Identifying Effective Messages for the Promotion of Physical Activity

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Abstract

Mass-mediated health campaigns have a high reach and are well able to raise awareness about health issues. However, with regards to attitudes and behavior their effects are often limited. One approach to increase the effectiveness of mass-mediated campaigns reposes on theory- and evidence-based development strategies, integrating communication science, cognitive psychology, and health psychology. As part of formative research, behavioral models such as the theory of planned behavior can be referred to in order to identify the relevant behavioral determinants. Against this background, a study including both qualitative interviews (n=10) and a representative telephone survey of 30 to 60 year-old German adults (n=1006) was conducted to identify factors that determine intentions to engage in physical activity. Results indicate that the intention to perform the behavior is most strongly influenced by perceived behavioral control, i.e., adults are more willed to engage in physical activity, if they believe they are able to. Perceived behavioral control is strong, if people have others accompanying them. Considering these results, it is fair to assume that campaigns addressing this aspect should be more effective than campaigns aiming at other components.

Key Words: Physical activity, Campaign development, Theory of planned behavior, Diabetes prevention, Targeting

Introduction

Type 2 diabetes, obesity, as well as associated metabolic and cardiovascular diseases have reached epidemic degrees and have become one of the major health threats in modern society (Kirk, Barnett & Mutrie, 2007). Hence, adequate prevention strategies are needed that are able to reduce incidence rates in the long run. One of the most important strategies to prevent and/or reduce type 2 diabetes and obesity lies in increased physical activity, which has been shown to improve glycaemic control and quality of life and to decrease diabetes risks (American College of Sport Medicine, 2000; Kirk et al., 2007). Still, little is known about the best way to promote physical activity in the population.

In general, health promotion strategies can be divided into two major approaches: Interpersonal measures of health promotion (e.g., doctor-patient-consultations, group trainings) and mass-mediated campaigns, distributed via television, radio, newspapers, magazines, or posters (PSAs). Mass-mediated health campaigns have a high reach and are well able to raise awareness about health issues. However, with regards to attitudes and behavior their effects are often limited (Silk, Atkin & Salmon, 2011; Snyder & Hamilton, 2002). Interpersonal measures of health promotion are more effective, since they address individual knowledge and needs. At the same time, they are limited in reach and cost efficiency. It is a major challenge in health promotion to balance efficiency and wastage, effectiveness and costs.

One approach to increase the effectiveness of mass-mediated campaigns reposes on an integrated strategic campaign development including both a founded definition of the target group and, even more importantly, a theory- and evidence-based development of the campaign message (e.g., Finnegan & Viswanath, 2008). Apart from epidemiological and medical findings regarding the effectiveness of lifestyle and health behavior changes (e.g., increasing physical activity) also results from communication science regarding the use and effects of mass media channels, findings from cognitive psychology regarding information processing and persuasion strategies, as well as knowledge from health psychology explaining the determinants of health behavior are important to consider (Rossmann**,** in press).

Social psychology and health psychology provide several theories that explain (health) behavior and behavioral determinants, e.g., social-cognitive theory (Bandura, 2001), transtheoretical model (Prochaska, Redding, & Evers, 2008), health belief-model (Champion & Skinner 2008), and theory of planned behavior (TPB, Ajzen 2005; Fishbein & Ajzen, 2010). Basically, each theory is useful to determine the relevant factors of a specific behavior. However, the well-established TPB together with its persecutor in the health domain, the integrated behavioral model (IBM, Montano & Kasprzyk, 2008), provide a particularly good theoretical starting point. As compared to other behavioral theories, TPB and IBM are better able to identify the main factors and underlying beliefs determining behavioral intentions and behavior. Hence, referring to TPB and IBM enables health scholars to

measure the determinants of health behaviors, e.g., physical activity, very precisely. Indeed, many studies confirmed the TPB in the context of physical activity behaviors (e.g., Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997). Therefore, this study is based on the theory as well. Specifically, this study aims to test the applicability of the TPB and the IBM to physical activity intentions in Germany and to identify the most important factors determining intentions to engage in physical activity among 30 to 60 year-old German adults.

Theory of Planned Behavior and Integrated Behavioral Model

According to the TPB, behavior (e.g., physical activity) depends on the intention to perform the behavior (e.g., "Do I want to engage in physical activity?") in the first place (see e.g., Ajzen, 2005; Fishbein & Ajzen, 2010). The intention to perform a behavior is driven by three specific components: attitudes towards the behavior (e.g., "Is it good to engage in physical activity?"), subjective norm (e.g., "Do important others think it is good to engage in physical activity?", "Are important others engaged in physical activity?") and perceived behavioral control (e.g., "Am I able to engage in physical activity?"). These three components are determined by specific beliefs. Attitudes towards the behavior depend on so called behavioral beliefs, which consist of perceived consequences of a behavior (e.g., "Physical activity makes me feel better.") and the evaluation of these consequences (e.g., "It is good to feel better."). Subjective norms describe the perceived social pressure to perform a specific behavior. They are a function of normative beliefs, i.e., a person's belief that important others approve or disapprove of performing the behavior (e.g., "My husband thinks it is good to engage in physical activity."), the belief that important others are engaged or not engaged in the behavior (e.g., "My husband is engaged in physical activity."), and the motivation to comply with the others (e.g., "It is important to me what my husband thinks."). Perceived behavioral control, the third major determinant of intentions, is a function of so called control beliefs, which are based on perceived factors facilitating or impeding the performance of a behavior (e.g., "I don't have time to engage in physical activity.") and the perceived power of the factor to facilitate or inhibit the performance of the behavior (e.g., "Having no time hinders me very strongly to engage in physical activity."). Background factors, such as media influences, demographic attributes, or general values are assumed to influence people's behavioral beliefs affecting behavior or behavioral intentions indirectly (cf. Ajzen, 2005: 135).

The IBM (Montano & Kasprzyk, 2008) is based on the TPB but specifies the behavioral control component and integrates some further determinants. Specifically, the behavioral control component is divided into two dimensions, namely perceived behavioral control as defined in the TPB, and self-efficacy as known from the social cognitive theory (Bandura, 2001). Furthermore, the IBM adds further factors assumed to directly affect behavior, such as knowledge and skills, salience, and habit (Montano & Kasprzyk, 2008).

TPB/IBM and physical activity

In the past decades numerous studies and several meta-analyses have been conducted which confirm the assumptions of the TPB for different issues both in the health domain and in other contexts (see e.g., Albarracín et al, 2001; Armitage & Conner, 2001; Sheeran & Taylor, 1999; Sheppard, Hartwick & Warshaw, 1988; for an overview, see Fishbein & Ajzen, 2010; Rossmann, 2010). Research also confirms the TPB in the context of physical activity behaviors. Based on a meta-analysis of 31 studies Hausenblas et al. (1997) concluded that physical activity could well be explained by the TPB components. Hagger et al. (2002) confirmed the TPB in their meta-analysis of 72 studies as well, however, they found that past behavior and self-efficacy improved the model. It was able to explain 60% of the variance for intentions to engage in physical activity and 47% of the variance for actual behavior. Downs and Hausenblas (2005) conducted a further meta-analysis of 111 studies and confirmed the ability of the TPB to explain physical activity. Further studies supported the model for different ethnic groups (see e.g., Bourdreau & Godin 2009; Kwan et al., 2009; Plotnikoff, Courneya, Trinh, Karunamuni & Sigal, 2008, for Canada; Blanchard et al., 2008, for the USA; Guinn, Vincent, Jorgensen, Dugas, & Semper, 2007, for Mexican women; Nigg, Lippke, & Maddock, 2008, for different ethnic groups), for younger (Blanchard et al., 2008; Keats, Culos-Reed, Courneya, & McBride, 2007; Kwan et al., 2009) and older individuals (Conn, Tripp-Reimer, & Maas, 2003; Fabio, Grano, Barbaranelli, & Violani, 2006; Gretebeck et al., 2007), individuals with overweight (Godin, Amireault, Bélanger-Gravel, Vohl, & Pérusse, 2009), cancer patients (Keats et al. 2007) as well as individuals suffering from type 1 or type 2 diabetes (White, Terry, Troup, & Rempel, 2007; Plotnikoff et al., 2008; Plotnikoff, Karunamuni, & Brunet, 2009; Plotnikoff et al., 2010; Bourdreau & Godin, 2009).

TPB/IBM and campaign development

Against this background, TPB and IBM provide fruitful theoretical tools for the development of health campaigns to promote physical activity. Specifically, the models can be applied to formative research in order to identify the most important determinants of health behaviors, such as physical activity, together with the underlying behavioral, normative, and control beliefs. Even if research indicates that behavioral intentions are generally influenced by attitudes, subjective norms, and perceived behavioral control, one can assume that the individual effect sizes for the three components vary. Accordingly, research showed subjective norms to have a smaller impact on intentions as compared to the other two components (see e.g., Singh, Leong, Tan, & Cheong Wong, 1995). In addition, scholars observed different effect sizes as a function of the subgroup under consideration (see e.g., Trinh, Rhodes, & Ryan, 2008, for differences between women and men; Plotnikoff et al., 2009, for differences between patients with type 1 and type 2 diabetes). Therefore, it is crucial to know which of the

determinants influences behavioral intentions most strongly in order to decide which campaign message to choose. Assuming, for instance, that perceived behavioral control has a strong impact on intentions to engage in physical activity, whereas attitudes and subjective norms are only marginally related to intentions, it will be reasonable to address a campaign to the perceived behavioral control component and to examine in the next step which control beliefs are most strongly related to the control dimension. In this way, it is possible to decide which factors, i.e., which message contents, will be most effective in changing health behavior.

Maddock, Silbanuz, and Reger-Nash (2008) applied this strategy to the identification of effective messages for a mass-mediated health campaign to promote physical activity. At first, the authors conducted a TPB study in order to find out which of the TPB components had the strongest impact on intentions to go for a walk at least 30 minutes per day within their specific target group. Their results indicated perceived behavioral control to be the strongest determinant of regular physical activity. Perceived behavioral control in turn depended most strongly on lack of time, i.e., the more people felt they didn't have enough time to go for a walk each day the less they felt able to perform the behavior. Against this background, the authors developed the so called „Step it up"-campaign. The central message of this campaign was: it is easy to go for a walk at least 30 minutes per day if you separate the time span into three 10 minute-walks (see Hawai Department of Health, 2009). A row of evaluations in various health domains have demonstrated interventions addressed to one of the TPB components as described above to be effective in changing different health behaviors (Albarracín et al., 2003; Jemmott, Jemmott, & Fong, 1992; Kalichman, 2007; Kamb et al. 1998; Rhodes, Stein, Fishbein, Goldstein, & Rotheram-Borus, 2007).

Target group

The present study is aimed at identifying effective campaign messages for the promotion of physical activity among 30 to 60 year-old German adults. Reasons behind this specification were threefold: (1) Within this age-group a considerable number of individuals have already developed risk factors for type 2 diabetes but do not yet suffer from type 2 diabetes. Therefore, it is important to change physical activity behavior at that age. (2) At the same time, there is a higher chance to change lifestyle behaviors within this age-group as compared to older people. (3) Further, when considering 30 to 60 year-old adults we are dealing with a rather homogenous target group with regards to phase of life, occupation, and family status. Attributes that are important for the development of successful campaign messages, such as lifestyle and media use habits, will be rather similar enabling us to reach the target group through the same messages.

Research questions

A successful campaign requires empirical evidence on the influence of behavioral determinants on health behavior, e.g., the TPB components, within a specific target group. For instance, Maddock et al., (2008) demonstrated that time is a crucial factor for engaging in physical activity behavior among young adults. However, with regards to older people one can assume that health problems play a more important role. So far, we do not know whether and how the TPB components explain physical activity of adults between 30 and 60 years. Against this background, the present study seeks to find out which determinants explain intentions to engage in regular physical activity of 30 to 60 year-old adults in Germany. Specifically the study seeks to answer the following research question:

RQ1. Which of the TPB components (attitudes towards behavior, subjective norms, perceived behavioral control) has the strongest influence on intentions to engage in physical activity?

As research demonstrates, behavior and behavioral intentions are not only determined by attitudes towards behavior, subjective norms, and perceived behavioral control. Also other factors, such as self-efficacy, knowledge, salience, past behavior, and habit might influence intentions and behavior (e.g., see IBM, Montano & Kasprzyk, 2008). Furthermore, we assume several background factors to play a role in the context of type 2 diabetes and physical activity, such as demographic attributes (age, gender, education, occupation, income), perceived diabetes risk, determinants of risk perception (reactance, optimistic bias, third person effects) and media use (see e.g., Ajzen, 2005; Rossmann, 2010).

RQ2. How stable is the impact of the TPB components after controlling for further factors, namely self-efficacy, knowledge, salience, past behavior, and habit, and for background factors, namely demographic attributes, perceived diabetes risk, determinants of risk perception, and media use?

The TPB assumes attitudes, subjective norms, and perceived behavioral control to be influenced by specific beliefs underlying the components. In order to identify suitable campaign messages we want to find out which beliefs determine the TPB components.

RQ3. Which of the behavioral beliefs, norm beliefs, and control beliefs have the strongest impact on the TPB components?

Method

In order to identify the relevant behavioral, norm, and control beliefs we conducted qualitative interviews with 10 German adults aged between 30 and 60 years. They were evenly distributed in respect to gender, education, and body weight. 2 of 10 participants suffered from type 2 diabetes. This gave us the opportunity to identify diabetes-specific beliefs about physical activity behavior. The audio-

taped interviews were transcribed, categorized, and finally summarized. The most frequent answers were considered for the next step of the study and thus served as a basis for the quantitative survey (see table 4 in the results section for the selected items). For instance, with regards to perceived consequences of regular physical activity (behavioral beliefs) the participants mentioned 'I feel better', 'I am in a better mood' or 'I lose weight' fairly often, important others (normative beliefs) were partners, children, parents/siblings, colleagues, and friends, factors facilitating or impeding the performance of physical activity (control beliefs) were, e.g., 'Being active with someone else', 'Having people who motivate me' or 'Being close to exercise facilities' as well as 'Being physically active is expensive', 'Being physically active is time consuming' or 'Suffering from physical discomfort', respectively.

As a second step, computer-aided telephone interviews were conducted with a representative sample of German adults between 30 and 60 years. The respondents were selected randomly in a two-step selection process and were interviewed for about 30 minutes. Altogether, 1006 respondents participated in the survey. Although the response rate was low (12.6%), the sample is nearly representative for German adults between 30 and 60 years considering age (M = 46.36; SD = 7.82) and gender (51.59% female; 48.41% male). However, education, occupation, and income were biased towards higher education levels, higher occupation rates, and higher incomes (see table 1). After weighting for household size, age, gender, and education our sample reached a satisfying degree of representativeness.

Table 1. ***Sociodemographic Attributes of the Sample vs. German Population***

	Sample (unweighted)	Sample (weighted)	German Population	
Age	46	45	45	years
Gender	48%	50%	50%	male
	52%	50%	50%	female
Education	52%	80%	80%	low
	48%	20%	20%	high
Occupation	86%	86%	86%	employed
	14%	16%	25%	unemployed
Income	26%	25%	38%	less than 2000 Euro
	74%	75%	62%	more than 2000 Euro

Note. N (sample) = 1006 respondents between 30 and 60 years, N (German Population) = 82 Mio.

The TPB components (behavioral intentions, attitudes towards physical activity, subjective norms, perceived behavioral control, as well as behavioral, normative, and control beliefs) were collected following the guidelines to the measurement of TPB constructs as provided by Ajzen (2006; see also Rossmann, 2010). In respect to behavioral intentions, the respondents had to answer two questions treated as single items: Firstly, respondents had to indicate their general intention to engage in physical activity for at least 30 minutes several times a week. Secondly, the respondents had to indicate on how many days per week they intended to engage in physical activity for at least 30 minutes. Attitudes towards being physically active were assessed using a list of eight adjectives (good, healthy, pleasant, useful, fun, not useful, strenuous, and harmful), which represent instrumental and experiential aspects of attitudes as well as an overall evaluation. These items formed the attitude index (SD = .51). Subjective norms were assessed using two items for descriptive and injunctive norms and were measured with a 5-point scale (SD = 1.09). Perceived behavioral control was measured with two items ("Do you think you will be able to engage in physical activity 30 minutes per day in the near future?"; "Do you think you can control whether you will engage in physical activity 30 minutes per day in the near future?"). In spite of the fact that reliability was low here (α = .27), a mean index was computed (M = 3.76; SD = .90) because the items are theoretically grounded in the TPB and measure two different aspects of perceived behavioral control. The items for behavioral, normative, and control beliefs were extracted from the results of the qualitative interviews and were measured using 5-point scales (for a list of all items see the left column of table 4).

Further, we collected data on additional determinants postulated in the IBM, namely self-efficacy (10 items; 5-point scale from 1 (*totally disagree*) to 5 (*totally agree*); α = .84; M = 3.84; SD = .53; German self-efficacy scale, see Schwarzer & Jerusalem, 1999), habit (3 Items; 5-point scale from 1 (*totally disagree*) to 5 (*totally agree*); α = .77; M = 4.16; SD = .89; see Verplanken & Orbell, 2003), knowledge about causes and consequences of diabetes (summative index of 7 questions ranging from 0 (*no true answer*) to 7 (*all answers true*), M = 5.58; SD = 1.39), health prevention behavior (α = .79; M = 3.34; SD = .85), and past physical activity behavior (average number of days per week with physical activity for at least 30 minutes;

light, moderate or strenuous activity; means and standard deviations see below; Godin Leisure-Time Exercise Questionnaire, see Godin & Shephard, 1985). For the background factors participants had to indicate demographics, media use behavior, their personal diabetes risk (*Min* = 0.00; *Max* = 17.00; *M* = 5.26; *SD* = 3.21; Find Risk-Scale, see Deutsche Diabetes-Stiftung, 2010) as well as reactance (3 items; 5-point scale from 1 (*totally disagree*) to 5 (*totally agree*); $\alpha = .56$; $M = 3.47$; $SD = .80$; based on Hong & Faedda, 1996), third person perception (difference of two items for self and others; $M = -.78$; $SD = 1.30$; see e.g., Perloff, 1993; Paul, Salwen, &Dupagne, 2000), and optimistic bias (1 item; 5-point scale; $M = 2.24$; $SD = 1.00$; Chapin, 2000).

Results

On the average, German adults engage in physical activity five days a week for at least 30 minutes (*M* = 4.90; *SD* = 2.02 days/week). However, it is important to recognize that a very broad definition of physical activity was introduced which suggests physical activity to include any type of sportive exercises, as well as other activities, such as going for a walk, exhausting indoor work, gardening, etc. – generally spoken, activities that increase one's heart beat and respiratory rate. Accordingly, the respondents mentioned indoor work, gardening, going for a walk, and work most frequently in an open-ended question about the specific type of physical activity they were thinking of. By contrast, average activity levels decreased remarkably, when considering light (*M* = 2.40; *SD* = 2.51 days/week), moderate (*M* = 1.72; *SD* = 1.96) or strenuous (*M* = 1.13; *SD* = 1.45) sportive activities only.

In the next step, we examined which factors determined people's intentions to engage in physical activity. Specifically, we computed multiple and hierarchical regression analyses in order to find out which of the TPB components (attitudes towards the behavior, subjective norms, perceived behavioral control) had the strongest influence on intentions. In this way, we were able to identify influences of independent variables on a dependent variable over and above third variable influences and to quantify and compare variance shares explained by the independent attributes. Our analyses revealed a consistent pattern: Altogether, the TPB components explained people's intentions at least in part ($R^2 = .21$; $p < .01$ for the general intention, $R^2 = .10$; $p < .01$ for the intended frequency), whereas the impact of perceived behavioral control was considerably stronger as compared to attitudes and subjective norms ($\beta = .39$; $p < .01$ for the relationship between perceived behavioral control and general intention, $\beta = .28$; $p < .01$ for the relationship with the intended frequency).

As suggested by the IBM, behavioral intentions might also be determined by factors other than attitudes, subjective norms, and perceived control. Therefore, we computed stepwise hierarchical regressions controlling for the influence of background factors and including the impact of knowledge, habit, self-efficacy, precautionary behavior, and past behavior. As table 2 indicates, the observed relationships for the TPB components remained stable.

After controlling for the background factors, attitudes, subjective norms, and perceived behavioral control explained 18% of the variance for general intentions to engage in physical activity and 7% of the variance for the intended frequency. Again the influence of perceived behavioral control was considerably stronger as compared to the other two components. Only few significant relationships could be observed for the other factors. As was expected, habit and past behavior correlated positively with the intended frequency of physical activity, in that individuals intended to engage in physical activity more often the stronger physical activity was habitualized and the more they had been engaged in physical activity in the past. However, perceived behavioral control was still the key determinant of both general and specific intentions to engage in physical activity after controlling for background factors. That is, people's intention to engage in physical activity depended mainly on the question whether people were convinced to be able to.

Table 2 ***Influence of Model Components on Intentions to Engage in Physical Activity***

	General Intentions	Specific Frequency
1. Socio-demographic attributes		
Sex	*-.02*	*-.01*
Age	*.00*	*.13***
Education	*-.12***	*-.01*
Occupation	*-.02*	*-.08*
Income	*.05*	*-.06*
R^2 change	*.02*	*.03***
2. Diabetes risk	*.06*	*.03*
R^2 change	*.00*	*.00*
3. Risk perception bias		
Optimistic bias	*-.02*	*.07*
Third person effect	*.04*	*-.02*
Reactance	*.01*	*-.00*
R^2 change	*.00*	*.00*
4. Media use		
Television	*-.02*	*-.12***
Radio	*.07*	*.05*
Internet	*-.02*	*-.02*
Newspapers	*-.05*	*.03*
Magazines	*.03*	*-.04*
R^2 change	*.01*	*.02*
5. IBM components		
Knowledge	.00	*.00*
Self-efficacy	.01	*.06*
Precaution	.06	*-.02*
Habit	.11*	*.18***
Past behavior	-.10*	*.21***
R^2 change	*.02**	*.09***
6. TPB components		
Attitudes	*.06*	*.07*
Subjective norms	*.16***	*.02*
Perceived behavioral control	*.37***	*.25***
R^2 change	*.18**	*.07***
Adjusted R^2	**.23****	**.17****

Note. Hierarchical Regression, general intentions (*N*=683), specific frequency (*N*=540), sex (1=male, 2=female), education (0=low, 1=high), occupation (0=no, 1=yes), income (1=under 2000€ per month, 2=2000€ and more), media use (television, radio: in minutes per day; Internet: 1=no, 2=yes; newspaper: days per week; magazines: number per month), IBM components (= further factors in the Integrated Behavioral Model).
* *p*< .05, ** *p*< .01.

The main purpose of this study was to identify appropriate key messages for motivating 30 to 60 year old adults to engage in physical activity. One reason to examine this specific target group was the assumption that it should be rather homogenous according to the behavioral determinants. In order to confirm this assumption we split the sample into various subgroups (male vs. female, 30 to 45 years vs. 46 to 60 years, low vs. high education, low vs. high diabetes risk, low activity vs. high activity) and computed hierarchical regression analyses as described above separately for the subgroups. As table 3 shows, the three TPB components explained between 4% and 10% of the variance of the intended frequency to engage in physical activity over and above the influences of background factors and further influences described in the integrated behavioral model. Even if the size of the beta-coefficients varied between the subgroups, perceived behavioral control remained the strongest determinant of behavioral intentions in all groups.

Table 3 ***Influence of Model Components on Intended Frequency to Engage in Physical Activity in Various Subgroups***

	Attitudes	Subjective Norms	PBC	R^2 *change*	*Adjusted* R^2
Male (*N* = 265)	.07	-.05	.19**	.04*	.23**
Female (*N* = 273)	.05	.06	.31**	.10**	.26**
30 to 45 years (*N* = 264)	.05	-.06	.30**	.08**	.23**
46 to 60 years (*N* = 274)	.09	.07	.22**	.06**	.24**
Education low (*N* = 281)	.11	-.02	.28**	.08**	.25**
Education high (*N* = 275)	.04	.04	.21*	.05*	.23**
Low diabetes risk(*N* = 315)	.04	.06	.20**	.04*	.17**
High diabetes risk(*N* = 223)	.11	.01	.28**	.08**	.31**
Low activity (*N* = 93)	.10	-.06	.27*	.07	.07
Higher activity (*N* = 445)	.08	.03	.25**	.07*	.21**

Note. Hierarchical Regression, each row in the table shows the beta coefficients of the 6th step in the regression after controlling for socio-demographic attributes, diabetes risk, risk perception bias, media use, and IBM components, R^2 change refers to the three TPB components attitudes, subjective norms, and perceived behavioral control, adjusted R^2 refers to the complete model.
* p < .05, ** p < .01.

In the next step, we analyzed the behavioral, norm, and control beliefs underlying the TPB components. We computed multiple regression analyses with the beliefs (as independent variables) and each of the components (as dependent variables). Objective of this procedure was to identify the relevant beliefs underlying people's perceived behavioral control as a starting point for the development of effective campaign messages aimed at changing the target group's intentions to engage in physical activity effectively. Therefore, we applied this procedure not only to the total sample but additionally computed this step separately for two specific risk groups most in need to be reached: 1) adults with an increased risk to develop type 2 diabetes (*N* = 405), 2) adults engaging in physical activity less than three times a week ("low activity", *N* = 175).

Overall, the relationships between the behavioral, normative, and control beliefs and the corresponding TPB components were weak. Nevertheless, the results indicate some of the beliefs to be more important as compared to others within specific risk groups. Specifically, we found a considerable relationship between perceived behavioral control and the belief that it is easier to engage in physical activity if one can do that with other people, both for adults with an increased diabetes risk and for the low activity group. People high at risk for type 2 diabetes as well as less active adults had a higher confidence in their ability to be physically active if other people joined them and if they found that important for engaging in physical activity. In addition, relationships between beliefs and the other TPB components suggested commonness to be a fruitful starting point. Among the normative beliefs, we found partner and friends to be more important than other groups. In addition, people's attitude towards engaging in physical activity depended mainly on affective beliefs (e.g., mood, stress reduction), while instrumental arguments (e.g., weight reduction, disease prevention) only played a minor role (see table 4).

Table 4 ***Influence of Behavioral, Norm, and Control Beliefs on the TPB Components***

Attitudes	Total	High risk	Low activity
Behavioral beliefs			
I feel better.	*.08**	*.08*	*.15*
I am in a better mood.	*.20***	*.15**	*.20**
I lose weight.	*-.06**	*-.02*	*-.16**
I reduce everyday stress.	*.11***	*.11*	*.30***
I am in better physical shape.	*.04*	*-.01*	*-.03*
I prevent diseases.	*.12***	*.06*	*-.02*
I have less time for other things.	*.01*	*.00*	*.15**
I have more stress.	*-.14***	*-.07*	*-.10*
I meet other people.	*.05*	*.01*	*.09*
Adjusted R²	**.23****	**.09****	**.26****
Subjective norms	(*N* = 497)	(*N* = 197)	(*N* = 82)
Normative beliefs			
Partner * motivation	.28**	.37**	.30*
Children * motivation	-.16*	-.09	.11
Parents, siblings * motivation	-.09	-.10	-.07
Colleagues * motivation	.11	.18*	-.09
Friends * motivation	.18**	.12	-.07
Adjusted R²	**.10****	**.16****	**.04**
Perceived behavioral control	(*N* = 951)	(*N* = 378)	(*N* = 166)
Control beliefs			
Being physically active is expensive * power	.02	.01	-.05
Being physically active with someone else * power	.06	.12*	.21*
Having people who motivate me * power	.00	-.05	.05
Being physically active is time consuming * power	.07*	.06	.08
Suffering from physical discomfort * power	.04	-.03	.02
Having to conquer one's inner self * power	-.04	-.05	-.06
Being close to exercise facilities * power	.01	.02	-.06
Negative consequences for health * power	-.05	.02	-.04
Having a regular schedule * power	-.01	-.01	-.07
Others may smile at me * power	.00	.10	-.02
Adjusted R²	**.00**	**.00**	**-.01**

Note. Multiple Regressions, total (*N* = 990), high risk (*N* = 395), low activity (*N* = 171).
* *p* < .05, ** *p* < .01.

Discussion

Research has amply demonstrated that the TPB components are able to explain physical activity intentions and behavior. The results of the present study confirmed these findings. Other factors showed only minor influences on behavioral intentions. The crucial determinant of people's intention to engage in physical activity was perceived behavioral control indicating that adults between 30 and 60 years were more willing to be physically active, if they believed they were able to. These results found for the German population between 30 and 60 years of age are in line with results found in previous studies and for other populations.

In various countries worldwide the TPB determinants have been shown to be good predictors of physical activity intentions and behavior (see e.g. meta-analyses conducted by Downs & Hausenblas, 2005; Hausenblas et al., 1997; Hagger et al., 2002; Plotnikoff et al., 2013). However, the strength of the associations between behavioral determinants and behavioral intentions varied. Whereas subjective norms played only a minor role in most studies, as was observed here, some studies found that attitudes determined intentions to engage in physical activity most strongly as opposed to the results of this study (e.g., Everson, Daley, & Ussher, 2007; Kwan et al., 2009; Murnaghan et al., 2010), and others found perceived behavior control to be the strongest predictor in line with this study (e.g., Conn et al. 2003; Fabio et al., 2006; Gretebeck et al., 2007). It is reasonable to assume that this difference can be explained by the particular age-group under consideration, i.e., whereas attitudes play the most important role for younger target groups, perceived behavioral control becomes more important when growing older (see also Downs & Hausenblas, 2005). Hence, it can be assumed that campaigns aimed at younger adults should be effective when they address attitudes, whereas campaigns aimed at promoting physical activity among older adults should focus on perceived behavioral control. However, more research is needed to draw a general conclusion for differences between age-groups and similarities or differences between cultures.

In addition, we examined the relevant behavioral beliefs for the target group under consideration and found that perceived behavioral control was strong, if people at risk for diabetes had others accompanying them and found this important. Against this background, it can be assumed that campaigns addressing perceived behavioral control in combination with companionship/ community/friends should be more effective than campaigns addressing knowledge, attitudes, or subjective norms. However, comparing the results for behavioral beliefs with previous studies it becomes evident that they can't be generalized for other

populations. Conn et al. (2003) examined behavioral beliefs regarding physical activity behavior for older women in the USA and identified being not committed to exercise and being too tired as most important control beliefs. Keats et al. (2007) found that lack of ability and physical limitations were the most important control beliefs for adolescent cancer survivors in Canada, and Trinh et al. (2008) identified physical ability and opportunity as most important control beliefs for Canadian boys and girls. With regards to behavioral beliefs the results depend on the target group and should therefore be interpreted against the background of the specific sample under consideration, as was done here by conducting qualitative interviews in the first step. This is the reason, why formative research is so important in order to address a specific target group with adequate messages.

Our study has to face several methodological limitations: Firstly, as indicated above the response rate was low, so that the sample is not exactly representative for German adults between 30 and 60 years. Only after weighting for household size and several demographic attributes, the sample was fairly representative. Secondly, the correlation between past behavior and general intentions to engage in physical activity revealed an unexpected negative relationship. We assume that at least some of the respondents misinterpreted the German word for "several times a week" as "more often than in the past". Therefore, the later analyses focused on the more specific intended frequency of engaging in physical activity. Thirdly, a full scale TPB study needs a long-term design with at least two measurements: The first one collecting the data on determinants of behavior, the second one measuring behavior. Only in this manner, it is possible to prove causal relationships between predictors of behavior and actual behavior. However, due to limited resources we were not able to conduct a long-term study. For this reason, this study merely concentrated on the explanation of behavioral intentions. However, TPB research indicates that the relationship between behavioral intentions and actual behavior is usually high enough to assume that we can explain actual behavior by knowing the determinants of behavioral intentions (see e.g., Sheeran, 2002).

Conclusion

In spite of the methodological limitations, the results indicate that the intention to engage in physical activity is influenced most strongly by perceived behavioral control and that perceived behavioral control is strong, if people have others accompanying them. Considering these results it is fair to assume that campaigns addressing this aspect should be more effective in this target group than campaigns aimed at other components.

However, knowing only the message content will not guarantee an effective campaign. In the next step, theories from cognitive psychology and communication science as well as empirical evidence on media use patterns of the target group in question have to be considered in order to decide how to present the message, whether and how to use images or slogans, whether to confront the target group with humoristic, fear, or other appeals, and whether to disseminate the campaign via information or entertainment programs on television, newspaper, or posters. Also these steps need to be prepared carefully against the background of theoretical knowledge as well as empirical evidence. Finally, no matter how well a campaign is planned and developed, its effectiveness can only be justified by conducting evaluation studies in a randomized controlled trial. By now it can only be argued that the campaign message was identified carefully, its effectiveness has to be proven.

Beyond methodological and practical implications, the present study has theoretical relevance. While TPB claims sufficiency of the described TPB components in explaining behavioral intentions and behavior (see e.g., Conner & Armitage, 1998), IBM suggests that attitudes towards behavior, subjective norms, and perceived behavioral control are *not* sufficient in explaining behavior in the health domains. In addition, past behavior, habit, salience of the behavior, and knowledge have to be considered (see Montano & Kasprzyk, 2008). Indeed, our results indicate that habit and past behavior increase the explained variance of behavioral intentions at least slightly, whereas knowledge and salience of the behavior seem to be irrelevant. For future studies in the health communication area, our results suggest to add components of IBM into a theoretical model based on TPB components.

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