

# Self-efficacy Moderates the Mediation of Intentions Into Behavior via Plans

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**Objective:** To examine the putative moderating role of self-efficacy in the intention-planning-behavior relationship. **Methods:** In N=812 individuals, intentions (independent variable) were assessed at baseline, whereas action plans (mediator), self-efficacy (moderator), and physical activity (dependent variable) were measured again 4 weeks later. We examined a moderated-mediation model. **Results:** Self-efficacy moderates the mediation process: the

strength of the mediated effect increased along with levels of self-efficacy. The results remain valid after accounting for baseline physical activity. **Conclusions:** For plans to mediate the intention-behavior relation, people must hold sufficiently high levels of self-efficacy. If they lack self-efficacy, planning may be in vain.

**Key words:** physical activity, self-efficacy, intentions, action plans, moderated mediation

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Health-compromising behaviors such as physical inactivity and poor dietary habits are difficult to change. Most social cognitive theories assume that an individual's intention to change is the best direct predictor of actual change, but people often do not behave according to their intentions.<sup>1-6</sup> Several reasons account for the discrepancy between intention and behavior. For example, unforeseen barriers could emerge, or a person might give in to temptation. Therefore, intentions need to be supplemented by more proximal factors that might facilitate the translation of intentions into

action.<sup>2-7</sup> A theory that models this is the Health Action Process Approach (HAPA).<sup>1</sup>

Some of these postintentional factors proved to be important, such as perceived self-efficacy<sup>8</sup> and action plans.<sup>2-5</sup> However, we do not fully understand how these 2 factors interact in bridging the intention-behavior gap. Authors of previous studies have specified them as mediators within a multiple mediator model.<sup>1,9</sup> This study, however, examines an interaction between them in order to elucidate the mechanisms that come into play after people have formed an intention to change their health-compromising behaviors.

## Action Plans as a Mediator

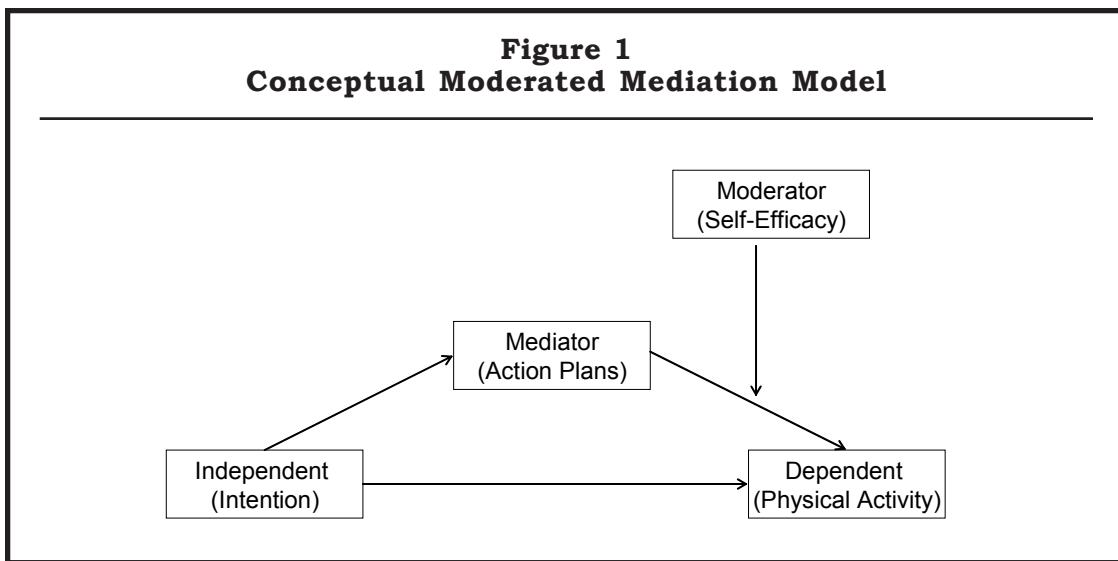
People are more likely to translate their good intentions into action when they make an action plan. Intentions foster action planning, which in turn facilitates behavior change. Meta-analyses have summarized the findings on the effects of planning on health behaviors (for an overview, see Gollwitzer & Sheeran).<sup>3</sup> This process reflects mediation.<sup>10</sup> *Mediation*

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**Figure 1**  
**Conceptual Moderated Mediation Model**



describes how an effect occurs, ie, how an independent variable (X) affects a dependent variable (Y) via a third variable called mediator (M).

Self-reported action planning partially mediates the intention-behavior relationship. It also explains more variance of health behavior (eg,<sup>7</sup> Study 2;<sup>11,12</sup> Study 1-3; full mediation,<sup>4-6</sup>). However, evidence is inconclusive, as some studies have failed to find mediation effects of planning<sup>7</sup> (Study 1,<sup>12</sup> Study 4). This suggests that we cannot subsume the relationships between intentions, action plans, and behavior within simple mediation models, but the mediation also depends on third variables. Thus, mediation mechanisms might differ in subgroups of participants (eg, sex, age-groups). For example, the degree to which planning mediates between intentions and behavior may be higher in older than in younger individuals.<sup>13-15</sup> This represents a case of moderated mediation.<sup>16,17</sup> The amount to which the mediator translates the effect of the independent variable into the dependent variable may depend on the levels of a moderator. In general, *moderation* takes place if a variable modifies the form or strength of the relation between an independent and a dependent variable or the mediation role of another variable between the two.<sup>18</sup> Thus, “moderators provide information on when the effects are present” (p. 11).<sup>18</sup> If a moderator has only 2 levels (eg, women and men), then me-

diation in the one group and lack of mediation in the other group reflect *moderated mediation*. If a moderator is a continuous variable, moderated mediation is equivalent to an interaction between the mediator and a fourth variable, called moderator.

**Perceived Self-efficacy as a Moderator**

One putative moderator for the degree to which planning mediates the intention-behavior relationship is self-efficacy. This construct reflects optimistic self-beliefs when overcoming temptations or adopting a novel course of action. Self-efficacy should moderate the planning-behavior relation because people harboring self-doubts might fail to act upon their plans.<sup>8</sup> For persons with high levels of self-efficacy, planning might be more likely to facilitate goal achievement because optimistic self-beliefs instigate the execution of plans: Whether intentions affect behavior via action plans (mediation) might depend on the level of self-efficacy (moderation).

**Aims of the Study**

The aim of our study, therefore, is to analyze whether action plans (mediator variable) mediate the effect of intentions (independent variable) on behavior (dependent variable) as a function of the underlying level of self-efficacy (moderator variable). We hypothesize that the moderator operates on the planning-be-

**Table 1**  
**Means (M), Standard Deviations (SD), and Intercorrelations for**  
**Intention, Action Plans, Self-efficacy, and Physical Activity**  
**(Time 1 [T1], Time 2 [T2]) (N=812)**

	Intention T1	Action Plans T1 & T2	Self-efficacy T1 & T2	Baseline Activity (T1)*	Physical Activity T2*
<b>M</b>	2.55	3.09	2.62	174.25	189.49
<b>SD</b>	0.77	0.79	0.78	153.84	160.01
<b>Intention</b>	1.00	.			
<b>Action Plans</b>	.38	1.00			
<b>Self-efficacy</b>	.41	.44	1.00		
<b>Baseline Activity (T1)*</b>	.25	.27	.31	1.00	
<b>Activity T2*</b>	.26	.33	.30	.56	1.00

**Note.**

All correlations  $P < .01$

\* = Minutes per week

T2 = 4 weeks after baseline (T1)

havior relation, which is statistically reflected by an interaction between action plans and self-efficacy. Figure 1 illustrates the putative mechanism.

Our study examines whether perceived self-efficacy moderates the mediating effect that action plans have on the intention-behavior relationship, using physical activity as the target behavior. This is done in 3 steps, examining (1) whether intentions affect behavior through action plans (ie, whether a mediation exists), (2) whether the strength of the planning-behavior association depends on the level of self-efficacy and how this effect influences the mediation (whether the mediation is moderated by self-efficacy), and (3) whether this moderated mediation holds true after accounting for baseline physical activity (moderated mediation in behavioral change). To our knowledge, ours is the first study to test moderated mediation for this research question.

## **METHOD**

### **Participants**

An online study was conducted using the software dynQuest.<sup>19</sup> Two thousand seven potential participants responded to the initial Web page; if individuals answered 75% or more of the questions they were considered as participants at Time 1 (T1; 1915; 95.4%). Of these, 1752 (91.5%) provided their e-mail addresses in order

to receive an invitation for a follow-up assessment. Eight hundred twelve (46.3% of those who could potentially participate) answered the follow-up questionnaire 4 weeks later.

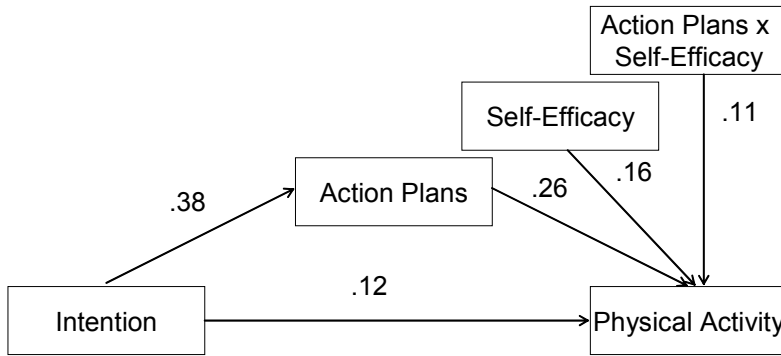
Significant differences ( $P < .05$ ) between dropouts and study participants appeared only in terms of sex (more men dropped out), education (persons without a high school degree were more likely to drop out), and baseline behavior (T1, participants performed more physical activity). No other differences transpired between the initial sample and those persons who completed all measurement points in time in measured social cognitive variables and Socio-demographics. Thus, the longitudinal sample was mainly representative for the initial one. Missing data were imputed within each measurement point in time, using the expectation maximization (EM) algorithm in SPSS.<sup>20</sup>

The final sample consisted of 812 participants, aged 16 to 78 years,  $M = 36.69$ ,  $SD = 12.20$ , 74.4% of whom were women, 51.0% were living with a partner, 75.0% had completed senior high school, and 48.9% of the high school graduates also held a university degree.

### **Procedure**

Participants were recruited by personal invitations, press releases (radio, newspaper and magazine reports), and adver-

**Figure 2**  
**Results of Regression Analyses for Moderated Mediation**



**Note.**  
 All coefficients  $P < .01$

tisements posted on a university Web site with a link to the questionnaire. After informed consent, participants followed a link to a self-administered questionnaire. After 4 weeks, they received an e-mail invitation to answer a follow-up online questionnaire (Time 2, T2).

**Measures**

At T1 we measured intentions; at both T1 and T2 we assessed action plans, perceived self-efficacy and physical activity. T1 and T2 action plans as well as T1 and T2 self-efficacy were averaged, due to their theoretical status between intentions and behavior. By this, we achieved a temporal order. Items were used and validated in previous studies<sup>1,9,12,21-24</sup>; examples given below are translations from German. Response formats for intentions, action plans, and self-efficacy were 4-point Likert scales, ranging from totally disagree (1) to totally agree (4). We obtained scale scores by averaging item responses. Table 1 reports means, standard deviations, and intercorrelations of all variables.

We used an index (taken from Lippke et al)<sup>22</sup> reflecting 2 intensity levels of physical activity to measure intentions. The items were “I intend to perform the following activities at least 5 days per week for

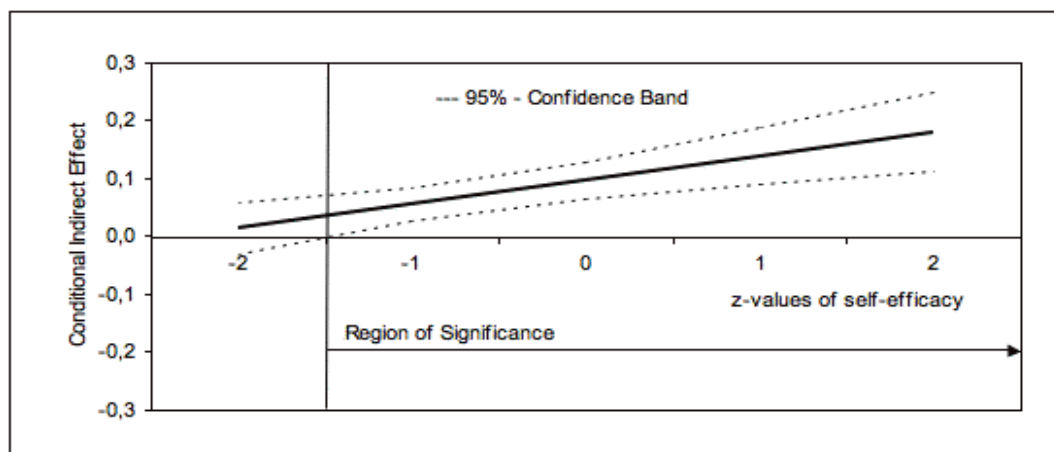
30 minutes...” (1) “...strenuous physical activity (heart beats rapidly, sweating),” (2) “...moderate physical activity (not exhausting, light perspiration)” (intercorrelation of the 2 items  $r = .21$ ).

We assessed action plans with regard to the when, where, and how of activity (taken from<sup>21</sup>). The wording of the 3 items was “I have already planned [where; how; when, and how often] I will be physically active” (Cronbach alpha = .90).

Three items measured perceived self-efficacy, such as “I am certain that I can resume my strenuous activity level (at least 5 times per week for 30 minutes or more), even if I have stopped working out for a longer time period.”<sup>1</sup> These items reflect optimistic beliefs about one’s capability to resume an exercise regimen after a break (Cronbach alpha = .92).

To assess physical activity, we used the Godin Leisure-Time Exercise Questionnaire (GLTEQ)<sup>23</sup> that asked participants to report the average number of times in an average week (during the past month) that they had engaged in strenuous (rapid heart beats, sweating), moderate (not exhausting, light perspiration), and mild (minimal effort and no perspiration) intensity physical activity per session. The GLTEQ was modified to include the specific number of minutes

**Figure 3**  
**Indirect Effect of Intentions Via Action Plans on Physical Activity, Moderated by Self-efficacy (95%-confidence band)**



per intensity category.<sup>24</sup> We then added participation responses for strenuous and moderate activity in each activity category to obtain a summary score of number of minutes of physical activity per week. (The intercorrelation of the 2 items was  $r=.48$ .)

#### Analytical Procedure

Recommended multiple regression procedures<sup>16,18</sup> were the basis of the analyses. In the first step, the simple mediator model was tested by Sobel Z, using a SPSS macro (syntax).<sup>25</sup> In the second step, self-efficacy was added as a moderator of the planning-behavior relationship, using the MODMED macro (Version 1.1; Model 3).<sup>16</sup> In the third step, T1 physical activity was entered as a covariate into the same model, using the MODMEDC macro (Version 1.0; Model 3, which allows for the inclusion of covariates).<sup>16</sup> We used centered variables to test the interactions.<sup>26</sup> Moderated mediation is expressed by an interaction between self-efficacy and action plans (moderator\*mediator) on behavior, which affects the mediation process.<sup>27</sup> In addition, we applied an extension of the Johnson-Neyman technique to moderated mediation.<sup>16,28</sup> This technique tests the significance of the indirect effect within the observed range of

values of the moderator until the value of the moderator is identified, for which the conditional indirect effect is just statistically significant at a set level (here,  $\alpha=.05$ ). Values of the moderator for which the mediation effect is significant constitute the region of significance.

#### RESULTS

##### Mediation: Action Plans Mediate the Intention-Behavior Relationship

Results yielded a significant indirect effect ( $\beta=.11$ ) of intentions on physical activity through action plans ( $P<.01$ ),  $R^2 = .13$ , Sobel  $Z = 6.02$  ( $P<.01$ ). Plans partially mediated the intention-behavior relation because intentions still had a direct effect on behavior,  $\beta = .19$ ,  $P<.01$ , albeit lower than without controlling for plans,  $\beta=.30$ ,  $P<.01$ .

##### Moderated Mediation: Self-efficacy Moderates the Planning-Behavior Relationship

Two regression analyses with centered variables tested the moderated mediation hypothesis. First, intentions predicted plans,  $\beta=.38$ ,  $P<.01$ . Subsequently, physical activity was predicted by intentions,  $\beta=.12$ ,  $P<.01$ , action plans,  $\beta=.26$ ,  $P<.01$ , self-efficacy,  $\beta=.16$ ,  $P<.01$ , and the self-efficacy\*plans interaction

(Moderator\*Mediator),  $\beta=.11$ ,  $P<.01$ , accounting for 16% of the behavioral variance. The significant interaction effect supported the assumption of moderated mediation (Figure 2). Plans partially mediated the intention-behavior relation, and perceived self-efficacy moderated this mediation.

We ran the analyses on the null hypothesis that the conditional indirect effect does not differ significantly from zero at specific values of the moderator. Action plans mediated the effect of intentions on physical activity only if self-efficacy was reported as being higher than 1.5 on a scale from 1 to 4.

Figure 3 shows the magnitude of the conditional indirect effect at all z-values of the moderator with a 95% confidence band. The 2 dotted lines represent the lower and upper boundaries of the region of significance. The indirect effect of intentions on physical activity via plans is significant in cases where this confidence band does not contain zero (region of significance).

**Moderated Mediation of Change: Accounting for Baseline Physical Activity (T1 Behavior)**

The previous analyses have confirmed the partial mediation of the intention-behavior relationship by plans (step 1) and the moderation of this mediation by levels of perceived self-efficacy (step 2). Both analyses predicted T2 physical activity, but not behavioral change so far. To account for T1 behavior, the second step is replicated with inclusion of T1 physical activity as a covariate (step 3). For this purpose, the moderated mediation model was respecified (Model 3, MODMEDC macro).<sup>16</sup>

T1 physical activity emerged as the best predictor of T2 physical activity,  $\beta=.47$ ,  $P<.01$ , followed by action plans,  $\beta=.17$ ,  $P<.01$ , self-efficacy,  $\beta=.06$ ,  $P<.05$ , and intentions,  $\beta=.06$ ,  $P<.05$ . Most importantly, the interaction between plans and self-efficacy stayed significant,  $\beta=.06$ ,  $P<.05$ , which replicated the moderated mediation found previously. Due to the baseline inclusion, a total of 35% of the criterion variance was accounted for. This final analysis also corroborated the above-mentioned mediation effect, conditional upon the value of self-efficacy, underscoring the finding that plans did not translate intentions into behavior within the sub-

group of individuals who had very low levels of self-efficacy.

**DISCUSSION**

Many studies have found evidence that action plans mediate between intentions and behavior, although inconsistent results have also emerged.<sup>7,12,29,30</sup> The purpose of our study was to analyze whether plans (mediator variable) mediate the effect of intentions (independent variable) on behavior (dependent variable) as a function of the underlying level of self-efficacy (moderator variable). Based on theory,<sup>1</sup> we have examined the hypothesis that the moderator operates on the planning-behavior relation, which is statistically reflected by an interaction between plans and self-efficacy. Our study has confirmed the assumption of plans as a partial mediator of the intention-planning relationship for the special case of longitudinal online reports of physical activity (step 1 of the analysis).

The main contribution, however, lies in the extension of the mediator model into a moderated mediator model (step 2)<sup>25</sup> and its replication with T1 behavior as a covariate (step 3). The hypotheses were in line with Bandura<sup>8</sup> that perceived self-efficacy may be a necessary precondition for the putative mediation process. Self-efficacious individuals are optimistic about their capability to resume an exercise regimen after a break, which might help them enact their plans. Therefore, self-efficacious people might be more likely to translate their intentions into action. In other words, action plans do not convert intentions into behavior if a person harbors self-doubts. Only people who report very low self-efficacy (mean value 1.5 or lower on 3 items ranging from 1 to 4) do not benefit from action plans. This attests to the fact that the mediating mechanism works for most people. In other words, planning is a very powerful volitional strategy because it is also beneficial if individuals are only moderately confident that they could take action. Only persons in the subgroup characterized by very low self-efficacy are different.

This leads us to the importance of the study. First, moderated mediation provides a better understanding of the mechanisms of health behavior change. Mediation obviously does not apply to everyone in the same way. For some subgroups of people, a putative causal mechanism does



not hold true. In the present case, this is the subgroup of individuals who are low in self-efficacy, but other researchers have found other relevant moderators, such as sex, age, subjective residual life-expectancy, or intention.<sup>11,15,31-33</sup> Planning helps to translate intentions into behavior particularly well in those individuals with average to high intentions, as they are more likely to act on their plans.<sup>3,21</sup> Also, in a different model of moderated mediation, intention has been specified as an independent variable and as a moderator as well (Model 1).<sup>11,16</sup>

Moderated mediation is a multifaceted phenomenon. There are various statistical models that pertain to particular cases in which a mediation process can be moderated by a third or fourth variable. For our study, we chose a model in which the effect of self-efficacy was specified at the point between planning and behavior, due to the assumption that self-efficacy is very proximal to behavior.<sup>5,34</sup> Further research may compare various moderated mediation models to extend our understanding of the mechanisms of health behavior change in different contexts, for different behaviors, and for different subgroups.

Second, the question arises how the present results can facilitate the design of interventions. It is obvious that people with very low self-efficacy are handicapped when it comes to adopting health behaviors. It is futile to teach them how to plan their behavior better or how to improve their intention levels. They need first to gain more confidence in their own resources in order to change or maintain a healthy lifestyle even when barriers prevail.

Third, our work might help behavior change researchers and practitioners to analyze their data from a novel perspective. It might also stimulate further insight into the mechanisms that are involved in behavior change. Further investigations should replicate the present findings. Especially testing the mediation effects in other behavioral domains, such as nutrition and smoking cessation, might be fruitful. Also, intervention studies may elaborate whether findings hold true in experimental manipulations. For example, one could raise perceived self-efficacy in a group of individuals with low self-efficacy to prepare them for a subsequent second intervention that tar-

gets behavior change by planning. Those who succeed in enhancing their self-efficacy beliefs beyond a predefined threshold should then benefit from the mediating role of plans as opposed to members of a control group who do not receive a self-efficacy preintervention.

Some limitations of our study are to be mentioned. The current data are based on online self-reports. Online studies give researchers the potential to reach large samples of persons with diverse socioeconomic status and age and from different geographic regions.<sup>35,36</sup> Although the validity of self-reports on physical activity appears to be satisfactory,<sup>37,38</sup> and the assessment we used had been validated,<sup>23</sup> further studies of (online) self-reports should replicate the results of this study. Moreover, the data are nonexperimental and longitudinal and thus do not allow for causal inferences. Experimental causal chain designs are needed to examine the intention-behavior mediation by planning.<sup>33</sup>

Nevertheless, our study is innovative because it extends a well-known mediator model by moderating processes. This can be an example for future studies that vary the kinds and number of such moderators, which would help to accumulate further evidence on the mechanisms of health behavior change.

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