Published in final edited form as:

J Health Commun. 2016 September ; 21(9): 1006–1015. doi:10.1080/10810730.2016.1204378.

The Moderated Influence of Perceived Behavioral Control on Intentions among the General U.S. Population: Implications for Public Communication Campaigns

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Abstract

This study reports results from a large population-based survey of U.S. adults showing perceived behavioral control (PBC) moderations of associations between (1) attitude and intention, and (2) perceived norms and intention to engage in six health behaviors. Results are based on data collected from a nationally representative sample of U.S. adults ages 40-70 (N=2,489) and extend understanding of how behavioral theory can be used to guide the design and evaluation of health communication campaigns. OLS regression analyses show evidence for a significant positive PBC moderation of (1) attitude and intention, and (2) perceived norms and intention such that attitude or perceived norms toward the behavior is more strongly associated with behavioral intention among participants reporting higher levels of PBC. Implications for message design and the evaluation of communication campaigns are discussed.

Advancing knowledge of the factors that shape intention and behavior is important for developing a sound foundation for the design, implementation, and evaluation of effective public communication campaigns (Atkin & Freimuth, 2013). The ultimate goal of public communication campaigns is to influence individuals and to change behavior (Atkin & Rice, 2012; Randolph & Viswanath, 2004). However, research examining the effects of media campaigns has shown that behavior change can be an elusive and challenging goal for many campaigns (e.g., Snyder & Hamilton, 2004). Campaigns can change behavior at the individual-level, the social-level, and/or the institutional-level (Hornik & Yanovitzky, 2003). The majority of campaigns aim to change behavior at the individual level, and must account for the specific individual factors which underlie behavioral intention and behavior among a given target population. Formative research on factors that account for intention and behavior can provide this critical information, enhancing the efficacy of media campaigns as well as informing the design of effective campaign messages (Rossi, Lipsey, & Freeman, 2003).

There are a range of behavioral change theories which have been widely used to guide the design of communication campaigns. Theories such as the transtheoretical model (DiClemente & Prochaska, 1982; Prochaska, DiClemente, & Norcross, 1992; Prochaska, 2013), and social cognitive theory (Bandura, 1977, 2011), among others, have been applied to model the process of expected campaign effects, and to guide measurement and evaluation. In fact, proper theoretical specification is essential for the evaluation of public communication campaigns (Valente & Kwan, 2012). The reasoned-action approach or the integrative model of behavior change (Fishbein, 2000; Fishbein, Cappella, Hornik et al., 2002; Fishbein, 2008; Fishbein & Ajzen, 2010) has been used in a number of health campaigns to guide the design of effective messages and the evaluation of campaign effects (e.g., Hornik & Yanovitzky, 2003). This theoretical framework is employed in the current study to examine intention to perform six behaviors related to cancer control. Prior research has identified the behavioral determinants of a number of cancer control behaviors (see McLallen & Fishbein, 2008). In contrast to previous research using this framework (e.g., Smith-McLallen & Fishbein, 2008; Fishbein, 2008), the current study contributes to research on the reasoned-action approach by testing theorized interactions between one of the model's main constructs – perceived behavioral control (PBC) – and the two other principal constructs – attitudes and perceived norms. Building on the results of Smith-McLallen and Fishbein (2008), we extend the findings by testing PBC-moderated interactions within the reasoned-action approach in the context of cancer control behaviors.

Theoretical Background

The reasoned-action approach (Fishbein, 2000; Fishbein et al., 2002; Fishbein, 2008; Fishbein & Ajzen, 2010) identifies the most proximal determinants of behavior, and explains how they operate to predict volitional behaviors. When considering the influences that shape human behavior, the reasoned-action approach states that behavioral intention is the most important predictor of behavior. According to this theoretical model, *behavioral intention* refers to the strength of a person's intention to perform a behavior.

Within the reasoned-action approach, behavioral intention is determined by three principal factors: an individual's (1) attitude towards the behavior; (2) perceived norms about the behavior; and (3) perceived behavioral control (PBC) regarding the performance of the behavior. *Attitude*, the first predictor, is a function of perceived desirability and likelihood of expected outcomes, and has been demonstrated to be a strong predictor of some of the behaviors under study here (Nejad, Wertheim, & Greenwood, 2004; Smith-McLellan & Fishbein, 2008; Payne, Jones, & Harris, 2004; Fishbein, 2008).

The second predictor of behavioral intention is perceived norms, the “perceptions of what others think one should do as well as perceptions of what others are doing” (Fishbein, 2000, p. 275). The conceptualization of perceived norms in the reasoned-action approach is comprised of two types of norms. The first refers to *subjective norms*, or perceptions regarding what important others think should to be done; the second – *descriptive norms* – captures the perception of what is typically done by others. Within the original theory of reasoned action (TRA: Fishbein & Ajzen, 1975)/theory of planned behavior (TPB: Ajzen, 1991) framework, only perceptions of subjective norms were measured. However,

subsequent studies using theories such as the theory of normative social behavior (Rimal & Real, 2003; 2005) found evidence suggesting that descriptive norms exert significant influence over behavior (Lapinski, Rimal, DeVries, & Lee, 2007; Rimal, 2008).

Furthermore, measures which combine both types of norms have been found to explain additional variance in behavioral intention previously not accounted for by a measure of subjective norms alone (e.g., Albarracin, Fishbein, & Middlestadt, 1998; Rhodes & Courneya, 2003; Sayeed, Fishbein, Hornik, Cappella, & Ahern, 2005).

In previous research using the same data as the current study, perceived norms were shown to be a significant predictor of all of the prevention and screening behaviors (Fishbein, 2008; Smith-McLellan & Fishbein, 2008) included in this study. This study re-analyzes the data previously published by Fishbein (2008) and Smith-McLellan & Fishbein (2008) to identify the presence of previously untested PBC-moderated interactions.

Perceived Behavioral Control (PBC) refers to an individual's confidence in his/her abilities to correctly perform the behavior in question (Ajzen, 1991; Bandura, 1986). Like attitude and perceived norms, PBC is considered the third proximal predictor of behavioral intention (Fishbein, 2000; Fishbein et al., 2002; Fishbein, 2008; Fishbein & Ajzen, 2010). Along with attitude and perceived norms, PBC represents another important predictor of cancer control behaviors among adults (Smith-McLellan & Fishbein, 2008). One important contribution of the reasoned-action approach relates to the role of PBC, as well as actual behavioral control, in shaping behavior. Actual behavioral control may be comprised of skills and environmental constraints, and is theorized to influence PBC and moderate the intention-behavior relation. Fishbein and Ajzen (2010) note that although stronger intentions generally lead to increased likelihood of performing a behavior, when actual behavioral control is low (e.g., lack of essential skills or presence of environmental barriers) individuals may be precluded from carrying out their intentions. This implies that skills, abilities, environmental barriers and facilitators need to be assessed in order to fully understand when a behavior is likely to occur. However, although these changes were added to the integrative model, our study only examines behavioral intention and constructs that precede it. As the role of environmental factors, skills, and actual behavioral control follows behavioral intention, these factors fall outside the scope of our study.

Like previous reasoned-action models, such as the theory of planned behavior (Ajzen, 1991; Ajzen, 2011), the reasoned-action approach aims to predict behavior, and to account for behavior change. Although it does not provide explicit guidance with regard to the construction of persuasive messages, it can offer direction as to what elements a message should contain (Fishbein & Yzer, 2003). By identifying the central factors underlying intention and behavior (e.g., attitude, perceived norms, or PBC), the reasoned-action approach can inform message strategy in health communication campaigns by focusing message content to target the most influential determinant of intention. More specifically, salient beliefs (e.g., 'smoking will increase my risk of lung cancer') which underlie the most important determinant (e.g., attitude toward smoking cessation) in a specific target population can be identified, and compared according to the extent to which they enable us to differentiate between intenders and non-intenders. These salient beliefs are then integrated into message content (Fishbein & Cappella, 2006).

Health communication research (e.g., Heckman, Manne, Kloss et al., 2011) and campaigns (e.g., Sayeed et al., 2005) applying the reasoned-action approach often focus on identifying main effects of behavioral determinants underlying behavior. However, previous studies have shown that interactions between behavioral determinants are possible, and may exert joint effects on behavioral intention. In addition to its main effect on behavioral intention, some research suggests that PBC may also interact with other predictors of behavioral intention (Barua, 2013; Eagly & Chaiken, 1993; Bansal & Taylor, 2002; Castanier, Deroche, & Woodman, 2013; Eagly & Chaiken, 1993; McMillan & Conner, 2003; Park, Klein, & Smith, 2009; Umeh & Patel, 2004; Yzer, 2007). This conceptualization of PBC as a possible moderator of the association between intention and attitude or perceived norms draws upon the notion that individuals' behavior will likely be influenced by attitudinal and normative considerations if individuals believe they are able to enact the behavior (Yzer, 2007).

The justification for the hypothesized interactions between PBC and the other constructs relates to the way in which each of the underlying constructs are conceptualized in the reasoned-action approach. According to the reasoned-action approach, one would expect direct and independent associations between attitudes and perceived norms on intention, which is consistent with the nature of these constructs. However, there is a theoretical justification for the proposition that PBC should be conceptualized differently. A behavior can be desirable but not socially endorsed, and the reverse is equally likely. However, attitudes and perceived norms should be influenced by PBC. When an individual believes they can act on their attitudinal or normative beliefs, these beliefs become more relevant for intention formation. In contrast, when PBC is low, attitudes and norms become less relevant in shaping intention, because action is not thought to be possible (Dillard, 2011). Thus, "attitudes or norms are not 'logically conditional' on one another in the same way that they may depend upon PBC" (p. 480). From a conceptual perspective, the implications of this idea are that the proposed association between PBC, norms and attitudes may not necessarily be direct and additive. As noted by Yzer (2007), the relationship between each of these constructs with intention may depend (to some degree) upon the formation of the other constructs, a proposition that is a more complex and interesting alternative to the simpler, additive model.

The proposition that PBC may act as a moderator variable that interacts with attitudes and perceived norms, not (only) as a concept that works in parallel with attitudes and norms, was first tested over thirty years ago (Eagly & Chaiken, 1993; Yzer, 2007, 2012). Prior studies show support for interactions and provide evidence to suggest that the reasoned-action approach should reconsider the role of PBC (Yzer, 2007). Indeed, Dillard (2011) found that among participants high in PBC, the strength of association between both attitude and norms in relation to their prediction of behavioral intention was strengthened. Other studies have found similar interaction effects between PBC and attitude (e.g., Conner & McMillan, 1999; Kidwell & Jewell, 2003; McMillan & Conner, 2003; Umeh & Patel, 2004; Yzer et al., 2014). However, these tests focused on one behavioral context, used small datasets with limited statistical power to detect the hypothesized effects, and had restricted range in the independent variables (Boudewyns, 2013; Yzer, 2007). Of the few studies that used national samples to test these interactions, none were performed with U.S. adults (Boudewyns, 2013).

The significance and novelty of the current study stems from the fact that it examines PBC-moderated interactions of attitude and perceived norms on intention to engage in six distinct cancer control and prevention behaviors using a nationally representative sample of U.S. adults. This study addresses methodological concerns about the validity of prior tests of the control interaction, such as potential effects of spuriousness, by testing the proposed interactions in a larger sample and in a consistent manner across multiple behaviors (see Dillard, 2011).

Based upon the research reviewed here, we expect to observe PBC-moderation of the association between attitudes and intention across prevention and screening behaviors.

H1: The association between attitude and cancer control behavior intentions will vary as a function of PBC such that attitude related to performing these behaviors will be more positive among participants high in PBC vs. participants low in PBC.

Of equal interest to us is the potential for PBC to interact with perceived norms in their effects on intention, as other studies have suggested (Kidwell & Jewell, 2003; Park, Klein, & Smith, 2009; Yzer et al., 2014). As with attitude, Dillard (2011) also observed a significant moderating effect of PBC on the norms-intention relation, in which the association between perceived norms and behavioral intention was strengthened among women high in PBC. Just as with attitudes (see H1), we expect to find PBC-moderation of the association between perceived norms and intention across prevention and screening behaviors.

H2: The association between perceived norms and cancer control behavior intentions will vary as a function of PBC such that perceived norms related to performing these behaviors will be more positive among participants high in PBC vs. participants low in PBC.

Although the role of PBC as a key determinant of intention is well-established within a reasoned-action framework, interactions between PBC, attitude and perceived norms are not typically reported in the literature, most likely due to a number of methodological limitations. Yzer (2007) and Barua (2013) have noted a number of methodological considerations related to PBC-moderated interactions of attitude and perceived norms on intention. First, studies that have observed these interactions have reported rather small changes in explained variance in outcomes, pointing towards modest effect sizes that require a great amount of power to detect (Ajzen, 2002; Aiken & West 1991; Cohen, Cohen, West, & Aiken, 2003; Jaccard & Tirrissi, 2003; McClelland & Judd, 1993).¹

Second, the nature of the interactions (as theorized here) may present an additional obstacle towards their detection. In the case of an interaction in which the slopes are in the same direction (e.g., more positive effects of attitude across higher levels of PBC), the interaction will require great statistical power to detect, compared with an interaction in which the slopes are in opposite directions (Yzer, 2007). Third, interactions are sensitive to skew in predictor and moderating variables, and are more likely to be detectable when there is

¹Previous studies have used limited samples (between 139 and 461 participants in six studies reviewed by Yzer, 2007), and an average sample size of 268 in a meta-analysis by Boudewyns (2013), a factor that may “have hurt robustness of the demonstrated effects” (Yzer, 2007, p. 115).

sufficient variance in the distribution of these variables (Ajzen, 2002), as well as in the interaction term (McClelland & Judd, 1993). In the context of health behaviors, this is particularly important as skew or clustering towards one end of the scale (e.g., most participants reporting high levels of PBC, attitude, or perceived norms related to a healthy behavior) may make detection of PBC-moderated interactions of attitude and perceived norms on intention difficult to observe (Yzer, 2007). Several studies reporting significant PBC-moderated interactions of attitude and perceived norms on intention focused on risk behaviors, such as substance abuse, as their target behavior, and did not look at a range of health behaviors.

To the best of our knowledge, this study is the first of its kind to address these methodological gaps and to test PBC-moderated interactions of attitude and perceived norms on intention to engage in six distinct health behaviors using a nationally representative sample of U.S. adults aged 40-70. The importance of testing several behaviors for support of PBC-moderated interactions of attitude and perceived norms on intention rests on the increased validity of results conferred by testing across multiple behaviors. The hypotheses tested here are also important for guiding cancer control communication campaigns at the national level as the use of a large nationally representative U.S. sample of adults may provide a more robust test of these moderated interactions.

Methods

Sample

A nationally representative sample of U.S. adults ages 40-70 years old was recruited by Knowledge Networks (KN), an independent research firm, to participate in an online survey approved by the Institutional Review Board (IRB) of the University of Pennsylvania. Previous research has shown that our sample is representative of U.S. adults ages 40-70 years of age in relation to prevalence of daily fruit and vegetable consumption, body mass index (BMI), and Internet access and familiarity [see Ramirez et al. (2013) for more details]. Within our sample, 76% of respondents identified themselves as White, Non-Hispanic, 11% as Black, Non-Hispanic, 7% as Hispanic, 3% as belonging to more than two races or ethnicities, and 3% as 'other', Non-Hispanic. A total of 2,489 participants (1,216 men, 1,273 women) participated in the study. Table 1 provides further details of the sample demographics. As missing data for variables tested in this study remained fairly low (less than 10% of cases were missing across all behavioral models), we relied on listwise deletion for data analysis.² Table 2 displays more information about the 1) percentage of the sample that was eligible for inclusion in analysis and 2) percentage of missing data in the eligible subsample. The following represent the final sample sizes for each behavioral model: colonoscopy (N = 1,259), mammography (N = 1,205), PSA (N=833), eating fruits and vegetables (N = 2,379), exercising (N = 2,344), and dieting to lose weight (N = 1,579).

²Models testing screening behaviors also excluded respondents who reported never having heard of colonoscopy screening and PSA testing. Samples were further restricted for analyses of behaviors that were only recommended for certain subgroups. For example, analysis for mammography included only women, for PSA test (prostate-antigen test) only men, and for colonoscopy only participants over the age of 50. Additionally, for the dieting analysis we only included the 67% of our sample who reported an unhealthy body mass index (BMI>25) indicating overweight or obesity.

Procedure

Procedures for sample recruitment and survey administration have been previously described elsewhere (for further details see Kelly, Niederdeppe, & Hornik, 2009; Kelly, Hornik, Romantan, et al., 2010; vSmith-McLellan & Fishbein, 2008). Using random-digit dialing, participants were selected from a nationally representative panel of U.S. adults by KN, which then provided Internet access to participants who lacked access. Data were collected through a cross-sectional web-based survey of participants from October 2005 to June 2006. In addition to standard demographic questions, the survey included questions related to components of the reasoned-action approach and six cancer-related behaviors comprised of three screening behaviors [(e.g., getting a colonoscopy, getting a mammography (women only), getting a PSA (men only)], and three prevention behaviors (e.g., eating fruits and vegetables, performing regular exercise, and dieting to control weight).³

Measures

Attitude—A global measure of attitude towards each of the six behaviors was assessed using two 7-point semantic-differential type scales. For example, respondents were asked the following about eating fruit and vegetables: *“My having five or more servings of fruits and vegetables most days in the next year is:”*, using scoring from -3 to +3 with answer options ranging from “extremely bad” to “extremely good” and “extremely unpleasant” to “extremely pleasant.” For each behavior, both items were positively correlated with each other (colonoscopy: $r = .59, p < .001$; mammography: $r = .47, p < .001$; PSA: $r = .55, p < .001$; fruits and vegetables: $r = .67, p < .001$; exercise: $r = .67, p < .001$; diet: $r = .54, p < .001$). Responses from scales were averaged and combined to form a global measure of attitude for each behavior.

Perceived norms—Descriptive and subjective norms were measured separately. Subjective norms were measured with a single-item 4-point scale asking respondents to indicate the perception of social approval surrounding the performance of each of the six behaviors. For example, participants responded to this question about fruit and vegetable consumption: *“Do most people who are important to you think you should or should not have five or more servings of fruits and vegetables most days in the next year?”* with answer options ranging from “definitely should not” to “definitely should”. The measure for descriptive norms was a single-item 4-point scale asking respondents to report the likelihood of the performance of the behavior in question by important others. For example, respondents were asked the following about eating fruit and vegetables: *“How many of the people who are most important to you ate five or more servings of fruits and vegetables most days in the past year?”*, using scoring from 1 to 4 with answer options ranging from “None or very few” to “All or almost all”. For cancer screening behaviors, respondents were asked: *“How many of the people who are most similar to you got a [cancer screening: colonoscopy (all)/ mammogram (women only)] in the past year?”*, with options ranging from “none or very few” to “all or almost all”.⁴ For each behavior, both items were positively correlated

³More specifically, these behaviors were defined using 2005 guidelines from the American Cancer Society: (1) getting a colonoscopy in the next year (or when recommended); (2) getting a mammogram in the next year (or when recommended, women only); (3) getting a PSA test in the next year (or when recommended, men only); (4) eating five or more servings of fruits and vegetables most days in the next year; (5) exercising at least three times in most weeks over the next year; and (6) dieting to control weight.

with each other (colonoscopy: $r = .47, p < .001$; mammography: $r = .52, p < .001$; PSA: $r = .45, p < .001$; fruits and vegetables: $r = .41, p < .001$; exercise: $r = .28, p < .001$; diet: $r = .21, p < .001$). A combined measure of perceived norms intended to capture perceived normative pressure (see Smith-McLallen & Fishbein, 2008) was created. This involved averaging and combining responses from the subjective and descriptive norm measures to form a global measure of perceived norms for each behavior.

Perceived behavioral control—PBC was measured with a single item 5-point scale asking respondents to report the extent to which they believed they could perform the behavior if they desired. For example, respondents were asked the following about eating fruit and vegetables: *“If you wanted to, how sure are you that you can have five or more servings of fruits and vegetables most days in the next year?”*, using scoring from 1 to 5 with answer options ranging from “not very sure” to “very sure”.

Behavioral intention—Behavioral intention was assessed with a single-item 5-point scale. Respondents were asked to report their likelihood of performing the behaviors. For example, respondents were asked: *“How likely is it that you will have five or more servings of fruits and vegetables most days in the next year?”*. For screening behaviors, respondents were first asked to indicate if they previously had the cancer screening in question. Respondents reporting having previously had that particular cancer screening were then asked to report the likelihood of having the same screening again in the future.⁵ Using scoring from 1 to 5, answer options for all measures of behavioral intention ranged from “very unlikely” to “very likely.” Descriptive statistics and correlations among all items relevant to each behavior appear in Table 2.

Analytic Approach

Multiple OLS regression was used to test associations of interactions between PBC and the other principal IM components of the reasoned-action approach (e.g., attitude and perceived norms) with behavioral intention across all six behaviors using two steps. In line with recommendations by Cohen et al. (2003), all independent variables were mean-centered prior to analysis to reduce issues of multicollinearity. Mean-centered variables were then used to generate interaction terms (Aiken & West, 1991). We report unstandardized b -coefficients rather than β -coefficients to ensure appropriate interpretation of results, as recommended by Aiken and West (1991) when using this approach. In Step 1, we entered attitude, perceived norms and PBC. In Step 2, we added product terms representing two interactions [(1) attitude $\times$ PBC and (2) perceived norms $\times$ PBC] to each behavioral model, and examined the change in variance explained by the model, as indicated by R^2 . Although parallel results of models presented in Step 1 were previously published in Smith-McLallen and Fishbein (2008), we provide these models to show the additional variance explained

⁴For descriptive norms measures, it should be noted that measures were slightly varied for gender-specific screening behaviors (e.g., getting a mammogram, PSA test) due to the potential for important others to be members of the opposite sex. For example, it would not make sense to ask women if their husbands (who might represent important ‘others’) adhere to recommendations for getting mammograms.

⁵For example, respondents who reported previously having a colonoscopy were asked: *“How likely is it that you will have a colonoscopy when it is next recommended?”*. Respondents who reported never having had a colonoscopy or noted not having had one within the past 10 years were asked: *“How likely is it that you will have a colonoscopy in the next year?”*.

upon entering PBC-moderated interactions of attitude and perceived norms on intention in Step 2. Analyses also adjust for effects of a number of covariates including age, gender, race, education, and marital status (see Table 1).

Results

Prior to testing our hypotheses, we examined the distribution of the key variables for diagnostic purposes as suggested by Yzer (2007). An initial examination of skew and kurtosis in Table 2 shows that, across all behaviors, most of the principal measures were well distributed. However, measures of PBC for the mammography and PSA models did show some evidence of skewness and kurtosis. A relatively high proportion of respondents reported increased levels of PBC for these behaviors. It should be noted, however, that the distribution for PBC for these behaviors is still within typical ranges for this measure as reported in previous studies using the reasoned-action approach (e.g. Yzer, 2007). Consequently, it was expected that the potential for detecting significant interactions between PBC and attitudes and perceived norms would be lower for the mammography and PSA models, compared with other models.

To test our hypotheses, we first regressed behavioral intention on mean-centered measures of attitude, perceived norms, and PBC (Step 1). Step 1 in Tables 3-4 show that, with the exception of perceived norms in the exercise model, all independent variables were significantly associated with behavioral intention. The amount of variance explained within each behavioral model (Adj. R^2 ranging from 0.42 to 0.54) suggests that the main components of the reasoned-action approach (entered as one block) are strongly associated with intention.

In Step 2 (displayed in Tables 3-4), two interaction terms, representing the moderation of (1) attitude and PBC, and (2) perceived norms and PBC, were added to each of the six models. The PBC-moderated interactions of attitude and perceived norms on intention (entered as one block) modestly but significantly increased the amount of variance explained across all behavioral models (Adj. R^2 increase ranging from 0.01 to 0.02). For all behaviors with the exception of PSA, the interaction term representing the moderation of attitude and PBC was significantly associated with intention, such that attitude was more strongly associated with behavioral intentions (H1) when PBC was high, compared with when it was low. To further examine the presence of PBC-moderated effects of perceived norms on PSA intentions, we used the Johnson-Neyman (J-N) technique (see Hayes & Matthes, 2009) to identify possible regions of significance, or point(s) along the PBC continuum at which the effect of perceived norms on intention may transition from statistical non-significance to significance. Using this technique, we observed the presence of a region of significance for PSA, which was reached when PBC fell below -3.10. Below this point, the coefficient for perceived norms is not statistically significant, but is positively significant when PBC is above it.

Results shown in Tables 3-4 provide evidence for significant PBC-moderated interactions of attitude on intention, accounting for covariates (e.g., gender, age, race, level of education, and marital status). We then examine these interactions more closely using a macro described in Hayes and Matthes (2009) to probe how attitude varies as a function of PBC.

We derive and interpret the coefficients for attitude when PBC is equal to the mean, and +/- one standard deviation from the mean. These interactions are displayed in Table 5, and suggest a statistically significant positive association between attitude and intention exists across all levels of PBC, with more positive associations between attitude and intention occurring at higher levels of PBC. As this pattern is consistent across all behavioral models, H1 is supported.

The results for the interaction term representing the moderation of perceived norms and PBC (H2) show a significant interaction between these variables in Tables 3-4, providing support for H2. Similar to what was observed for PBC-moderated interactions of attitude on intention, perceived norms were more strongly associated with behavioral intentions when PBC was high, compared to when it was low. However, it should be noted that there was no significant moderation of perceived norms and PBC in intention to exercise.

With evidence for these interactions displayed in Tables 3-4, we probed interactions of each behavioral model using the same approach used to probe PBC-moderations of attitude on intention described earlier. The results showing interactions are displayed in Table 5 and suggest a statistically significant positive association between perceived norms and intention exists across all levels of PBC for all behaviors (with the exception of exercise), with more positive associations between perceived norms and intention occurring at higher levels of PBC.

Discussion

The goal of this study was to test PBC-moderated interactions of attitude and perceived norms on intention in the context of cancer control behaviors recommended for the U.S. adult population. The results of this study provide evidence for PBC-moderation of attitude and perceived norms among a nationally representative sample of 40-70 year olds. The association of attitudes and perceived norms with behavioral intentions was stronger among adults who reported higher levels of PBC, compared to adults with lower levels of PBC. These results are consistent with previous studies (Bansal & Taylor, 2002; Connor & McMillan, 1999; Dillard, 2011; Kidwell & Jewell, 2003; McMillan & Conner, 2003; Povey, Conner, Sparks, James, & Shepard, 2000; Umeh & Patel, 2004; Park, Klein, Smith & Martell, 2009; Castanier et al., 2013; Yzer, 2014; see also review by Yzer, 2007), and provide further evidence, across six health behaviors, to support a reexamination of the role of PBC within the reasoned-action approach.

The current study tests theoretical moderation of PBC on attitude and perceived norms, while addressing previously noted methodological gaps including the use of a large representative sample of the general (U.S.) population. The examination of a range of health behaviors is also a valuable contribution to the literature as PBC-moderated interactions of attitude and perceived norms on intention for this class of behaviors can be difficult to detect given the tendency for clustering at one end of the scale to occur (Yzer, 2007). The power of our sample size and the sufficient distribution of our primary measures allowed for the successful detection of these interactions, contributing to empirical research in this area (Barua, 2013; Yzer, 2007; 2012).

One explanation for the observed interactions is that if a person believes s/he cannot perform a behavior, having a positive attitude or strong perceived norms about the behavior may have an attenuated effect on intention formation (Yzer, 2007). However, the opposite may also be possible; a person may not perform a behavior that he/she is capable of performing because s/he possesses a negative attitude towards it, or perceives norms that discourage it (Eagly & Chaiken, 1993). In the context of recommended cancer prevention and screening behaviors, it is likely that the nature of the behavior (i.e., socially sanctioned and recommended by health care providers) would suggest that the first perspective may be a more valid explanation. That is, individuals may hold positive attitudes and normative beliefs regarding these behaviors, but PBC acts as a *precondition* in forming intention, which may be important for designing more effective campaigns messages. PBC is also likely to vary as a function of a range of factors, such as an individual's prior experience, vicarious experience, persuasion, and physiological state (Bandura, 1997; Yzer, 2012). In the context of lifestyle behaviors, for example, PBC may be adversely influenced by an individual's prior failed attempts at exercising or dieting, and is likely to vary over time. Thus, for these behaviors, perceptions of behavioral control may adjust the 'volume' of the attitude-intention and perceived norms-intention relationship by dulling it among those with lower perceptions of capability, and bolstering it among those whose perceptions of control are higher, a relationship that is reflected in the results of this study. This proposition is also consistent with the conceptualization of PBC as a motivating element in behavior formation and change (Yzer, 2012).

The results presented here are expected to be of particular interest to campaign designers and evaluators, as well as to scholars in the area of health communication and behavior change theories. The implications of this study for practitioners designing campaigns are that messages aimed at modifying attitudes or norms, based on formative research using the reasoned-action approach, should also incorporate information designed to increase PBC. A combination of these elements should be particularly effective among individuals in the target population who feel low levels of PBC. For these individuals, the belief that they are not capable of carrying out the recommended behavior should be addressed prior to explaining the benefits or risks of performance of the behavior (i.e., attitudinal information). Given the variance in PBC towards performance of the different behaviors in question, the focus of the message content should also be tailored to previously elicited (specific) control beliefs relating to the most salient or frequently cited PBC beliefs separating high intenders from low intenders.

Although the PBC-moderated interactions reported in this study are small in magnitude, we do not consider their size a weakness as they were what we expected from a theoretical perspective and are consistent with results of past research in this area (e.g., Yzer, 2007). In addition, these results do further knowledge that can contribute to prevention efforts, particularly among populations with low levels of perceived behavior control. As Yzer (2007) noted, statistically small interactions can be highly valuable in practical applications. Particularly with regard to lifestyle and prevention behaviors such as diet and exercise, even a small increase in intention to perform the behavior represents a significant public health gain. The additional interactions may be modest at the individual level, however on the

aggregate they present a consistent and important finding for large-scale campaigns seeking to change behavior at the population level.

This study also offers further evidence to demonstrate the utility of testing PBC-moderated interactions of attitude and perceived norms on intention, and contributes to existing research in this area (Yzer, 2007). The examination of PBC-moderated interactions of attitude and perceived norms on intention in research applying the reasoned-action framework can identify additional pathways of influence on behavioral intention and behavior. Lastly, communication scholars may revisit evaluations of attitudes- or norms-based campaigns that were not found to have main effects on behavior change and reexamine the results among individuals reporting different levels of PBC. This suggestion is also valid in cases in which formative research applying this model (see Fishbein & Cappella, 2006) shows that PBC has a weak or non-significant direct association with intention. In this case, a researcher designing or evaluating a campaign might conclude that PBC does not play an important role in shaping intention, and may overlook the interactive effects of PBC and the other constructs.

A few limitations of this study should be mentioned. As the present study draws results from self-report data relating to cancer screening and prevention behaviors, the issue of whether respondents answered questions in a socially desirable manner remains a potential threat to our conclusions. In addition, although cross-sectional modeling is typical and represents the traditional methodological approach of research on the reasoned-action approach, the cross-sectional nature of this study presents another limitation.

Acknowledgments

The authors are grateful to Dr. Robert C. Hornik and the reviewers for their insightful comments on earlier drafts of the manuscript.

Funding: The authors acknowledge the funding support of the National Cancer Institute's Center of Excellence in Cancer Communication (CECCR) located at the Annenberg School for Communication, University of Pennsylvania (P50-CA095856-05).

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Table 1**Demographics (N=2,489)**

Sample Characteristics	N	%
Age		
40-49	984	39.5
50-59	874	35.1
60-70	631	24.4
Gender		
Male	1216	48.9
Female	1273	51.1
Education		
Less than high school diploma	245	9.8
High school diploma/GED	759	30.5
Some college	701	28.2
College degree	453	18.2
More than college degree	331	13.3
Race/ethnicity		
White, Non-Hispanic	1903	76.5
Black, Non-Hispanic	268	10.8
Other, Non-Hispanic	67	2.7
Hispanic	178	7.2
2 or more races, Non-Hispanic	73	2.9
Marital status		
Not currently married	1011	40.6
Currently married	1478	59.4
BMI		
< 25	746	30.0
> = 25	1686	67.7
Refused to answer	57	2.3

Table 2

Means, standard deviations, correlations, and distributions

Variables	M	SD	BI	ATT	PN	Skew (SE)	Kurtosis (SE)	% of Sample Eligible	% Missing Eligible
Colonoscopy (N=1,259)								54.4%	7.02%
Behavioral intention (BI)	3.48	1.57				-0.55(0.07)	-1.28(0.14)		
Attitude (ATT)	0.12	1.63	0.50			-0.32(0.07)	-0.63(0.14)		
Perceived norms (PN)	2.77	0.76	0.56	0.47		-0.19(0.07)	-0.50(0.14)		
PBC	4.29	1.18	0.46	0.31	0.35	-1.73(0.07)	1.96(0.14)		
Mammography (N=1,205)								51.1%	5.34%
BI	4.08	1.36				-1.30(0.07)	0.28(0.14)		
ATT	0.95	1.44	0.49			-0.91(0.07)	0.70(0.14)		
PN	3.21	0.72	0.54	0.44		-0.74(0.07)	0.08(0.14)		
PBC	4.56	1.00	0.58	0.36	0.37	-2.55(0.07)	5.70(0.14)		
PSA (N=833)								35.4%	5.34%
BI	3.62	1.40				-0.65(0.09)	-0.87(0.17)		
ATT	1.16	1.36	0.54			-0.68(0.09)	0.48(0.17)		
PN	2.67	0.70	0.61	0.50		0.06(0.08)	-0.41(0.17)		
PBC	4.44	1.01	0.48	0.36	0.38	-2.10(0.08)	3.82(0.17)		
Fruits/vegetables (N=2,379)								100.0%	4.42%
BI	3.28	1.28				-0.27(0.05)	-1.07(0.10)		
ATT	1.68	1.31	0.53			-0.91(0.05)	0.42(0.10)		
PN	2.71	0.60	0.52	0.45		0.24(0.05)	-0.40(0.10)		
PBC	3.90	1.15	0.53	0.44	0.45	-0.90(0.05)	-0.05(0.10)		
Exercise (N=2,344)								100.0%	5.83%
BI	3.62	1.22				-0.60(0.05)	-0.69(0.10)		
ATT	1.37	1.47	0.62			-0.88(0.05)	0.35(0.10)		
PN	2.72	0.56	0.38	0.40		0.13(0.05)	0.24(0.10)		
PBC	3.98	1.12	0.66	0.54	0.38	-1.07(0.05)	0.40(0.10)		
Diet (N=1,579)								67.7%	6.35%
BI	3.58	1.09				-0.65(0.06)	-0.16(0.12)		
ATT	1.07	1.34	0.54			-0.57(0.06)	0.31(0.12)		

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Variables	M	SD	BI	ATT	PN	Skew (SE)	Kurtosis (SE)	% of Sample Eligible	% Missing Eligible
PN	2.67	0.56	0.43	0.38		0.03(0.06)	0.24(0.12)		
PBC	3.86	1.04	0.56	0.41	0.34	-0.85(0.06)	0.33(.012)		

Note: All correlations are significant at $p<0.001$. Descriptive statistics of variables prior to mean-centering are presented.

Table 3

OLS regression models predicting cancer-screening intentions

Predictor	Colonoscopy (N=1,259)			Mammography (N=1,205)			Mammography (N=1,205)			PSA (N=833)		
Step 1	B	S.E.	P	B	S.E.	P	B	S.E.	P	B	S.E.	P
ATT	0.22	0.02	***	0.21	0.02	***	0.23	0.02	***	0.24	0.03	***
PN	0.79	0.05	***	0.85	0.05	***	0.66	0.05	***	0.77	0.06	***
PBC	0.30	0.03	***	0.31	0.03	***	0.58	0.03	***	0.30	0.04	***
Step 2												
ATT*PBC				0.06	0.02	***	0.05	0.02	**	0.04	0.02	NS
PN*PBC				0.14	0.03	***	0.12	0.03	***	0.13	0.04	***
Adj. R ²	0.48			0.50	*		0.52	*		0.53		*

Note: All models adjust for effects of age, gender, education, race, and marital status. Only unstandardized regression weights presented.

* p<0.05;

** p<0.01,

*** p<0.001.

Significance of Adj. R² values indicates significant change in variance explained.

Table 4
OLS regression models predicting prevention behavior intentions

Predictor	Fruits & vegetables (N=2,379)			Fruits & vegetables (N=2,379)			Exercise (N=2,344)			Exercise (N=2,344)			Diet (N=1,579)			Diet (N=1,579)		
	B	S.E.	P	B	S.E.	P	B	S.E.	P	B	S.E.	P	B	S.E.	P	B	S.E.	P
Step 1																		
ATT	0.31	0.02	***	0.34	0.02	***	0.31	0.01	***	0.34	0.01	***	0.25	0.02	***	0.32	0.02	***
PN	0.32	0.04	***	0.31	0.04	***	0.02	0.03	NS	0.04	0.03	NS	0.30	0.03	***	0.17	0.03	***
PBC	0.37	0.02	***	0.35	0.03	***	0.49	0.02	***	0.53	0.02	***	0.38	0.02	***	0.41	0.03	***
Step 2																		
ATT*PBC				0.09	0.01	***				0.10	0.01	***				0.12	0.01	***
PN*PBC				0.10	0.03	***				0.01	0.02	NS				-0.06	0.02	**
Adj. R ²	0.42			0.44		*	0.54			0.56		*	0.47			0.48		*

Note: All models adjust for effects of age, gender, education, race, and marital status. Only unstandardized regression weights presented.

* p<0.05;

** p<0.01,

*** p<0.001.

Significance of Adj. R² values indicates significant change in variance explained.

Table 5
Conditional Effects of Attitude and Perceived Norm on Intention Across Levels of PBC

Behavior	Attitude				Perceived Norms			
	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Colonoscopy (N=1,259)								
At <i>M-1SD</i>	0.15	0.03	5.15	***	0.69	0.05	13.46	***
At <i>M</i>	0.21	0.02	9.52	***	0.86	0.05	17.78	***
At <i>M+1SD</i>	0.28	0.03	9.06	***	1.02	0.07	15.38	***
Mammography (N=1,205)								
At <i>M-1SD</i>	0.18	0.03	6.45	***	0.54	0.05	10.23	***
At <i>M</i>	0.23	0.02	10.19	***	0.66	0.05	13.82	***
At <i>M+1SD</i>	0.28	0.03	9.09	***	0.77	0.06	12.18	***
PSA (N=833)								
At <i>M-1SD</i>	0.21	0.03	6.25	***	0.67	0.06	10.56	***
At <i>M</i>	0.24	0.03	8.01	***	0.79	0.06	13.92	***
At <i>M+1SD</i>	0.28	0.04	6.68	***	0.92	0.08	12.14	***
Fruits and vegetables (N=2,379)								
At <i>M-1SD</i>	0.24	0.02	11.72	***	0.20	0.05	4.10	***
At <i>M</i>	0.34	0.02	18.66	***	0.32	0.04	8.04	***
At <i>M+1SD</i>	0.45	0.03	17.07	***	0.43	0.05	8.15	***
Exercise (N=2,344)								
At <i>M-1SD</i>	0.23	0.02	14.30	***	0.03	0.04	0.93	NS
At <i>M</i>	0.34	0.02	23.53	***	0.04	0.03	1.26	NS
At <i>M+1SD</i>	0.45	0.02	22.44	***	0.05	0.05	1.09	NS
Diet (N=1,579)								
At <i>M-1SD</i>	0.19	0.02	9.13	***	0.34	0.04	9.29	***
At <i>M</i>	0.27	0.02	15.32	***	0.27	0.03	8.22	***
At <i>M+1SD</i>	0.35	0.02	14.67	***	0.21	0.05	4.51	***

Note: All models adjust for effects of age, gender, education, race, and marital status. Only unstandardized regression weights presented.

* $p < 0.05$;

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p<0.01,

p<0.001.

Only unstandardized regression weights presented.

*
p<0.05;
**
p<0.01,

p<0.001

NS = not significant at p=0.05.

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