Attitudinal, Perceptual, and Normative Beliefs Influencing the Exercise Decisions of Community-Dwelling Physically Frail Seniors

Kathleen Benjamin, Nancy C. Edwards, and Virendra K. Bharti

For seniors, an inactive lifestyle can result in declines in mental and physical functioning, loss of independence, and poorer quality of life. This cross-sectional descriptive study examined theory-of-planned-behavior, health-status, and sociodemographic predictors on exercise intention and behavior among 109 older and physically frail adults. Significant predictors of being a high versus a low active were a strong intention to continue exercising, positive indirect attitudes about exercise, and having been advised by a doctor to exercise. Findings indicate that a strong intention to continue exercising differentiates between those who report low levels and those who report high levels of physical activity. The results also highlight the salience of physician’s advice for seniors to exercise.

Key Words: theory of planned behavior, perceived behavioral control, theory of reasoned action, motivation to comply

Nearly two thirds of Canadians are not active enough to achieve any real health benefits from physical activity (Craig, Russell, Cameron, & Beaulieu, 1999). The proportion of physically inactive people increases with age. Among adults 65 years and older, 67% of women and 55% of men are inactive (Canadian Fitness and Lifestyle Research Institute, 2001). For seniors, an inactive lifestyle can result in declines in mental and physical functioning and loss of independence. These, in turn, might contribute to an increase in the rate of falls, frailty, and an increase in health-care costs (Gillespie et al., 2003; Strawbridge, Shema, Balfour, Higby, & Kaplan, 1998).

The theory of planned behavior (TPB), which is an extension of the theory of reasoned action, proposes that more positive attitudes, greater perceived social pressure, and greater behavioral control will lead to stronger intentions to perform a given behavior (Ajzen, 1988, 1991). The TPB extends the theory of reasoned action by adding the concept of perceived behavioral control (PBC) to account for behaviors that are not under a person’s complete volitional control (Ajzen, 1988, 1991; Ajzen & Fishbein, 1980). Attitudes are favorable or unfavorable evaluations...
associated with behavior. They are assumed to be a function of one’s beliefs about
the behavior, weighted by evaluations of the importance of the beliefs. Subjective
norms (SN) refer to the perceived social pressure to perform or not to perform a
given behavior. They are assumed to be a function of one’s belief that significant
others would either approve or disapprove of the behavior, weighted by the person’s
motivation to comply with these referents. PBC beliefs refer to the perceived ease or
difficulty associated with the behavior. They are assumed to be a function of one’s
beliefs about the resources or opportunities, weighted by the perceived power of
each factor, that either facilitate or inhibit the behavior. PBC can influence behavior
directly or indirectly through modifications of intentions (Ajzen, 1988, 1991).

In past research, attitudes, SN, and PBC have been measured in two distinct
ways (i.e., indirect and direct measures; Brenes, Strube, & Storandt, 1998). Direct
measures capture one’s global-based beliefs about the target behavior, and the
indirect measures capture one’s belief-based beliefs. Although some authors have
reported no difference in the predictive power of the indirect versus the direct
measures (e.g., Ajzen & Madden, 1986; Dzewaltowski, Noble, & Shaw, 1990),
Brenes and colleagues (1998) found indirect measures of SN and PBC to be more
predictive of exercise behavior at 1 month than direct measures were. Indirect
measures might be particularly valuable for researchers interested in identifying
specific beliefs that are amenable to change (Brenes et al.).

The combined effect of attitudes, SN, and PBC accounts for an average 39%
of the explained variance in intentions and an average 32% in the explained variance
in behavior (Armitage & Conner, 2001; Godin & Kok, 1996; Hagger, Chatzisarant-
is, & Biddle, 2002). Attitudes and PBC tend to be the most significant predictors
of intentions to exercise, whereas SN is a weaker predictor. The weaker influence
of SN might be related to difficulties in the operationalization of the construct
(Godin & Kok) or to the possibility that social influences might be most influential
in exercise adherence as opposed to exercise initiation (Michels & Kugler, 1998).
The most significant predictor of exercise behavior is intentions. About one third
of the variance in behavior can be explained by the combined effect of intentions
and PBC (Godin & Kok).

Most applications of the TPB to the exercise domain have included samples
of young and relatively healthy subjects. Applications of the TPB in adults 65
years of age and over are limited (Brenes et al., 1998; Conn, 1998; Conn, Libbus,
Thompson, & Kelly, 1994; Conn, Tripp-Reimer, & Maas, 2003; Courneya, 1995;
Michels & Kugler, 1998).

Michels & Kugler’s (1998) study of 483 military beneficiaries age 65–70
years supported the efficacy of the TPB constructs in predicting exercise intentions
in older adults. This study also emphasized physicians’ role in promoting exercise
in older adults. Participants who exercised regularly were more likely to report
that their doctor recommended exercise for them (p < .01) than those who did not
exercise regularly.

In a study (Courneya, 1995) of 288 adults age 60 years and over, path analysis
indicated that intention, attitude, and PBC had a direct relationship with stages
of readiness for physical activity. In a study of 225 women 65 years and older, attitudes, SN, and PBC were significant predictors of intention, and PBC and attitudes were significant predictors of behavior (Conn et al., 2003). The authors suggested that future research should consider the concept of social companion-ship for exercise.

In a longitudinal study (Brenes et al., 1998) of 105 adults age 53–84 years recruited from YMCAs, intentions did not significantly predict exercise behavior at 1, 3, and 9 months. This finding probably resulted from the lack of variance in the intentions among this sample: Most intended to exercise (Brenes et al.). Direct measures of attitudes, SN, and PBC predicted 9% of exercise behavior at 1 month, but at 1 month, only the direct measures of PBC made a significant independent contribution. These direct measures did not predict exercise behavior at 3 and 9 months. Indirect measures of SN and PBC predicted 18% and 27% of exercise behavior, respectively, at 1 month. At 3 months, indirect measures of PBC predicted 10% of exercise behavior. These indirect measures did not predict exercise behavior at 9 months, however.

A few qualitative studies have attempted to describe other salient influences on exercise behavior. For example, in an analysis of qualitative interviews with 30 older women regarding overall physical activity, Conn (1998) identified three major factors affecting physical activity decisions. These were social influences, perceived psychosocial benefits of activity, and joint problems and fatigue. Conn also reported that these women talked about physical activity as being embedded in their social lives. This is in contrast to an earlier study (Conn et al., 1994) of older women engaged in episodic exercise in which women described exercise as separate from their daily lives.

In summary, the TPB appears to be a useful theory for predicting exercise behavior, but only a few authors have applied the TPB to exercise behavior among samples of older adults. Furthermore, most of these studies have used relatively healthy and functionally independent samples of older adults. Frail seniors typically have greater disability and medical complexity, which can influence their exercise beliefs and their patterns of exercise. With an aging population and an imperative to maintain and enhance the functional independence of seniors, a better understanding of the determinants of exercise among frail seniors is essential. Thus, the objective of this cross-sectional descriptive study was to examine TPB, health-status, and sociodemographic predictors of exercise intention and behavior among older, physically frail adults.

Methods

PARTICIPANTS AND PROCEDURES

A convenience sample of 109 physically frail seniors was recruited from a variety of senior health-promotion programs and community programs in the Ottawa–Carleton region in Ontario, Canada. These programs were home care, day programs at two
long-term care facilities, a day hospital program, three retirement residences, two seniors’ walking programs, and one women’s church organization. Seniors recruited from the home-care program were interviewed in their homes, and the other seniors were interviewed at the site where they were recruited. Seniors eligible to participate were 65 years of age or older, living in the community, English speaking, cognitively intact, and physically frail.

To assess eligibility, two screening tools were used: the Physical Self-Maintenance Scale (PSMS) and the Short Portable Mental Status Questionnaire (SPMSQ). The PSMS was developed as a disability measure for use among community-dwelling and institutionalized adults 60 years and older. The original PSMS included items on both activities of daily living (ADL) and instrumental ADL (IADL; Lawton & Brody, 1969). Items of the PSMS have been incorporated into subsequent instruments such as the OARS: Multidimensional Functional Assessment (McDowell & Newell, 1996). The PSMS correlated with physicians’ ratings of functional health \( r = .62 \) and with an IADL scale \( r = .61 \); Lawton & Brody). A Pearson correlation of .87 was obtained for pairs of nurses rating 36 patients, and a correlation of .91 was obtained for research assistants who independently rated 14 patients (Lawton & Brody). Two types of scoring methods can be used (McDowell & Newell). For this study, those scoring between 8 and 20 were considered eligible. Thus, very independent seniors and severely disabled seniors were excluded.

The SPMSQ was used to screen for cognitive impairment. It is a brief screening tool consisting of 10 questions that has been extensively used in both community and institutional settings. Incorrect answers were assigned a score of 1. A score of 0–2 errors indicates intact intellectual functioning (Pfeiffer, 1975). Thus, a score of 0–2 qualified seniors for inclusion in this study.

Ethical approval was obtained from the Research and Ethics Committee at the University of Ottawa. Data were collected in face-to-face interviews by the lead author (K.B.) using a structured questionnaire.

MEASURES

The exercise questionnaire included questions on health, sociodemographics, and physical activity and scales to measure the TPB constructs. A pool of potential TPB items was drawn up by the lead author (K.B.) from previous empirical and theoretical literature, as well as from discussions with seniors, clinicians, and researchers. The initial pool of 35 TPB items was evaluated for face and content validity by a panel of nine researchers and clinicians with expertise in fall prevention, gerontology, statistics, and kinesiology. All items were retained. TPB items were then pilot tested with a sample of 10 participants. Revisions after the pilot testing consisted of some minor rewording and the elimination of one TPB item that participants felt was not relevant (i.e., “Lack of time would discourage me from exercising”). Figure 1 provides a list of items used to measure the constructs of the TPB. A summary of the TPB constructs follows.
Figure 1. List of items used to measure the components of the theory of planned behavior.

**Attitudes**

Indirect attitudes
- Exercising would make my muscles and bones stronger.
- Exercising would make me feel too tired.
- Exercising would reduce the risk of falling.
- Exercising would give me more energy.
- Exercising would help me meet people.
- Exercising would help me think more clearly.
- Exercising would help me to enjoy life more.
- Exercising would make me feel more relaxed.
- Exercising would help me maintain my independence.
- Exercising would keep my joints flexible.
- Exercising would be painful.
- Exercising would reduce my aches and pains.

Direct attitudes
- Exercising would be inconvenient.

**Subjective Norms**

Indirect normative beliefs
- Most members of my family think I should exercise.
- Most of my friends think I should exercise.
- My doctor thinks that I should exercise.
- Other health care workers (e.g.: my therapist, my nurse, etc.) think I should exercise.

Direct normative beliefs
- Most people who are important to me think I should exercise.

**Motivation to comply**

- Generally speaking, to what extent do you want to do what your family thinks you should do?
- Generally speaking, to what extent do you want to do what your friends think you should do?
- Generally speaking, to what extent do you want to do what your doctor thinks you should do?
- Generally speaking to what extent do you do what other health care workers (other than your doctor) think you should do?

**Perceived Behavioral Control**

Indirect control beliefs
- Not knowing how to exercise would discourage me from exercising.
- The cost of an exercise class would discourage me from exercising.
- Fatigue would discourage me from exercising.
- My health problems would discourage me from exercising.
- Lack of transportation would discourage me from exercising.
- Lack of someone to exercise with would discourage me from exercising.
- Lack of motivation would discourage me from exercising.
- Lack of support would discourage me from exercising.
- At my age, it is hard to get interested in doing regular exercise.

Direct control beliefs
- If I wanted to, I could easily exercise.

**Intentions**

- I intend to continue exercising within the next month.
Attitudes. Twelve items measured participants’ indirect attitudes, and one item measured their direct attitudes. The 12 indirect-attitude items measured participants’ beliefs about the advantages and disadvantages of exercising. Typically, direct-attitude items would consist of general questions assessing participants’ global beliefs toward exercise (e.g., How positive or negative do you feel toward engaging in exercise?). In this study, however, direct attitude was measured with the item “Exercising would be inconvenient.” This item emerged from interviews with seniors and was relevant for the sample. It was hoped that this item would elicit an experientially based view of exercise as opposed to a more belief-based view of the advantages and disadvantages of exercise. The 13 attitude items were scored on a five-point Likert scale (very unlikely, unlikely, neither, likely, or very likely).

The outcome-evaluation scale was omitted from the questionnaire. This decision was based on the work of others who have reported difficulties with this scale (e.g., high response latency and high number of “don’t know” responses; Aminzadeh, 1997; Mullen, Hersey, & Iverson, 1987; Young, Lierman, Powell-Cope, Kasprzyk, & Benoliel, 1991). Typically, the overall attitude score is computed as follows: \[ \sum = (a_1 \times e_1) + (a_2 \times e_2) + \ldots + (a_{13} \times e_{13}). \] Because the evaluative component was not included, however, we averaged the 12 indirect-attitude items. A single item assessed direct attitude.

Subjective Norms. Four items measured participants’ indirect normative beliefs that family members, friends, and health-care workers would want them to exercise, and one item measured their direct normative beliefs. These five items were scored on a five-point Likert scale (very unlikely, unlikely, neither, likely, or very likely). Participants’ corresponding motivations to comply with the recommendations made by these referents were measured with four items. A unipolar scale was used to score participants’ motivation to comply (very little, a little, somewhat, a lot, or a great deal). Because we did not include a corresponding item for motivation to comply for the direct-attitude item, we computed a total SN score for only the indirect SN items: \[ (\text{ISN}_1 \times \text{MC}_2) + \ldots + (\text{ISN}_4 \times \text{MC}_4). \] The one item measuring direct SN was entered as a separate variable.

PBC. Nine items measured participants’ indirect control beliefs with respect to specific difficulties involved in exercising, and one item measured their direct control beliefs. Typically, the indirect measurement of PBC consists of items assessing the strength of the participants’ control beliefs (e.g., Lack of an exercise partner would discourage me from exercising) followed by items assessing the power of these factors to influence behavior (e.g., When I do not have an exercise partner, I am less likely to exercise). Control-beliefs scores are multiplied by the power scores, and these products are summed to give a total PBC score. In this study, however, specific items assessing perceived power of each factor were not included in an effort to minimize the response burden for this frail population. The 10 PBC items were scored on a five-point Likert scale (very unlikely, unlikely, neither, likely, or very likely). The PBC (indirect) score was obtained by averaging the nine indirect items. There was a single item for direct PBC.
OTHER PREDICTORS

Sociodemographics. To increase comparability, questions on age, gender, marital status, living arrangements, mother tongue, education, and income were collected using standard questions from Canadian health surveys.

Health, Activity, Pain Status, and Advice to Exercise. One item asked participants to compare their health with that of their peers (response options were excellent, very good, good, fair, or poor). One item asked participants to compare their level of activity to their peers (response options were a lot more active, a little more active, about the same, a little less active, or a lot less active). Another item asked participants if pain prevented their activities (response options were free of pain or pain that does not prevent any activities, pain that prevents a few activities, pain that prevents some activities, and pain that prevents most activities). These three items were extracted from the OARS: Multidimensional Functional Assessment (Duke University Centre for the Study of Aging and Human Development, 1978) and other Canadian health surveys (Ministry of Health of Ontario, 1988). Participants were asked if they had been advised to exercise (yes or no) and, if yes, who advised them to exercise (doctor, nurse, physiotherapist, chiropractor, home-care worker, or other).

OUTCOMES

Intention. One item measured participants’ intentions to continue exercising within the next month. This item was scored on a five-point Likert scale (very unlikely, unlikely, neither, likely, or very likely).

Exercise Behavior. Exercise was defined as any physical activity performed for the purposes of improving or maintaining health or fitness. Questions to determine exercise type, frequency, and duration were extracted from the Ontario Health Survey (Ministry of Health of Ontario, 1988). Modifications made to this tool were as follows: Some activities were deleted (e.g., squash) and replaced with activities more common for frail seniors (e.g., chair exercise), participants were asked about recent exercise (i.e., within the past week rather than past month), and five response options for exercise intensity were added. Because all but 1 participant in this study reported doing some type of exercise, the investigator developed the total exercise score (TES), which permitted classification of participants as either “low” or “high” actives. Health Canada’s (1999) Physical Activity Guide to Healthy Active Living for Older Adults and other literature guided the development of this scoring method (King, Rejeski, David, & Bucher, 1998; U.S. Department of Health and Human Services, 1996). This score was a composite of the frequency, intensity, and duration of each reported exercise. Participants were asked how often they performed each type of exercise during the week. For exercise intensity, five options were provided (very light, light, somewhat moderate, moderate, or vigorous). Exercises performed at a somewhat moderate
to vigorous intensity were assigned a value of 1, and exercises performed at a very light to light intensity were assigned a value of zero. Participants were provided with four options for exercise duration (1–15 min, 16–30 min, 31–60 min, or >60 min). In calculating the TES, the investigator assigned an average numerical value of 8, 23, 46, or >60 min for each category.

Health Canada’s (1999) *Physical Activity Guide to Healthy Active Living for Older Adults* recommends that seniors accumulate 30–60 min of at least moderate activity most days of the week. Using 5 days per week as a reference point, this would equate to 150–300 min of at least moderate-intensity exercise per week. Therefore, for this group of physically frail seniors, the cut point of 150 min per week was used to classify respondents as either high actives or low actives. The TES represented the sum of the cross-products of the frequency, intensity, and duration for each type of exercise. Thus, participants who obtained a TES of 150 or less were classified as low actives, and those with a TES of 151 or higher were classified as high actives.

**DATA ANALYSES**

Data were analyzed using SAS 8.02 and SPSS 11.5.0. The internal reliability of all scales measuring TBP constructs was assessed using Cronbach’s alpha. Descriptive statistics were used to examine frequency distributions of all variables. Bivariate analysis (Pearson’s chi-square) was undertaken to examine relationships between predictor and outcome variables. Collinearity among predictors was assessed. Variables with a $p$ value of .25 or less on bivariate analysis were included in initial logistic-regression models. Categories were collapsed to remove singularities or zero cells. Standardized mean scores for predictors were categorized either as quartiles (indirect attitude, indirect SN, motivation to comply) or based on the shape of the LOWESS smoothed plot (PBC). A smooth plot was also applied to verify best categories for the age variable. This procedure justified the categories as 65–74, 75–84, and >84 years. The effect size was calculated for each predictor based on actual data observed (continuous or categorical).

Multivariate hierarchical logistic modeling proceeded as follows. Sociodemographic and health-related variables (gender, pain status, and advice to exercise) were initially entered. Those that were significant ($p < .05$) were retained during the second step of hierarchical modeling when the TPB predictors were entered. A step-by-step approach was used to drop nonsignificant ($p > .05$) variables from the model. The Wald statistic was examined and the estimated coefficients compared with the previous model to check the importance of excluded variables. The likelihood-ratio test was used to compare models. Two-way interaction terms (interactions between significant TPB predictors with pain and age category) were then tested and found to be nonsignificant. The goodness of fit of the model was assessed using Hosmer and Lemeshow’s goodness-of-fit test.
Results

SAMPLE CHARACTERISTICS

A typical participant was female, 80 years of age, and widowed; lived alone; had a high school education; was dependent in at least one activity of daily living; and reported good health and having pain that prevented a few to most of their activities. Most participants (87.2%) obtained scores from 8 to 11 on the PSMS (the screening tool for physical frailty). If one views frailty as occurring along a continuum (i.e., low to high degree of frailty), then most of this sample would be at the lower end of the continuum. About 17% of participants reported being free of pain, 24.8% indicated that pain did not prevent any of their activities, and the remainder reported that pain prevented a few (23.9%), some (23.9%), or most (11.0%) activities.

All but 1 participant reported doing some type of physical activity, with walking being the most common type. Based on the TES, 59 participants were classified as low actives and 50 participants were classified as high actives. In the low-active group, the TES ranged from 0 to 150 min/week \( (M = 69.9, SD = 52.5) \). In the high-active group, the TES ranged from 152 to 896 min/week \( (M = 277.1, SD = 133.0) \). For the total sample \( (N = 109) \), the TES ranged from 0 to 896 min/week \( (M = 164.9, SD = 52.5) \).

On bivariate analysis, (see Table 1) high actives were more likely to be male \( (p = 0.03) \), to have received advice to exercise from their physician \( (p = 0.006) \), to have pain that prevented a few or some of their activities \( (p = 0.02) \), to have very positive attitudes toward exercise (indirect measures of attitude; \( p = 0.05 \)), to perceive greater social pressure to exercise (direct measure of SN; \( p = 0.03 \)), to have greater control beliefs (indirect measure of PBC; \( p = 0.027 \)), and to express stronger intentions to continue exercising \( (p = 0.005) \).

EXERCISE BEHAVIORS

The most common exercises reported by participants were indoor walking (78.0%), light housework (65.1%), and chair exercises performed in a formal class setting (45.9%). Most participants who walked for exercise reported walking for 1–15 min per session and perceived this exercise to be moderate in intensity. Fewer participants engaged in weight training at home (11.9%) or in an exercise class (6.4%), swimming (4.6%), gardening (9%), or heavy housework (9%). Compared with low actives, more high actives did chair exercises \( (p = 0.025) \), used weights \( (p = 0.017) \), and climbed stairs at home for exercise \( (p = 0.008) \).

EFFECT SIZE

The effect size of the TPB constructs is presented in Table 2. The largest effect size, 68.3%, was obtained for intentions to continue exercising. This indicates that the intentions to continue exercising of the average person in the high-active group exceeded the intentions to continue exercising of the low-active group.
Table 1  Results of the Bivariate Analysis (N = 109)

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<th>Category</th>
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<th>High active (n)</th>
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<td>Quartile 2</td>
<td>16</td>
<td>10</td>
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<td>Quartile 3</td>
<td>18</td>
<td>16</td>
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<td>Quartile 4</td>
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</tbody>
</table>

(continued)
Table 1 (continued)

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Category</th>
<th>Low active (n)</th>
<th>High active (n)</th>
<th>(\chi^2)</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory-of-planned-behavior construct subjective norms (direct)</td>
<td>very unlikely/unlikely</td>
<td>17</td>
<td>5</td>
<td>8.92</td>
<td>3</td>
<td>.03</td>
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<tr>
<td></td>
<td>neither</td>
<td>5</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>likely</td>
<td>33</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>very likely</td>
<td>4</td>
<td>10</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>PBC (indirect)</td>
<td>(\leq 2.7)</td>
<td>16</td>
<td>26</td>
<td>7.25</td>
<td>2</td>
<td>.027</td>
</tr>
<tr>
<td></td>
<td>2.7-3.2</td>
<td>16</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(&gt;3.2)</td>
<td>27</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBC (direct)</td>
<td>very unlikely/unlikely</td>
<td>17</td>
<td>13</td>
<td>1.62</td>
<td>2</td>
<td>.444</td>
</tr>
<tr>
<td></td>
<td>likely</td>
<td>39</td>
<td>31</td>
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<td>6</td>
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<tr>
<td>Intentions</td>
<td>unlikely/neither</td>
<td>13</td>
<td>2</td>
<td>10.78</td>
<td>2</td>
<td>.005</td>
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<tr>
<td></td>
<td>likely</td>
<td>36</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>very likely</td>
<td>10</td>
<td>21</td>
<td></td>
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</tr>
</tbody>
</table>

Note: PBC = perceived behavioral control.

*This represents the average of the indirect subjective-norms items (normative beliefs items) multiplied by the corresponding motivation-to-comply items. 

Table 2  Effect Size of the Constructs of the Theory of Planned Behavior on Exercise Behavior

<table>
<thead>
<tr>
<th>Construct</th>
<th>Comparison</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude (indirect)</td>
<td>High active vs. low active</td>
<td>.111</td>
</tr>
<tr>
<td>Attitude (direct)</td>
<td>High active vs. low active</td>
<td>.118</td>
</tr>
<tr>
<td>Subjective norm (total score)</td>
<td>High active vs. low active</td>
<td>.179</td>
</tr>
<tr>
<td>Subjective norm (direct)</td>
<td>High active vs. low active</td>
<td>.463</td>
</tr>
<tr>
<td>Perceived behavioral control (indirect)</td>
<td>Low active vs. high active</td>
<td>.381</td>
</tr>
<tr>
<td>Perceived behavioral control (direct)</td>
<td>High active vs. low active</td>
<td>.133</td>
</tr>
<tr>
<td>Intentions to continue exercising</td>
<td>High active vs. low active</td>
<td>.683</td>
</tr>
</tbody>
</table>
INTERNAL RELIABILITY AND CORRELATIONS

There was adequate to high internal consistency for all of the TPB constructs: attitudes (indirect) = .79 (12 items), SN (indirect) = .77 (four items), SN (motivation to comply) = .70 (four items), and PBC (indirect) = .73 (nine items). A single item was used for direct attitude, direct SN, and direct PBC. Generally, medium to high correlations were found between the direct and indirect measures of the TPB constructs ($r = .23$ to $.79$), and low to medium correlations were found between most of the theory’s variables and intentions to continue exercising ($r = .16$ to $.36$). The strongest correlation was between the direct and indirect measures of subjective norm ($r = .79, p < .01$).

LOGISTIC REGRESSION

Multivariate findings are summarized in Table 3. Significant predictors of being a high versus low active, while controlling for other variables, were a strong intention to continue exercising, positive indirect attitudes about exercise, and having been advised by a doctor to exercise. Those who reported that they were very likely or likely to continue exercising were 5.5 and 12.5 times more likely to be high actives, respectively, than those who were very unlikely, unlikely, or neutral in their response to this question. Those with negative indirect attitudes toward exercising were less likely to be high actives than those with more positive attitudes, although

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Odds ratio</th>
<th>95% confidence limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentions to continue exercising</td>
<td></td>
<td></td>
</tr>
<tr>
<td>very likely to continue</td>
<td>5.46</td>
<td>1.03, 29.04</td>
</tr>
<tr>
<td>likely to continue</td>
<td>12.46</td>
<td>1.88, 82.67</td>
</tr>
<tr>
<td>very unlikely, unlikely or neither likely nor unlikely to continue$^a$</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Indirect attitudes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quartile 1</td>
<td>1.85</td>
<td>0.45, 7.67</td>
</tr>
<tr>
<td>Quartile 2</td>
<td>0.21</td>
<td>0.05, 0.84</td>
</tr>
<tr>
<td>Quartile 3</td>
<td>0.33</td>
<td>0.08, 1.33</td>
</tr>
<tr>
<td>Quartile 4$^b$</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Advised to exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>advised by physician</td>
<td>7.75</td>
<td>2.2, 27.31</td>
</tr>
<tr>
<td>advised by others</td>
<td>1.45</td>
<td>0.45, 4.65</td>
</tr>
<tr>
<td>not advised$^c$</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

$^a,b,c$Reference categories.
results were significant only for those in the second quartile. This is likely because there was much higher variability for the first quartile ($SD = 0.29$, range = 1.25) than for the second quartile ($SD = 0.12$, range = 0.42). Those advised by their physician to exercise were 7.8 times more likely to be in the high-active group than those in the low-active group. Health-status and sociodemographic variables did not meet the criterion for significance and thus were not retained in the final logistic-regression model.

**Discussion**

Several limitations need to be considered when interpreting the data. In this convenience sample, most participants reported doing some form of physical activity. This might be partly related to the settings where participants were recruited. Nearly 40% of the participants were attending formal exercise programs provided at the recruitment sites. These individuals might have already overcome some of the barriers to exercise. Because all exercise measures were based on self-reports, participants might have overestimated the intensity or duration of their exercises. In addition, seniors were asked to describe their exercise behavior during the preceding week. Therefore, we cannot be sure that the factors assessed are predictors of future exercise behavior. Similarly, the assignment of an average estimate for exercise duration might have resulted in an over- or underestimation of the TES and misclassification of some seniors as either low or high actives. Finally, the sample size was adequate for analysis but small, necessitating the collapse of some categories of variables.

The findings are generally consistent with previous research. A strong intention to continue exercising differentiated between those who reported low levels versus high levels of physical activity. Seniors who reported moderately positive attitudes toward exercise were more likely to be high actives. Consistent with other studies (Eakin, Glasgow, & Riley, 2000; Elley, Kerse, Arroll, & Robinson, 2003; Michels & Kagler, 1998; Petrella, Koval, Cunninghame, & Paterson, 2003), findings indicate the salience of physicians’ advice about exercise for seniors.

Sociodemographic and health characteristics and some TPB constructs were not significant predictors of high and low actives in the final multivariate model. There are several possible explanations for this. First, instruments to measure TPB constructs were newly developed for this study. Although items were selected based on empirical and theoretical literature, they might not have been inclusive of items most relevant to physically frail seniors. Alternatively, not all TPB constructs might be relevant for physically frail seniors. Physician advice to exercise is not a measure of subjective norms as defined by the model, but this indirect expression of a norm or expectation by an important referent (physician) was very influential for study participants. It might be that among those who are physically frail, advice from a physician also provides a “safety prescription,” easing a frail senior’s concern that they might fall or otherwise injure themselves while exercising. In future studies, it would be interesting to ask seniors to describe the nature of the advice they
received from their physician and to determine whether or not the advice provided is consistent with the type and level of physical activity chosen by the senior.

It was surprising that perceived behavioral control was not a significant predictor of high and low actives in the final multivariate model. This finding is inconsistent with previous research (Armitage & Conner, 2001; Brenes et al., 1998; Hagger et al., 2002). There are three possible explanations for this. First, as discussed earlier, the total PBC score is typically a composite score obtained by summing the cross-products of the participant’s control beliefs and perceived power of those control. In this study, however, specific items assessing the perceived power of each control belief were not measured. Thus, the PBC measure used in this study is not directly comparable to that used in studies with the composite score. Second, although there were nine items measuring indirect PBC, only one item was used to assess direct PBC. This might not have adequately tapped the direct PBC construct. Third, many of the participants in this convenience sample were recruited from various health-promotion programs in which exercise was promoted. Therefore, some participants might have already overcome barriers to exercise, thereby decreasing the salience of the PBC constructs. In future studies, it would be useful to compare seniors who are and are not engaged in programs such as day care in which exercise might be promoted.

Because fear of falling and falls efficacy differentiate among seniors with varying health status and between fallers and nonfallers (Campbell, Robertson, Gardner, Norton & Bucher, 1999; Cumming, Salkeld, Thomas, & Szonyi, 2000), these might be useful measures to include in future studies of physical activity and seniors. In addition, features of the physical environment that might influence the activity levels of physically frail seniors, such as housing design and the outdoor built environment, require consideration.

Despite growing support for the beneficial effects of strength training for older adults including the frail elderly (Binder et al., 2002; Brown et al., 2000; Connelly, 2000; Fiatarone et al., 1990; Gill et al., 2003; Jette et al., 1999), the typical exercise class attended by participants in this sample consisted of seated range-of-motion exercises. Unfortunately, this type of chair exercise might not prevent declines in lower body strength, balance, or mobility (Lazowski et al., 1999). In Canada, it is estimated that over 85% of seniors have at least one physician visit each year (Lindsay, 1999). This encounter offers an important opportunity for physicians to actively encourage seniors to engage in physical activity, but physicians and other health-care providers need to advise seniors to engage in a level and type of exercise that is likely to provide health benefits.

Similar to findings of other studies (Hirvensalo, Lampinen, & Rantanen, 1998), walking was the most common exercise reported by participants. Walking programs should target not only healthy seniors but also seniors with functional disability. Approaches to promoting physical activity include using existing spaces such as corridors in seniors’ apartment buildings and modifying the built environment by installing safe sidewalks. Those planning exercise programs in the community need to overcome the misconceptions associated with aging and exercise.
For example, social marketing strategies could portray positive images of the types of exercise common among the frail population by profiling positive role models with obvious functional limitations.

Further research with a larger and more representative sample of physically frail seniors is needed to fully explore the influence of sociodemographic, health-status, and TPB constructs on exercise behavior. Longitudinal prospective studies are also needed that follow seniors with progressive or varying degrees of frailty and examine the stability of TPB predictors during periods of physical transition (either declines or improvements in physical function). Physically frail seniors living independently in the community or in residential care facilities should be followed. Finally, the next generation of research on physical activity and physically frail seniors also needs to reflect the emerging evidence demonstrating the influences of the physical, social, and policy environment on exercise choices (Lockett, Willis, & Edwards, in press). Socioecological models would help guide the identification of a broader range of variables that reflect the many potential sources of influence on seniors’ exercise behavior.

Conclusion

The objective of this cross-sectional descriptive study was to examine TPB, health-status, and sociodemographic predictors of exercise intention and behavior among 109 older, physically frail adults. Significant predictors of being a high active were a strong intention to continue exercising, positive attitudes about exercise, and having been advised by a doctor to exercise.

This study expands our knowledge of the determinants of exercise among frail older adults living in the community and helps guide future exercise research. Although the focus of this study was on community-living seniors, the findings have implications for health-care providers in a variety of service-delivery settings.

References


