Intention–behavior gap is wider for walking and moderate physical activity than for vigorous physical activity in university students

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Abstract:

Objectives: The theory of planned behavior proposes that physical activity is the result of intentions; however little is known about whether the relation between intentions and behavior differs between vigorous, moderate physical activity, and walking. For university students, vigorous physical activity is oftentimes enacted as a goal-directed behavior; whereas walking is oftentimes a means to achieving a goal other than physical activity (e.g., transportation).

Design: The study was a one-week prospective study.

Methods: Undergraduate students (N = 164) reported intentions for walking, moderate physical activity, and vigorous physical activity and self-reported these behaviors one week later.

Results: Hierarchical linear modeling revealed that intentions were more strongly related to vigorous physical activity than to moderate physical activity or walking.

Conclusions: Intention-enhancing interventions may effectively promote vigorous physical activity, but other motivational processes may be more appropriate to target in interventions of walking and moderate physical activity.

Keywords: Motivation | Theory of planned behavior | Exercise | Physical activity intensity

Article:

1. Introduction

Important health benefits can be obtained by participating in physical activity of varying degrees of intensity, from vigorous exercise to slow-paced walking.[1] The theory of planned behavior[2] proposes that physical activity is primarily determined by behavioral intentions, and, to a smaller degree, by perceived behavioral control (i.e., perceptions of the ease or difficulty of performing physical activity). As is the case with most behaviors, the majority of physical activity is unexplained by behavioral intentions.[3–5] The behavior left unexplained by intentions is referred to in the literature as the *intention–behavior gap.*[6] A small intention–behavior gap suggests that interventions that enhance behavioral intentions will produce behavior change; however a large intention–behavior gap suggests that interventions may require additional strategies of behavior change beyond intention-enhancement.

A meta-analysis of the physical activity intention–behavior gap estimated that people only follow-through with slightly more than half (52%) of their physical activity intentions.[7] To address this, research has been focused on the motivational, self-regulatory, and habitual individual differences and states that make it more likely that people will follow through with their intentions.[8] With this new knowledge, intervention strategies can be incorporated to help people implement their physical activity intentions[9] and these programs can be tailored for those less likely to follow through with their intentions.[8] The question then arises, how physical activity interventions should be tailored to best aide people in bridging the intention–behavior gap. Most intention–behavior gap research has focused on individual differences[8] or motivational strategies;[9] however little is understood about what aspects of physical activity (e.g., intensity) might influence the intention–behavior gap. Such research could point toward effective, easy to implement strategies for making physical activity interventions more successful.

The intention–behavior gap may be different between vigorous physical activity, moderate physical activity, and walking. Vigorous and moderate physical activity is less seamlessly embedded in daily life than walking, and therefore may be more dependent on intentional control. For example, vigorous physical activity often requires special clothing, equipment or social contexts and is unlikely to occur without some planning to coordinate these different components. Walking is less onerous and requires less preparation. As a representation of the effort that people are willing to put forth to perform the behavior,[2] intentions may more strongly regulate vigorous and moderate physical activity than walking.

The findings of two previous studies support that the intention–behavior gap may be wider for walking than for vigorous and moderate physical activity. In the first study, a sample of university students and community-based adults reported their intentions for six types of physical activity.[10] One month later, the participants reported the frequency of their engagement in each activity throughout the past month. It was found that intentions explained significantly more variability in engagement in team sports, aerobics, dancing, swimming, and cycling then walking. In the second study, university students reported their intentions for lifestyle physical activity (i.e., any activity performed with a primary goal other than physical fitness and health) and exercise (i.e., activity performed with physical fitness and health as a primary goal) and frequency of these activities throughout a typical week. It was found that intentions for exercise accounted for more variability in exercise behavior (and specifically vigorous activities) than

intentions for lifestyle physical activity accounted for in lifestyle physical activity.[11] These studies demonstrated that the intention–behavior gap varies between the mode and style of physical activity, but neither study directly evaluated the magnitude of the intention–behavior gap between vigorous physical activity, moderate physical activity, and walking.

A more recent study directly tested for differences in intention–behavior relations between moderate and vigorous activity with a between-group comparison of university students.[9] In this study, one group reported intention and behavior of moderate physical activity and another group reported intentions and behavior of vigorous physical activity. No significant differences were found between the magnitude of the intention–behavior relations between the two groups, which may suggest that the intentional regulation of physical activity does not differ between moderate and vigorous physical activity. It remains unclear, however, whether these effects extend to a within-person level. This may not be the case, given that intentions are influenced by individual factors, such as attitudes.[3–5] Identifying whether there are within-person differences in the intentional regulation of vigorous physical activity, moderate physical activity, and walking will have important implications for how to target these behaviors in interventions.

The aim of our study was to determine whether there were differences in the intentional regulation of vigorous physical activity, moderate physical activity, and walking. This is the first study to test whether the magnitude of the relation of intentions with prospective behavior differed between vigorous physical activity, moderate physical activity, and walking. Analyses were conducted at the within-person level and accounted for between-person differences; this analysis strategy reduces the risk of making incorrect conclusions from strictly between-person analyses and better represents behavioral processes.[12,13] We hypothesized that intentions would be more strongly related to vigorous physical activity than to moderate physical activity or walking. In accordance with the theory of planned behavior,[2] perceived behavioral control of these behaviors was accounted for in the models.

2. Methods

Participants (N = 164, 75 women, 87 men, 2 did not report sex) were mostly White (88%), non-Hispanic (96%) students in their second (15%), third (69%), or fourth (16%) year at the university. Data were collected as part of a class project in an undergraduate Kinesiology course with the approval of the local Institutional Review Board. All participants provided informed consent to participate in the project and gave permission to use their data for research purposes. The decision to participate in the research study had no bearing on the course grade. Participants made laboratory visits at the beginning and end of a one-week interval. During the first lab visit, participants reported on their intentions for vigorous physical activity, moderate physical activity, and walking. During the second lab session, participants reported on their vigorous physical activity, moderate physical activity, and walking during the previous week.

Participants completed three versions of items adapted from previous research.[14] The items were adapted based on physical activity intensity (i.e., separate assessments for vigorous physical activity, moderate physical activity, and walking; 15 items total). Prior to rating the items (described below), participants were provided with definitions and examples of the intensities of physical activity that matched those from the International Physical Activity

Questionnaire.[15] *Vigorous physical activity* was defined as activities that take hard physical effort, and examples included heavy lifting, digging, aerobics, or fast bicycling. *Moderate physical activity* was defined as an exertion of more than minimal effort, and examples included carrying light loads, bicycling at a regular pace, or doubles tennis. Participants were explicitly informed that moderate physical activity did not include walking. *Walking* was defined as walks of at least 10 min characterized by an exertion of minimal effort, completed with a normal heart rate, and in which you could easily hold a conversation.

Physical activity intentions at each level of intensity were assessed using two items: 'I plan to engage in [vigorous physical activity/moderate physical activity/walking] regularly over the next week' and 'I intend to engage in [vigorous physical activity/moderate physical activity/walking] regularly over the next week.' Participants rated each item on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*) and scores at each level of intensity were calculated as the mean response to the two items. Internal consistency was acceptable for each of these intention scales (αs > .70).

Perceptions of behavioral control at each level of intensity were assessed using three items: "How much personal control do you feel you have over engaging in [vigorous physical activity/moderate physical activity/walking] in the next week if you really wanted to do so," "How much do you feel that engaging in [vigorous physical activity/moderate physical activity/walking] over the next week is beyond your control even if you really wanted to," and "Is engaging in [vigorous physical activity/moderate physical activity/walking] over the next week up to you if you wanted to do so?" Participants responded to these items on 7-point Likert scales ranging from either *very little control* to *complete control* (item 1) or *not at all* to *very much* (items 2 [reverse scored] and 3). The second item reduced internal consistency considerably (αs ranged from .46 to .56), so it was dropped and the internal consistencies of the remaining items were acceptable (αs $\geq$ .70). Thus, scores at each level of intensity were calculated as the mean of the remaining two items.

Participants self-reported vigorous physical activity, moderate physical activity, and walking using the short version of the International Physical Activity Questionnaire (IPAQ)[15] which has demonstrated acceptable reliability and validity in an adult population.[16] Participants reported the number of days in the past week that they participated in vigorous and moderate physical activity and walked for at least 10 min at a time. They also reported how much time they typically spent doing these physical activity behaviors per day. Responses were processed using standard scoring procedures and intensity-specific physical activity scores were calculated as the product of days, time (in minutes), and a weight representing the metabolic equivalent for activity at each intensity (walking = 3.3, moderate = 4, vigorous = 8). The estimated energy expenditure values used to score the IPAQ were selected based on Ainsworth and colleague's compendium of physical activities.[17]

Intraclass correlations (ICC; ratio of between- vs. within-person variability) were estimated to determine whether people varied their intentions between intensities. A series of multilevel linear regression models were estimated in SAS 9.2 PROC MIXED[18] to test for differences in the relation between intentions and vigorous physical activity, moderate physical activity, and walking. Likelihood estimation was applied to the 1% of missing intentions and perceived behavioral control data. Different physical activity intensities were nested within-people, so

between-person effects were accounted for with the inclusion of the person-level average of the three intention scores and the three perceived behavioral control scores in the models. Within-person effects were tested as the intensity-specific deviations from the person-level average scores.[19]

Contrast coding was used to compare the intention–behavior relations in three separate models. For the first model, the coding scheme contrasted the intention–behavior coefficients between vigorous (coded as +1) and moderate (coded as −1) physical activity (walking coded as 0). For the second model, the coding scheme contrasted the coefficients between vigorous physical activity (coded as +1) and walking (coded as −1; moderate physical activity coded as 0). For the third model, the coding scheme contrasted the coefficients between moderate physical activity (coded as +1) and walking (coded as −1; vigorous physical activity coded as 0).

The specifications of the models are shown in Eqs. (1)–(7):

Level-1.

$$\begin{aligned} Physical\,activity_{ip} = {} & \beta_{0p} + \beta_{1p}(intentions_{ip}) \\ & + \beta_{2p}(perceived\,behavioral\,control_{ip}) \\ & + \beta_{3p}(contrast\,code_{ip}) + \beta_{4p}(contrast\,code_{ip} \\ & \times intentions_{ip}) + \beta_{5p}(contrast\,code_{ip} \\ & \times perceived\,behavioral\,control_{ip}) + e_{ip} \end{aligned} \quad (1)$$

Level-2.

$$\begin{aligned} \beta_{0p} = {} & \gamma_{00} + \gamma_{01}(average\ intentions_{p}) \\ & + \gamma_{02}(average\,perceived\,behavioral\,control_{p}) + u_{0p} \end{aligned} \quad (2)$$

$$\beta_{1p} = \gamma_{10} + u_{1p} \quad (3)$$

$$\beta_{2p} = \gamma_{20} \quad (4)$$

$$\begin{aligned} \beta_{3p} = {} & \gamma_{30} + \gamma_{31}(average\,intentions_{p}) \\ & + \gamma_{32}(average\ \ perceived\,behavioral\,control_{p}) \end{aligned} \quad (5)$$

$$\beta_{4,5p} = \gamma_{4,50} \quad (6)$$

in which, at a within-person level (level-1), physical activity for person *p* at intensity *i* was predicted by intentions, perceived behavioral control, the contrast code, the interaction terms between the contrast code and intentions and perceived behavioral control, and residual variance.

The between-person coefficients (level-2) were set to account for between-person differences by constraining the level-1 intercepts (Eq. (2)) and intention–behavior slopes (Eq. (5)) with the person-level average intentions and perceived behavioral control scores. The other level-2 equations represent the unconstrained within-person slopes (Eqs. (3), (4), and (6)). There were significant individual differences in the level-1 intercept (Eq. (2)) and the slope between physical

activity and intentions (Eq. (3)) so this variation was estimated with residual terms (represented by *u*). The other slopes did not significantly differ between people and were, therefore, held as fixed effects (Eqs. (4) and (6)).

3. Results

Descriptive statistics and correlations among intentions, perceived behavioral control, and physical activity (without accounting for within-person nesting) are presented in Table 1. There were small-to-medium positive relations between intentions for vigorous physical activity, moderate physical activity, and walking. Vigorous physical activity, moderate physical activity, and walking were all positively related to intentions. The ICC revealed that between-person differences accounted for 37% of the variability in intention ratings, suggesting that intentions are comprised of a mix of between- and within-person variability.

The results of the multilevel analyses are shown in Table 2. In each model, intentions significantly, positively related to physical activity at a within-person level (γ_{10}). Intention–behavior relations were stronger for vigorous physical activity than for either moderate physical activity or walking but did not significantly differ between moderate physical activity and walking (γ_{40}). These effects were present after accounting for significant between-person effects in intention–behavior relations (γ_{01}, γ_{31}), and also for the effects of perceived behavioral control on behavior, although these effects were found to be non-significant (γ_{20}, γ_{50}, γ_{02}, γ_{32}).

Table 1
Summary of descriptive statistics and correlations of intentions, perceived behavioral control, and vigorous physical activity, moderate physical activity, and walking.

	M	SD	α	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Intentions (vigorous)	5.55	1.47	.94	–	.52*	.22*	.35*	.38*	.24*	.40*	.08	.18*
2. Intentions (moderate)	5.91	1.17	.90		–	.40*	.27*	.37*	.28*	.20*	.25*	.21*
3. Intentions (walking)	5.70	1.35	.98			–	.25*	.37*	.35*	.10	.26*	.20*
4. Perceived behavioral control (vigorous)	6.17	1.22	.80				–	.74*	.38*	.07	.20*	.13
5. Perceived behavioral control (moderate)	6.31	1.08	.81					–	.59*	.11	.22*	.18*
6. Perceived behavioral control (walking)	6.22	1.06	.70						–	.14	.18*	.18*
7. Vigorous physical activity	189.77	197.37	–							–	.35*	.13
8. Moderate physical activity	228.07	225.92	–								–	.28*
9. Walking	338.75	418.95	–									–

Note.
* $p < .05$.

Table 2
Results of multilevel model testing if the relation between physical activity and motivation is moderated by intensity of physical activity.

	Vigorous vs. walking		Vigorous vs. moderate		Moderate vs. walking	
	Coefficient	*SE*	Coefficient	*SE*	Coefficient	*SE*
Within-person fixed effects						
Intercept, γ_{00}	−1197.20*	484.07	−1012.32*	480.51	−1213.41*	489.32
Intentions, γ_{10}	193.41*	61.39	203.97*	61.40	191.38*	65.68
Perceived behavioral control, γ_{20}	−102.97	89.34	−54.05	90.05	−123.74	98.38
Contrast, γ_{30}	231.43	472.56	−46.50	461.41	45.05	490.49
Contrast × intentions, γ_{40}	226.87*	81.63	201.40*	86.81	41.63	92.25
Contrast × perceived behavioral control, γ_{50}	−167.40	114.47	−137.68	133.37	−121.16	136.89
Between-person fixed effects						
Average intentions, γ_{01}	330.40*	78.39	336.15*	77.87	343.40*	78.38
Average perceived behavioral control, γ_{02}	79.22	81.80	45.76	80.22	68.98	82.33
Contrast × average intentions, γ_{31}	119.29	75.54	182.81*	74.07	−51.24	78.38
Contrast × average perceived behavioral control, γ_{32}	−111.64	80.02	−108.83	77.14	21.88	82.32
Random effects						
Intercept, σ^2_{u0}	278,124*	93,179	292,495*	91,567	246,632*	93,167
Intentions, σ^2_{u1}	<.001	<.001	<.001	<.001	<.001	<.001
Covariance, σ^2_{u0u1}	−73,102	65,781	−104,279	53,654	−31,831	81,150
Residual variance, e_{ip}	1,342,072*	109,139	1,290,792*	104,642	1,419,710	115,033

Note. Unstandardized estimates and standard errors. *SE*, standard error; σ^2, variance of random effects.
* $p < .05$.

4. Discussion

Our results indicated that there were significant differences in the intentional regulation of vigorous physical activity, moderate physical activity and walking. Vigorous physical activity was more amenable to intentional regulation than either moderate physical activity or walking. Previous research demonstrated that the magnitude of the intention–behavior gap differs systematically as a function of individual differences (e.g., physical activity habit strength, intention stability, intrinsic motivation)[20–23] and motivational strategies (e.g., planning, implementation intentions).[9,24] These findings extend on previous studies comparing the intentionality of varying types of physical activity[10,11] to demonstrate that the intention–behavior gap is also dependent on intensity of physical activity. The present study also extended previous research which found that there were not significant between-group differences in the intentional regulation of vigorous and moderate physical activity[9] by demonstrating that there are within-person differences in the intentional regulation of these intensities of physical activity, when accounting for between-person differences.

The results of this study suggest that focusing on activities of lesser intensity may help bridge the intention–behavior gap, thereby potentially enhancing the effectiveness of intention-enhancing physical activity interventions. This may provide a simple way to elicit a sense of mastery in people highly susceptible to not following through with their intentions. These findings also suggest interventions should focus their efforts differently depending on the intensity of the targeted physical activity. Efforts to increase walking have had limited success in the past[25] and this may be because conventional interventions focus on enhancing intentions, but the present findings suggest that walking may be regulated by different processes. Methods for reducing the intention–behavior gap for milder forms of physical activity such as walking may be more effective if they account for action control–the translation of intentions into behavior[26,27] or automatic processes such as habit formation or automatic evaluations that regulate unintentional behavior.[19–21] Alternatively, walking interventions might be more suited for strategies beyond enhancement of intentions. Rather than the theory of planned behavior,[2] walking interventions might consider basing strategies on the theoretical frameworks of the social cognitive theory, transtheoretical model, or self-determination theory.[28,29]

Limitations of this study will need to be considered and addressed in future research. For example, the present study was based on a sample of mostly Caucasian, non-Hispanic, and healthy young adults, so more research is necessary before these results can be generalized to broader populations. Additionally, this sample had relative high levels of physical activity intentions and perceived behavioral control. Future research with less motivated samples is necessary to ensure study effects were not impacted by ceiling effects. For example, it may be that the intentionality of physical activity intensities is different for populations who perceive physical activity, in general, as more difficult to perform (e.g., people with physical disabilities). Additionally, the present study used a 7-day recall measure of physical activity. Future research using daily recall or objective measures of physical activity will help rule out that the results of the present study were impacted by individuals' perceptions of intensity or self-reporting biases (e.g., recall bias).

This study demonstrates that the intentional regulation of vigorous physical activity, moderate physical activity, and walking is not homogenous in university students. Physical activity is often represented as primarily an intentional behavior,[2–5] but it seems that this representation is more representative of vigorous physical activity than of moderate physical activity or walking. Further investigations into why walking and moderate physical activity is less intentionally regulated than vigorous activity and how best to intervene with the lesser intensities of physical activity are necessary to extend our understanding of how to effectively increase these popular and easily implemented forms of physical activity. Such research may be especially influential for efforts to increase physical activity in populations with functional limitations including older adults and people with chronic diseases.

Practical implications

- Vigorous physical activity is more intentionally regulated that moderate physical activity and walking.
- Techniques to enhance intentions may be more effective for vigorous exercise interventions than for walking interventions.
- Further investigations into the motivation of lesser intensities of physical activity are necessary.

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