Predicting the Physical Activity Intention–Behavior Profiles of Adopters and Maintainers Using Three Social Cognition Models

Ryan E. Rhodes, Ph.D. · Ronald C. Plotnikoff, Ph.D. · Kerry S. Courneya, Ph.D.

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Abstract
Background Most of the population have positive intentions to engage in physical activity (PA) but fail to act; thus, the need to understand successful translation of intention into behavior is warranted in order to focus intervention efforts.

Purpose The objective of the study is to examine constructs of the transtheoretical model, theory of planned behavior, and protection motivation theory as predictors of physical activity intention–behavior profiles across 6 months in a Canadian workplace sample.

Methods Employees from three large organizations in the province of Alberta (n=887) completed a baseline survey relating to their demographic and medical background, PA, and social–cognitive constructs. A total of 611 participants completed a second assessment 6 months later.

Results Participants were grouped by five profiles: non-intenders, unsuccessful adopters, successful adopters, unsuccessful maintainers, and successful maintainers. Perceived importance and concern for PA (cognitive processes, instrumental attitude, perceived severity) distinguished nonintenders from the other four profiles, self-management and self-regulation of the behavior (behavioral processes, self-efficacy) distinguished successful adopters from unsuccessful adopters, while control over constraints (cons, perceived control, self-efficacy) were the key discriminators of successful maintainers from unsuccessful maintainers.

Conclusion The results provide useful information for intervention campaigns and demonstrate a need to consider adoption and maintenance profiles.

Keywords Transtheoretical model · Theory of planned behavior · Protection motivation theory · Intention–behavior gap

Introduction
The benefits of regular physical activity (PA), are well-established [1, 2], and most of the population are aware of the considerable psychological and physical health advantages obtained from an active lifestyle and express a general desire to incorporate PA into their lives [2]. Indeed, a recent Canadian survey found that 87% of adults intend to be active; however, only 43% were active according to national guidelines [3]. Thus, closing this intention–behavior “gap” appears a timely pursuit for health promoters.

Most popular theories of human behavior include an intention-type construct, yet the thrust of these models has focused on the antecedents of intention with the assumption that intention itself is the proximal determinant of behavior (e.g., [4–6]). Recently, however, several researchers (e.g., [7–11]) have theorized and provided evidence for both intention formation (i.e., action planning) and intention translation (i.e., action control) phases in behavioral acts. This suggests that additional constructs, specifically behavioral self-regulation processes, may mediate intention–behavior relations. By contrast, recent evidence has shown that intention stability is a reliable moderator of intention–behavior relations [12, 13]. That is, the intention–behavior gap may be a result of some people changing their initial
intentions prior to behavioral enactment. Regardless of the foundation for intention–behavior discordance, the importance of differentiating successful and unsuccessful intention–behavior profiles is obvious in order to create effective behavioral interventions.

Our literature search yielded three studies in the PA domain that have separated the intention–behavior relationship into profiles of behavioral success or failure at time 2 based on initial intentions at time 1 [11, 14, 15]. These studies employed either the theory of reasoned action [14], planned behavior (TPB) [11], or the transtheoretical model (TTM) [15] in an attempt to predict intention–behavior profiles. Two convergent findings were present. First, intention–behavior profiles were asymmetrical, with a significant proportion of the samples falling under nonintenders who did not subsequently perform PA, intenders who were unsuccessful at performing PA, or intenders who were successful in performing PA. The absent cell was for nonintenders who subsequently performed PA. This is similar to the findings with other behaviors [16] and suggests that intention is a necessary, if not sufficient, antecedent of behavioral enactment.

Second, although the studies differ somewhat in terms of constructs employed, outcome expectancies distinguished between nonintenders and intenders, but not between unsuccessful/successful intender profiles [11, 14–15]. Self-efficacy over PA, however, discriminated all three profiles with a linear progression from nonintenders to successful intenders [11, 15] which complements work and theorizing by Schwarzer [7] and Sniehotta et al. [17, 18].

Three unique findings were also present across the studies. Rhodes et al. [11] showed that attitude was able to distinguish among all intention–behavior profiles with a similar progression from nonintenders to successful intenders. Similarly, Rhodes and Plotnikoff [15] found that the behavioral processes of change from the TTM were strong predictors of action control. This complements prior theorizing [10, 19] showing that volitional behavioral strategies may be instrumental in translating intentions into PA behavior. Finally, Rhodes and Plotnikoff [15] extended the intention (time 1)–behavior (time 2) profiles to include past behavioral status and thus delineate between adopters and maintainers of PA (time 2). The results provided evidence that nonintenders are comprised entirely of inactive individuals; therefore, further widening the asymmetry of intention–behavior relations. Also, intention–behavior profiles by adoption and maintenance groupings were reliably distinguished by social cognitive constructs with a linear trajectory from nonintenders to successful maintainers. These results support the theorizing of Rothman et al. [20] who suggest that the antecedents of adoption and maintenance of a behavior differ.

Still, there are some limitations to this work such as undergraduate sampling and short time duration [11]. It seems prudent therefore to evaluate these findings with a more generalizable sample and longitudinal design, and extend the results to evaluate whether the TPB constructs can distinguish between the action control profiles of adopters and maintainers. It is also worthy to employ different models with other, unique constructs beyond TPB and the TTM. Finally, given the current paucity of research on the topic, it is important to replicate both the structure found in Rhodes and Plotnikoff [15] and the predictive capabilities of the constructs.

The purpose of this study therefore, was to evaluate the PA intention–behavior profiles of a workplace sample across 6 months using the constructs of three popular health behavior models: TPB, TTM, and protection motivation theory (PMT). An application of PMT to understanding intention–behavior profiles is novel, and it brings four unique measurement domains beyond prior work with TPB and TTM (i.e., perceived vulnerability, severity, fear, and response efficacy see [5]). Based on prior findings [11, 14–15], we had three hypotheses: First, instrumental attitude (i.e., perceived utility of PA; TPB) and subjective norm (TPB), pros/cons and cognitive processes (TTM), and severity, vulnerability, and fear (PMT) would only differentiate intenders from nonintenders, but not profiles of action control. Second, based on Rhodes and Plotnikoff [18], behavioral processes of change (TTM) would discriminate adopters better than maintainers, affective attitude (i.e., perceived enjoyment of performing PA; TPB) may discriminate action control for maintainers more than adopters, while perceived behavioral control (TPB), self-efficacy (TTM/PMT), and response efficacy (PMT) would differentiate all action control groupings. Finally, the intention–behavior profiles that would emerge from the sample would replicate the findings of Rhodes and Plotnikoff. That is, participants could be grouped into five profiles of nonintenders, unsuccessful adopters, successful adopters, unsuccessful maintainers, and successful maintainers.

Method

This study is a secondary analysis from the Physical Activity Workplace Study (PAWS) which is reported elsewhere [21]. The study sample represents an intervention trial with null main effects, so the entire sample was collapsed for this secondary data analysis.

Participants and Procedures

Employees from three large organizations in the province of Alberta (n=887) completed a baseline survey relating to their demographic and medical background, PA levels, stage of change, and social–cognitive constructs. A total of 616
participants (69% follow-up) completed a second assessment 6 months later. Study participation was voluntary but an incentive in the form of a draw (i.e., a one in ten chance of winning a $25 gift certificate, and personalized study results at the end of the study were included for recruitment purposes.

Instruments

PA was defined as activities performed at a moderate or higher intensity, at least four times per week, and accumulating 30 min per time [22] for the framing of social cognitive variables. Descriptors of PA intensity, type, and how activity could be accumulated were provided similar to Health Canada’s recommendations [22]. Participants were instructed to answer all questions based on this definition of regular physical activity.

TPB Measures

Attitude constructs were measured by a scale with five-point response options [23]. Participants were asked to what extent regular physical activity over the next 6 months will be enjoyable, interesting, relaxing, useful, wise, and beneficial. The first three items assessed affective attitude, and the last three assessed instrumental attitude. Cronbach’s alphas for affective attitude and instrumental attitude were 0.79 and 0.72 respectively. Injunctive and descriptive norm subcomponents were based on recommendations provided by Ajzen [24] and others who have applied this construct in the exercise domain [25, 26]. To assess injunctive norms, participants were asked to rate whether: (1) most people in their social network want them to do regular PA in the next 6 months; (2) most people in their social network would approve if they did regular PA in the next 6 months; (3) their doctor or health care provider wants them to participate in regular PA in the next 6 months; and (4) their doctor or health care provider would approve for them to get regular PA in the next 6 months. To assess descriptive norms, participants were asked whether (1) most of their family members will participate in regular PA; (2) most of their friends participate in regular PA; (3) their spouse/partner participates in regular physical activity; and (4) their co-workers participate in regular physical activity. Cronbach’s alphas for injunctive norm and descriptive norms were both 0.66. Perceived Behavioral Control was assessed using two items [25–27]. Participants were asked, “How much personal control they feel they have over participating in regular physical activity in the next 6 months even if they were really motivated” and “How much they feel that participating in regular physical activity is beyond their control in the next 6 months even if they were really motivated?” with the response options of “absolutely no control” (1) to “complete control” (5). Cronbach’s alpha for this item was 0.73.

TTM Measures

Self-Efficacy was assessed with a nine-item scale [28]. Participants were asked to rate their confidence (1 = not at all confident to 5 = extremely confident) if they could participate in regular PA over the next 6 months when: a little tired, in a bad mood or feeling depressed, doing it by themselves, it became boring, there are no noticeable improvements in fitness, having other demands, feeling stiff or sore, there is bad weather, when a little ill. Cronbach’s alpha for these items was 0.92. Pros & Cons were measured with items from Plotnikoff, Blanchard et al. [29]. Pros were measured by assessing the extent the following items influenced their decision to participate in regular PA over the next 6 months: reduce tension or manage stress; feel more confident about one’s health; sleep better; and have a more positive outlook (1 = not at all to 5 = very much). Cronbach’s alpha for these items was 0.81. Cons were measured by assessing the extent to which the following items influenced their decision to participate in regular PA over the next 6 months: take too much of their time, result in having less time for their family and friends; and make them too tired because of other daily responsibilities. Cronbach’s alpha was 0.74 for these cons items.

Processes of change measures were assessed using a PA Processes of Change Questionnaire (PCQ) validated by Plotnikoff and colleagues based on Marcus and colleagues [28, 30]. Individuals were asked to recall the past month and to rate the frequency of occurrence of each item on five-point scales ranging from 1 (never) to 5 (very often). The behavioral processes measure consisted of 11 items: two items each for counterconditioning, contingency management, self-liberation, and stimulus control, while helping relationships comprised three items. The experiential processes measure contained ten items: two items each for consciousness-raising, dramatic relief, environmental reevaluation, self-reevaluation, and social liberation. Cronbach’s alpha for the behavioral processes and experiential processes were 0.84 and 0.77, respectively.

PMT Measures

PMT’s three-threat constructs Severity, Vulnerability, and Fear were assessed with three items each based on the measures developed by Plotnikoff and colleagues [31, 32] (our measures added the component of diabetes threat). Severity was measured with the following items: “for me, being physically inactive would be a very bad thing,” “for me, having heart disease would be a very bad thing,” and “for me, having diabetes would be a very bad thing,” with a response option of “definitely not” [1] to “definitely yes” [5]. Cronbach’s alpha for this item was 0.71. Vulnerability was assessed with the following three items: “if I don’t get
enough physical activity, I would be at risk for serious health problems,” “if I don’t get enough physical activity, I will be at risk for heart disease (or further heart disease complications),” and “if I don’t get enough physical activity, I will be at risk for diabetes (or further diabetes complications),” with a response option of “definitely not” [1] to “definitely yes” [5]. Cronbach’s alpha for this item was 0.85. Fear was measured with the following three items: “not getting enough physical activity would frighten me because of the possibility of developing serious health problems,” “not getting enough physical activity would frighten me because of the possibility of developing heart disease (or further heart disease complications),” and “not getting enough physical activity would frighten me because of the possibility of developing diabetes (or further diabetes complications),” with a response option of “definitely not” [1] to “definitely yes” [5]. Cronbach’s alpha for this item was 0.91. PMT’s coping constructs included response efficacy and self-efficacy. Response efficacy was measured with four items: “for me, physical activity will keep me healthy,” “for me, physical activity will help me either remain fit or get-fit,” “for me, physical activity will reduce my chances of getting serious health problems,” and “I have easy access to places where I can get physical activity,” with a response option of “definitely not” [1] to “definitely yes” [5]. Cronbach’s alpha for this item was 0.80. Self-efficacy was measured as described above.

Past Physical Activity, Intention, and Future Physical Activity Constructs of past physical activity, intention, and future physical activity were assessed from items of a widely used staging algorithm [20] in the form of a yes/no format via pencil and paper. This measure and format has been documented as the most reliable and valid stage assessment in the exercise domain [33] and used with success in prior intention–behavior profile research [15]. Recent validation of the measure is also available [34]. The question for physical activity at time one and two was an amalgamation of the precontemplation, contemplation, and preparation items that all include the statement “I have been inactive over the last 6 months, and presently do not get regular physical activity.” The intention measure was phrased, “Currently, have you thought about it and decided not to do any regular physical activity?”

Analysis Plan

Our analysis plan included basic descriptives and bivariate correlations of the TTM, TPB, and PMT constructs, followed by the creation of intention–behavior profiles. To achieve this, we separated participants by previous physical activity status (inactive, active) at time 1, intention to be active over the next 6 months (nonintender, intender) at time 1, and resulting physical activity over the next 6 months (inactive, active) at time 2. This allowed for eight possible profiles. Power analysis for detecting at least a medium effect size ($f=0.25$) suggested that the minimum cell size per profile needed to retain in the analyses was $n=30$. Identifying predictors of profile membership was then achieved using discriminant function analysis, with follow-up analyses of variance tests and Tukey post hoc comparisons when findings were significant. Because this was originally a randomized controlled trial with a large proportion of females, condition (control, experimental) and gender (male, female) were also entered as covariates in the analyses. All tests were performed at a more conservative 0.01 alpha level in order to provide some protection against experiment-wise error and Cohen’s [35] effect size $d$ was used to assist in consideration of the meaningfulness (small=0.20, medium=0.50 and large=0.80) of significant differences.

Results

Study characteristics are reported in Table 1. Five of the 887 participants who were administered the baseline questionnaire at time 1 did not complete the intention or behavior measure and therefore could not be classified with an intention–behavior profile. Thus, the final sample for this study was 611 participants. Assessment of those who only completed time one measures compared to those who completed measures for both time periods suggested no significant differences on all demographic and PA-related variables ($p>.05$). Basic descriptives and bivariate correlations of the constructs for the three models can be found in Table 2. Overall, the correlated ranged from trivial to medium using Cohen’s [35] effect size estimates with three notable exceptions of large-sized correlations (vulnerability and fear $r=0.69$; pros and cognitive processes $r=0.53$; behavioral and cognitive processes $r=0.58$).

Our grouping of the intention–behavior profiles revealed three profiles that we deemed too small in response rate to include in meaningful analysis. These profiles were for previously inactive nonintenders (T1) who became active after 6 months (T2) ($n=9$; 1% of sample), previously active nonintenders (T1) who were subsequently inactive 6 months later (T2) ($n=3$; 0%), and previously active nonintenders (T1) who were subsequently active 6 months later (T2) ($n=5$; 1% of sample). Consequently, five profiles were examined. These were: nonintenders (i.e., previously inactive nonintenders at T1 who remained inactive at T2; $n=32$; 5% of sample), unsuccessful adopters (i.e., previously inactive intenders at T1 who resulted in inactivity at T2; $n=132$; 22% of sample), successful adopters (i.e.,
Intention–Behavior Profiles

The multivariate examination of social cognitive constructs across intention–behavior profiles identified one significant discriminant function ($\chi^2 [52]=399.10, p<0.01$; Eigenvalue=0.83, canonical correlation=0.67, Wilk’s $\Lambda=0.50$). Affective attitude, PBC, behavioral processes, and self-efficacy were the key correlates with this discriminant function and correctly identified 50% of cases (see Table 3). For TPB variables, follow-up tests showed that affective attitude discriminated several of the profiles but did not identify differences between unsuccessful and successful adoption or maintenance. PBC, however, discriminated unsuccessful maintainers from successful maintainers ($d=0.37$). Instrumental attitude discriminated nonintenders from all profiles of intenders ($d=0.35$ to 0.65), and subjective norm constructs did not contribute substantially to the discrimination of the profiles. For TTM, the behavioral processes discriminated unsuccessful adopters from successful adopters ($d=0.43$). Self-efficacy discriminated between all groups ($d=0.39$ to 0.71) with the exception of successful adopters and nonintenders. Cognitive processes discriminated nonintenders from all other intention profiles ($d=0.54$ to 0.74), while cons discriminated unsuccessful maintainers from successful maintainers ($d=0.44$). Pros showed some differences across profiles, but no differences across successful/unsuccessful adoption or maintenance. Finally, the PMT construct of perceived severity discriminated nonintenders from all profiles of intenders ($d=0.60$ to 0.95), while response efficacy showed some differences across profiles, but not in terms of successful/unsuccessful adoption or maintenance. By contrast, severity and fear did not show significant analysis of variance results.

Discussion

The purpose of this study was to evaluate the PA intention–behavior profiles of a workplace sample across 6 months using the constructs of TPB, TTM, and PMT. The study findings replicate prior work focused on profiles of intention and behavior, while extending past literature through the inclusion of PMT and TPB constructs. It is acknowledged that many of the constructs across these models have measurement domain overlap [36, 37], but that they can be used in complement of one another for convergent and divergent interpretations of the findings. Overall, the results provide useful information for future targeted intervention campaigns.

Our first hypothesis was that instrumental attitude and subjective norm (TPB), pros/cons and cognitive processes (TTM), and severity, vulnerability, and fear (PMT) would only differentiate action planning, but not profiles of action control. This was generally supported. For TTM, the discriminating variable was the cognitive processes of change; for TPB, it included instrumental attitude; and for PMT, this included perceived severity. The findings complement prior work with TTM and TPB [11, 15], but collectively, it is interesting to note that all of these variables measure a perceived importance and concern for PA. From an intervention standpoint, this suggests that moving individuals to the consideration of behavioral action should focus on increasing awareness of PA benefits, but the approach is unlikely to result in behavioral action.

It is important to point out, however, that some constructs showed limited utility and did not differentiate intenders from nonintenders as originally hypothesized. Specifically, TPB subjective norm constructs (injunctive norm, descriptive norm) and PMT constructs of fear and vulnerability did not discriminate intention–behavior profiles in a meaningful way. All of these constructs have shown limited utility in past PA literature [31, 38, 39] and do not appear as critical variables to target in any PA intervention.
Our second hypothesis concerned profiles of action control exclusively; it was hypothesized that the behavioral processes of change (TTM) would discriminate adopters better than maintainers, affective attitude (TPB) would show differences between maintainers more than adopters, while perceived behavioral control (TPB), self-efficacy (TTM/PMT), and response efficacy (PMT) would differentiate all action control groupings. This hypothesis was generally supported. In accordance with our hypothesis, successful and unsuccessful adopters of PA were differentiated by the TTM’s behavioral processes and the TTM/PMT’s self-efficacy construct. This replicates prior literature using these constructs or very similar constructs to predict adoption of PA behavior from positive initial intentions (e.g., [7, 15, 17, 18]. We have interpreted these to collectively represent self-management and self-regulation of the behavior which is consistent with their respective operational definitions [40, 41] and prior theorizing on action control [7, 41]. It was also interesting to note that, unlike TTM and PMT, TPB constructs did not differentiate action control for adopters. The TPB lacks self-regulation-based constructs [42], and these appear important for understanding action control [15, 18].

For maintainers of PA, TPB’s PBC construct, TTM/PMT’s self-efficacy, and the TTM construct of cons discriminated action control profiles. The distinctiveness of these constructs compared to adoption profiles supports the importance of considering past behavior when understanding action control; only self-efficacy was similar across both sets of profiles. Considering these constructs collectively, it appears that constraints may be the key discriminators of action control during maintenance. The importance of control over behavioral constraints, independent of intent, is a theoretical tenet of TPB [4] and self-efficacy theory [40], and its predictive capability in action control is supportive of this theorizing [11, 15]. It is interesting; however, that these constructs discriminate maintenance profiles better than adoption as this was not originally hypothesized. This may be due to more accurate self-evaluation, and thus prediction, from behavioral experience or potentially because these constructs are more salient when attempting to sustain PA rather than adopt it. Unlike adoption, the behavioral processes did not emerge as predictors of action control during maintenance. This replicates prior research [15] and has considerable face validity, as individuals with maintenance profiles would presumably be versed in the simple strategies (e.g., prompts and cues) to regulate PA behavior based on their past success.

Finally, our third hypothesis was that only five of eight possible intention–behavior profiles would emerge from the sample, and this was supported by the results. That is, people can be reliably grouped into nonintenders, and
unsuccessful/successful adopters/maintainers, but not into groupings of nonintenders who become active or previously active nonintenders. The results confirm the asymmetrical structure of intention–behavior relations [16] and demonstrate that intention–behavior discordance occurs in the direction of unsuccessful intenders.

The reliable extension of groupings to include adopter and maintainer profiles is also useful information for three reasons. First, it demonstrates that difficulty with translating intentions into PA is not only a phenomenon for adopters, but also a concern for those who have been active. Between this study and Rhodes and Plotnikoff [15], adopters had a 34–35% success rate, while maintainers had a 71–77% success rate; this complements prior work showing that PA behavior continuance is an ongoing process that is susceptible to relapses [43]. Second, when evaluating TPB, TTM, and PMT constructs as predictors of the profiles, it is immediately apparent that past behavior has conditioned the responses in addition to intention–behavior profile [44]. Constructs generally had higher means for unsuccessful maintainers when compared to successful adopters. This is an important finding because it suggests that failure to consider the moderating role of past behavior on intention–behavior relations will result in biased coefficients. Third, the division of intention–behavior profiles by past behavior further accentuated the asymmetry of this relationship by demonstrating that nonintenders are entirely made-up of previously inactive people. This needs consideration when interpreting regression-based analyses of intention–behavior and the impact it may have.

Despite the population-based sampling of the present study, there are limitations that need to be taken into consideration when interpreting the results. First, the measures of physical activity were self-report and dichotomous. Continuous behavior measures have demonstrated better measurement of physical activity compared to dichotomous measures [45]. Self-report questionnaires need to be interpreted with caution because of recall error and other reporting biases. Still, the physical activity measure employed matched correspondence in physical activity

Table 3  Social cognitive constructs as predictors of action planning and control across six-month measurements

<table>
<thead>
<tr>
<th>Affective attitude</th>
<th>NI</th>
<th>UA</th>
<th>SA</th>
<th>UM</th>
<th>SM</th>
<th>$F_{4,581}$</th>
<th>Post Hocs</th>
</tr>
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<tbody>
<tr>
<td>Intention–behavior profiles</td>
<td>3.49 (1.00)</td>
<td>3.81 (0.85)</td>
<td>4.01 (0.84)</td>
<td>4.25 (0.71)</td>
<td>4.47 (0.61)</td>
<td>26.75*</td>
<td>NI&lt;SA&lt;UM,SM; UA&lt;UM,SM; SA&lt;SM</td>
</tr>
</tbody>
</table>

| Instrumental attitude | 4.46 (0.86) | 4.69 (0.47) | 4.77 (0.34) | 4.80 (0.40) | 4.85 (0.35) | 7.24* | NI<All; UA<SM |

| Injunctive norm | 3.48 (0.64) | 3.51 (0.72) | 3.71 (0.78) | 3.80 (0.70) | 3.73 (0.78) | 3.18 |

| Descriptive norm | 2.88 (0.88) | 3.10 (0.87) | 3.19 (0.80) | 3.38 (0.91) | 3.37 (0.89) | 3.98* | NI<UM,SM; UA<SM |

| Perceived control | 4.04 (0.77) | 3.75 (0.89) | 3.87 (0.78) | 4.10 (0.80) | 4.40 (0.66) | 18.53* | NI<SA<UM,SM; UA<SM,SM |

| Pros | 3.34 (1.01) | 3.70 (0.74) | 3.84 (0.75) | 4.04 (0.78) | 4.16 (0.75) | 14.22* | NI,UA<SA<SM,UM,SM |

| Cons | 2.27 (0.58) | 2.22 (0.69) | 2.07 (0.54) | 1.96 (0.65) | 1.68 (0.61) | 21.66* | NI,UA<SA<UM,SM |

| Behavioral processes | 1.99 (0.62) | 2.32 (0.66) | 2.59 (0.61) | 3.13 (0.89) | 3.27 (0.86) | 61.76* | NI,UA<SA<UM,SM |

| Cognitive processes | 2.44 (0.82) | 2.85 (0.69) | 2.99 (0.68) | 3.10 (0.77) | 3.10 (0.66) | 9.01* | NI<All; UA<UM,SM |

| Self-efficacy | 2.45 (0.58) | 2.54 (0.60) | 2.80 (0.72) | 3.15 (0.74) | 3.68 (0.74) | 75.19* | NI,UA<SA<UM<SM |

| Severity | 4.26 (0.66) | 4.62 (0.53) | 4.64 (0.52) | 4.66 (0.62) | 4.78 (0.44) | 8.09* | NI<All; UA<SM |

| Vulnerability | 3.55 (0.95) | 4.09 (0.87) | 4.03 (0.95) | 3.86 (0.88) | 3.91 (0.90) | 3.19 |

| Fear | 3.09 (1.04) | 3.64 (1.15) | 3.68 (1.15) | 3.70 (0.89) | 3.69 (1.05) | 2.12 |

| Response efficacy | 4.29 (0.77) | 4.51 (0.52) | 4.46 (0.51) | 4.53 (0.77) | 4.66 (0.50) | 5.28* | NI,UA,SA<SM |

Post hoc tests performed at $p<0.01$. Means presented are adjusted for gender and condition (experimental, control).

NI nonintenders, UA unsuccessful adopters, SA successful adopters, UM unsuccessful maintainers, SM successful maintainers

$p<0.01$
intensity, frequency, and duration with the social cognitive measures, thus supporting appropriate framing. Second, the overall study response rate was modest, and the study experienced an attrition rate of 31% over the two time points. These factors create unknown biases that limit the population generalizability of the results. Third, the sample was comprised of primarily Caucasian women, so the study may have limited generalizability. Finally, the constructs from TPB, TTM, and PMT were helpful in discriminating intention–behavior profiles, but other variables beyond these measurement domains will likely improve our understanding of the intention–behavior gap. For example, the self-efficacy construct was clearly the most consistent predictor of intention–behavior profiles. Although it has been added to models like PMT and TTM, the application of a full social cognitive theory complement of variables [36] may yield the best overall predictive model for understanding action control. Further, an inclusion of multiple efficacy constructs (e.g., task efficacy) may prove useful in future research. A full social–ecological model that includes other personal (e.g., personality, fitness level), social (e.g., social support, social capital), and environmental (e.g., neighborhood aesthetics, proximity to recreation) variables also seems a worthy future research effort.

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