1). Participants reported taking part in only 3 of the 5 measured activity classes: work, exercise, and recreation. Care-taking and yardwork were not reported and thus were excluded from the data analysis. The PAGH+ group had a 62.3% increase in estimated total energy expenditure following the 8-week program; this was significantly greater than the 14.6% increase observed in the PAGH

### Table 2  Participant Characteristics at Baseline

<table>
<thead>
<tr>
<th></th>
<th>PAGH+ Group</th>
<th></th>
<th>PAGH Group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Participants</td>
<td>Dropouts</td>
<td>Participants</td>
<td>Dropouts</td>
</tr>
<tr>
<td></td>
<td>(n = 15)</td>
<td>(n = 3)</td>
<td>(n = 14)</td>
<td>(n = 2)</td>
</tr>
<tr>
<td>Age (yrs) (mean ± SD)</td>
<td>73.2 ± 5.2</td>
<td>77.6 ± 4.4</td>
<td>76.8 ± 10.0*</td>
<td>79.0 ± 1.0*</td>
</tr>
<tr>
<td>Medications (mean ± SD)</td>
<td>3.0 ± 1.3</td>
<td>5.0 ± 1.0</td>
<td>3.1 ± 1.1</td>
<td>6.6 ± 0.7</td>
</tr>
<tr>
<td>Hypertension (n) (%)</td>
<td>7 (46)</td>
<td>2 (66)</td>
<td>7 (50)</td>
<td>2 (100)</td>
</tr>
<tr>
<td>Heart disease (n) (%)</td>
<td>5 (33)</td>
<td>1 (33)</td>
<td>5 (35)</td>
<td>0</td>
</tr>
<tr>
<td>Diabetes (n) (%)</td>
<td>2 (13)</td>
<td>1 (33)</td>
<td>2 (14)</td>
<td>0</td>
</tr>
<tr>
<td>Arthritis (n) (%)</td>
<td>2 (13)</td>
<td>1 (33)</td>
<td>3 (21)</td>
<td>1 (50)</td>
</tr>
<tr>
<td>Male (n) (%)</td>
<td>4 (26)</td>
<td>1 (33)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>House-residing (n) (%)</td>
<td>11 (73)</td>
<td>3 (100)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Apartment-residing (n) (%)</td>
<td>4 (27)</td>
<td>0</td>
<td>14 (100)</td>
<td>2 (100)</td>
</tr>
<tr>
<td>Walking assistance (n) (%)</td>
<td>0</td>
<td>1 (33)</td>
<td>2 (14)</td>
<td>0</td>
</tr>
</tbody>
</table>

*Note: PAGH+ received the *Physical Activity Guide Handbook* + behaviour change program; PAGH received the *Physical Activity Guide Handbook*.  
*Significant difference between groups: PAGH+ participants vs. PAGH participants; PAGH+ participants vs. PAGH dropouts, \(t\)-test, \(p < 0.05\).
Energy expended in work activities increased by 36% in the PAGH+ group, but decreased by 5% in the PAGH group, representing a significantly different response between groups over time, $p < 0.05$. Energy expended in exercise activities increased by 145% in the PAGH+ group and by 92% in the PAGH group; these changes were significant over time in both groups. Energy expended during recreational activities also increased significantly in both groups during the 8-week study, $p < 0.05$.

In the work category, activities with the greatest increases in participation were housework, cooking, shopping, and climbing stairs. Increased participation in these activities was reported by 80%, 60%, 53%, and 40% of PAGH+ group members, respectively, as compared to 20%, 30%, 28%, and 0% of PAGH group members. Both groups reported increased participation in various exercise and recreational activities, with some differences between groups. Stretching was the exercise activity with the most increased participation, reported by 73% of PAGH+ and 71% of PAGH group members. Members of the PAGH+ group, with access to the community centre, were more likely to increase their participation in aerobic classes, or to use the treadmill or bicycle ergometer. The recreational activity with the greatest increase in participation was leisurely walking, reported by 93% of PAGH+ and 71% of PAGH group members.

### Table 3 Functional Fitness Before and After the 8-Week Study (mean ± SD)

<table>
<thead>
<tr>
<th></th>
<th>PAGH+ Group ($n = 15$)</th>
<th>PAGH Group ($n = 14$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Lower body strength (# rep)*†</td>
<td>11.3</td>
<td>14.5</td>
</tr>
<tr>
<td></td>
<td>±2.9</td>
<td>±3.2</td>
</tr>
<tr>
<td>Lower body flexibility (cm)†</td>
<td>−1.3</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>±3.0</td>
<td>±2.9</td>
</tr>
<tr>
<td>Agility/Balance (sec)*†</td>
<td>6.7</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>±1.1</td>
<td>±1.2</td>
</tr>
</tbody>
</table>

*Significant difference between groups at pre- and posttest, $p < 0.05$; †Significant change within both groups over time, $p < 0.05$.

EFFECT OF USING THE PAGH

Response to the PAGH was favourable in both groups (Table 4). Although members of the PAGH+ group reported being more likely to use the handbook to manage their daily activity, or to seek additional information about physical activity, compared to members of the PAGH group, these differences were not significant, $\chi^2$, $p < 0.09$. Members of the behaviour-change group were significantly more likely to report that others had gained since they had used the guide.
Figure 1. Estimated total energy expenditure and energy expenditure in 3 classes of activities (Kcal/day) before and after the 8-week study (mean ± SD). Significant difference: *Between groups at Week 8; †Within groups over time (both p < 0.05). #Significant Group × Time interaction effect, p < 0.05.
Discussion

Introduction of the PAGH for Older Adults to community residing seniors resulted in many changes that could ultimately improve their health and quality of life. Functional fitness including lower body strength/endurance, flexibility, and agility/balance were improved, whether the PAGH was introduced alone or in conjunction with a behaviour-change program. Estimated daily energy expenditure also increased, and the addition of an 8-week behavior-change program led to a significantly greater increase, primarily due to increased work activities. The finding of improvements with the use of the PAGH alone is important, as this suggests that its distribution will help motivate sedentary older adults to become more active. Our data suggest that the provision of behaviour-change programs or lifestyle counseling, together with the PAGH, may be even more effective.

Our findings agree with those of others who have demonstrated that regular moderate, or lifestyle, physical activity is positively related to physical performance and functional mobility in older adults (Kaplan et al., 1993; Seeman et al., 1995; Tudor-Locke et al., 2000). Performance on the chair-stand test increased by
25% in the PAGH and 28% in the PAGH+ during the 8-week study. We used this test to monitor muscular strength and endurance, two fitness components that are emphasized in the PAGH. Performance on sit-to-stand tests is influenced by a number of factors associated with lower body strength, power, balance, and mobility (Hruda et al., 2003). These factors include lower limb proprioception, tactile sensitivity, visual contrast sensitivity, anxiety, vitality, and pain (Lord et al., 2002).

These factors may explain some of the difference between groups in our study at baseline, along with the presence of 4 men in the PAGH+ group. Changes in strength and endurance likely account for a significant proportion of the intervention response. Hruda et al. (2003) reported a 66% improvement in the same test in frail adults after a 10-week program of simple resistance exercises. The smaller response in our study may be due to the less structured exercise program, as well as to the higher functional capacity of our subjects. The lack of change in chair-stand test performance from pre- to posttest in the control group in Hruda’s study reinforces our conclusion that our PAGH group demonstrated a true increase in response to the PAGH, and not simply a learning effect. Participants in both studies performed the 30-s test only once at each trial.

Leg weakness is an important risk factor for loss of function in tasks related to walking speed and balance (Gehlsen and Whaley, 1990). Because of our interest in the relationship of fitness to function, we used the 8-foot up-and-go test to evaluate dynamic balance. Both groups improved their performance on this test, as they also did for the strength and endurance measure, a finding that is in accord with the belief that lower-body strength training improves walking speed (Schlicht et al., 2001). Previous studies have shown improvement in balance related tests in older community-living adults after participation in a variety of activities such as walking, dancing, resistance exercise, Tai chi, and strengthening exercise (Jarnlo, 1991; Judge et al., 1993). The magnitude of improvement in this study, 15% in the PAGH+ group and 8% in the PAGH group, compares with improvements of 31% in frail adults after a simple strength training intervention (Hruda et al., 2003) and suggests that lifestyle physical activity also provides a stimulus sufficient to elicit improvement in functional mobility in community-dwelling older adults.

The significant increase of flexibility in both groups, as measured using the chair sit-and-reach test, suggests there was little additional benefit from the behaviour-change program. Although participants were given practice trials, and the flexibility and agility/dynamic balance scores were taken from the best or average of two trials, the effects of learning on the functional tests scores cannot be entirely discounted.

Estimated total daily energy expenditure increased in both groups in the present study. However, a significantly greater increase in the PAGH+ group indicates that a behaviour-change program may be more effective than exposure to the *Physical Activity Guide Handbook* alone. Energy expenditure in the individual activity categories—work, exercise, recreational activity—increased to a different extent in each group. Although some members of both groups individually reported increased time on “work” related tasks, the average energy expended in this type of activity increased significantly only in the PAGH+ group, suggesting greater lifestyle change through daily living tasks in this group. Members of both groups increased energy expended in “exercise” and “recreational activities” during the
course of the study. These findings indicate that the addition of the behaviour modification program to the PAGH improved the ability of participants to incorporate a wide variety of physical activities into daily life.

Responses to the Physical Activity Guide Survey were positive for both groups. The majority stated that they received significant motivation from the Physical Activity Guide Handbook. That most participants reported the PAGH to be a good information source suggests they had already established a belief in the benefits of an active lifestyle, known to act as a positive influence on health behaviour change (Marcus et al., 1996). It could be expected that the sedentary subjects in both groups held positive beliefs about physical activity, as all were volunteers for a physical activity study. Most participants attempted to seek additional information sources and guidance about physical activity, which is further evidence of the successful motivating effect of the PAGH in both groups. Although members of both groups stated that they had increased their physical activity level as a result of receiving the PAGH, those in the behaviour-change program were more likely to use the daily physical activity log.

Participants in this study were all independent, community residing individuals. Members of both groups were sedentary at the start of the study, with similar average estimated physical activity energy expenditures of 3,900 kcal/week (YPAS). This is greater than the 2,313 kcal/week, also estimated by the YPAS, reported for older adults living in retirement homes, but less than the 8,125 kcal/week expended by those attending community centres (Harada et al., 2001).

The wider age range in the PAGH group (55–91 yrs) as compared to the PAGH+ group (67–82 yrs) likely resulted from self-selection of participants and the decision to limit the behaviour-change program to members of a community seniors’ center. Illness and health status also influenced participation, perhaps to a greater degree than age, as illustrated by comparing those who completed the study with those who dropped out. In addition, only 5% of initial volunteers from the seniors’ centre were screened out, as compared to 35% of volunteers from the apartment complexes. Differences in type of residence may also explain the differences in activity choices between the two groups. Gender may also have affected the results, as one-quarter of the PAGH+ group were men while all of the PAGH group were women. As social support is more significantly associated with physical activity levels in women than in men (Kaplan et al., 2001), the absence of weekly meetings may have had an especially large impact on the latter group. Unfortunately, we do not have data related to ethnicity, education, income, marital status, or smoking status, additional factors which could have differentially affected the two groups.

Functional fitness differences between groups at baseline may relate to house vs. apartment residence, as well as to differences in age, gender, and health status. However, age was not significantly correlated with any of the functional fitness measures or energy expenditure at baseline, nor with any of the change scores. Lower body strength and agility/balance were significantly higher in the PAGH+ group at baseline; however, changes in these parameters were not significantly related to age or initial values. The presence of four men in the PAGH+ group explains the higher initial strength, as their mean score was 13.3 repetitions, as compared to 10.6 and 7.9 repetitions for the women in the PAGH+ and PAGH
groups, respectively. In view of these findings, we believe that although statistically significant, the 3-year average age difference between groups was not a major confounding factor. Although it is likely that the two groups differed in many demographic, cultural, psychosocial, and health parameters not measured, such interpretation is beyond the scope of this study.

The short duration of the intervention may have contributed to the positive impact of using the PAGH. Although participation rates of older adults in group-based and home-based physical activity programs are high in the short term, they decline when programs continue beyond 1 year (van der Bij et al., 2002). It is possible that participants in this study may have discontinued using the PAGH if the study had continued beyond 8 weeks.

In conclusion, adoption of the PAGH, whether alone or in conjunction with a behaviour-change program, promoted increased physical activity in community-residing seniors and led to functional and health related benefits. The behaviour-change program led to significantly greater increases of total estimated energy expenditure, due primarily to increases in physical activity categorized as work (i.e., tasks of daily living). The community-based nature of this study necessitated the use of existing subject groups, recruited from senior apartment complexes or a community centre. Future studies would benefit by using a randomized design, blinded observers/testers, and including a control group that does not receive the PAGH. Follow-up evaluation of participant adherence over the long term would also provide useful information.

Acknowledgments

This study was supported by a Graduate Student/Faculty Member Collaborative Grant from the Centre on Aging at the University of Manitoba. We would like to thank Karen Pirnie, Executive Director of the St. James-Assiniboia Senior Centre, and Laurie Green, public health nurse in St. James Assiniboia, for their support.

References


Wheeler, G.D. (2000, Oct.). Oh Canada, are we fit (or healthy) enough to stand on guard for thee . . . in 2003? Presented at Canadian Society for Exercise Physiology Conference, Canmore, AB.


Received August 11, 2003; accepted in final form February 5, 2004.