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Comparing Theory-Based Condom Interventions: Health Belief Model Versus Theory of Planned Behavior

Erika A. Montanaro and Angela D. Bryan
University of Colorado Boulder

Objective: This study sought to experimentally manipulate the core constructs of the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) in order to compare the success of interventions to increase preparatory condom use behavior (i.e., purchasing condoms, talking to a boyfriend or girlfriend about using condoms, and carrying condoms) based on these theories. **Method:** A total of 258 participants were randomly assigned to one of three computer-based interventions (HBM, TPB, or information-only control). A total of 204 (79.1%) completed follow-up assessments 1 month later. **Results:** Regression analyses were conducted to determine which set of theoretical constructs accounted for the most variance in behavior at baseline. A series of structural equation models were estimated to determine which constructs were the “active ingredients” of change. The TPB accounted for 32.8% of the variance in risky sexual behavior at baseline, while the HBM only explained 1.6% of the variance. Mediation analyses revealed differential intervention effects on perceived susceptibility, perceived benefits, and attitudes toward condom use. However, it was attitudes toward condom use and condom use self-efficacy that were associated with intentions, which then predicted preparatory condom use behavior at follow-up. **Conclusion:** Except for attitudes, the mediators that were successfully manipulated by the interventions (i.e., perceived susceptibility, perceived severity, and attitudes) were not the same constructs that predicted intentions (i.e., attitudes and condom use self-efficacy), and subsequently predicted behavior. This suggests that the constructs that explain behavior are not the same as those that produce behavior change.

Keywords: condom use, HIV/STD, intervention, Theory of Planned Behavior, Health Belief Model

Health psychology researchers have attempted to determine the causes and processes of change in health behavior. Theory allows researchers a way to describe what variables are most important, how to measure them, and, in many cases, how the variables are causally organized to facilitate health behavior, as well as informing the formulation of research questions, and finally providing specific hypotheses to be tested (Noar & Zimmerman, 2005). Theory provides an organized framework that helps researchers focus on explaining and predicting behavior in a systematic manner (Glanz & Maddock, 2000). Empirically testing health behavior theories has been heralded as the fundamental basis of understanding health behavior (Noar & Zimmerman, 2005; Weinstein, 1993; Glanz & Maddock, 2000; Michie & Prestwich, 2010); however, as of Glanz and Bishop's (2010) review of behavioral science theory, there were very few studies that have directly compared different theories as the basis for the design of behavior change interventions. This is an important question if the goal is to develop more efficacious interventions, and determine which components of

which theories seem to be the driving factors in facilitating behavior change (Noar, 2008).

An overarching goal of the current work was to determine which components of the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) were most successful at explaining behavior and eliciting behavior change. Condom use preparatory behavior (i.e., purchasing condoms, talking to a boyfriend or girlfriend about using condoms, and carrying condoms) was the health behavior of interest for the study, given the relative frequency of condom use interventions in the literature (Lin, Simoni, & Zemon, 2005; Bryan, Aiken, & West, 1996; Albarracín, Johnson, Fishbein, & Muellerleile, 2001; Schmiede, Broaddus, Levin, & Bryan, 2009).

Current State of the Science of HBT

Two widely used theories of health behavior are the HBM (Janz & Becker, 1984) and the TPB (Ajzen & Madden, 1986). Both theories have a rich history in the literature describing their use for predicting and changing behavior (HBM: Janz & Becker, 1984; TPB: Godin & Kok, 1996). Further, both models have a narrow and well-articulated set of theoretical constructs, facilitating tight operationalization of measurement and intervention content for these theories. Both the HBM (Lin et al., 2005; Bryan et al., 1996) and the TPB (Albarracín et al., 2001; Schmiede et al., 2009) have been used to successfully explain and change condom use behavior. However, there is no clear answer to whether one theory might be better than the other at explaining and changing behavior, and

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Erika Montanaro and Angela D. Bryan, Department of Psychology and Neuroscience, University of Colorado Boulder.

Correspondence concerning this article should be addressed to Erika Montanaro, Department of Psychology and Neuroscience University of Colorado Boulder, Muenzinger D244 345 UCB, Boulder, CO 80309-0345. E-mail: erika.montanaro@colorado.edu

it is this direct theory comparison that is the motivating question of this investigation.

Health Belief Model

The most recently revised version of the HBM consists of five dimensions: perceived susceptibility (how vulnerable individuals feel toward health threats), perceived severity (an individual's assessment of how serious or dangerous a threat may be), perceived benefits (individuals' beliefs about whether a particular action will reduce the threat of illness), perceived barriers (beliefs about whether an individual can overcome the difficulties executing or negative consequences of executing recommended actions), and self-efficacy. Self-efficacy, one's perceived ability to take preventive action, was added to the model by [Rosenstock, Strecher, and Becker \(1988\)](#).

Theory of Planned Behavior

The TPB proposes that attitudes, normative beliefs, and perceived behavioral control (PBC; the degree to which one believes they have control over the behavior) directly influence intentions to engage in a behavior. Intentions, and under some circumstances PBC, are then the most proximal causes of action ([Ajzen & Madden, 1986](#)).

Various authors have commented on the similarity of the constructs in each theory, and some have argued that the theories essentially contain identical concepts that are simply described using different terminology ([Noar & Zimmerman, 2005](#); [Weinstein, 1993](#); [Aiken, 2010](#)). For example, each contains an attitudinal beliefs component, or the degree to which an individual quantifies the importance of positive or negative consequences of a given behavior. In the HBM, the positive side of the attitudinal construct is known as perceived benefits (e.g., condom use will prevent pregnancy), while the negative side is partially subsumed in the construct known as perceived barriers (e.g., sex does not feel as good with a condom). The TPB has a more general form of attitudes (e.g., for me, condom use would be . . . good vs. bad, healthy vs. unhealthy) that is assumed to be determined by behavioral beliefs (e.g., condom use will prevent pregnancy, sex does not feel as good without a condom). Each theory also includes relatively more distinct concepts. Perceived susceptibility (an individual's assessment of their risk of getting a condition) and severity (an individual's assessment of the severity of a condition and its consequences) are two of the core components of the HBM that are not included in the TPB, while intentions are unique to the TPB.

One of the biggest criticisms of health behavior research has been the dearth of studies testing theories against one another ([Weinstein, 1993](#); [Noar & Zimmerman, 2005](#); [Garcia & Mann, 2003](#)). [Weinstein \(2007\)](#) attributes the lack of rigorous theory comparison to an overreliance on correlational designs. Without the manipulation of an independent variable (i.e., an intervention condition) meant to *change* those constructs, it is simply not possible to examine whether *changes* in constructs, such as attitudes or self-efficacy, are actually linked to *changes* in intentions or behavior ([Weinstein, 2007](#)).

Current Study

The current study used an experimental design to compare the utility of the TPB versus the HBM as the theoretical basis for explaining college students' intentions to use condoms and subsequent preparatory condom use behaviors. Condom use is an important and relevant health behavior to examine, and thus was the focus of the current investigation. [Adefuye, Abiona, Balogun, and Lukobo-Durrell \(2009\)](#) reported that only 20–35% of college-aged students use condoms every time they have sex, and while the incidence of HIV and other sexually transmitted infections (STIs) has decreased among many demographic groups in the United States, adolescents and emerging adults remain among the subgroups at relatively higher risk for HIV and STI ([Centers for Disease Control and Prevention, 2012](#)).

There were three goals of this work. First, we assessed which of the two models accounted for more of the variance in behavior at baseline, replicating prior cross-sectional theory comparison work ([Conner & Norman, 1994](#); [Garcia & Mann, 2003](#)). Second, we determined whether the intervention guided by the TPB or the HBM was more successful at changing preparatory condom use behavior. Third, we conducted extensive mediational analysis to determine which constructs were the "active ingredients" of change (cf. [West, Aiken, & Todd, 1993](#)). For example, does the TPB intervention cause significantly greater increases in attitudes than the HBM or control interventions, and are those increases translated into change in intentions and behavior?

Method

Participants

A total of 258 participants were recruited from introductory psychology courses at a southwestern university. Participants had to be 18 or older and must have had vaginal or anal intercourse at least once. All procedures were approved by the local institutional review board. The sample was ethnically diverse, and participants averaged just under 20 years of age (see [Table 1](#)).

Procedure and Measures

Students were recruited from introductory psychology courses via the online Sona System software and given course credit after completion of the study. Participants were randomly assigned to one of three single-session, computer-delivered interventions: an HBM-based intervention, a TPB-based intervention, or an information-only (INFO) control intervention. All participants completed pretest questionnaires, received one intervention, and completed a series of postintervention questionnaires (total time from beginning the pretest to the completion of the postintervention assessments was about 60 min for the HBM and TPB interventions, and about 30 min for the INFO control intervention). The same questionnaires were used for pretest and posttest assessment. Sample items, number of items, and alpha coefficients of each scale are in [Table 2](#). [Table 3](#) describes the relationships between the constructs. To allow mediational analyses (e.g., [Bryan et al., 1996](#); [Schmiege et al., 2009](#)), assessments of each of the theoretical constructs were

Table 1
Demographic and Sexual History Characteristics

Characteristic	TPB	HBM	INFO	Test statistic	p
n	87	88	83		
Gender (female) ^a	64.4	65.9	61.4	$\chi^2(2, N = 258) = 0.379$	0.83
Age (years) ^b	19.66 (1.66)	19.72 (1.56)	19.55 (1.46)	$F(2, 255) = 0.23$	0.79
Ethnicity ^a				$\chi^2(14, N = 258) = 20.28$	0.12
White	35.6	50.0	37.3		
Hispanic	49.4	37.5	44.6		
Other	15.0	12.5	18.1		
Sexual orientation ^a				$\chi^2(4, N = 258) = 2.93$	0.57
Heterosexual	95.4	94.3	90.4		
Gay/lesbian	1.1	3.4	3.6		
Bisexual	3.4	2.3	6.0		
Relationship status ^a				$\chi^2(6, N = 251) = 2.96$	0.81
Casually dating	3.4	1.2	2.5		
Steadily dating	9.2	8.2	8.9		
Serious relationship	42.5	35.3	43		
Living together	0.0	0.0	0.0		
Married	0.0	0.0	0.0		
Not in relationship	44.8	55.3	45.6		
Age at first intercourse ^b	16.62 (1.59)	16.34 (1.63)	16.41 (1.59)	$F(2, 254) = 0.69$	0.50
No. of sexual partners ^b	5.53 (10.06)	6.23 (5.79)	5.82 (9.02)	$F(2, 250) = 0.15$	0.87
100% condom use ^a	18.4	13.6	22.9	$\chi^2(20, N = 258) = 18.32$	0.57

Note. TPB = Theory of Planned Behavior; HBM = Health Belief Model; INFO = information-only intervention.

^a Values are percent. ^b Values are *M* (*SD*).

also completed immediately after the intervention. To ensure constructs were appropriately measured for each theory, the HBM concepts were measured using the same techniques used in Bryan, Aiken, and West (1997), and the TPB constructs were measured using the same techniques as in Ajzen and Madden (1986). To distinguish between PBC and self-efficacy, scale items for PBC were modeled after those used by Armitage and Conner (1999). Brien, Thombs, Mahoney, and Wallnau's (1994) subscales of the Condom Use Self-Efficacy Scale were used to assess an individual's perceptions of his or her ability to use condoms. As can be seen in Table 2, all scales had alpha reliabilities above .650, with the exception of perceived barriers ($\alpha = .303$). This extremely low reliability implies that the barriers measured by this scale are not significantly related to one another, and thus do not form a coherent scale.¹

Interventions

Three computer-based interventions were developed for which the content strictly adhered to the theoretical constructs included in the two theories being tested (cf., Aiken, 2010). Interventions were completed on home computers at participants' convenience. Participants in every condition were given a list of area resources, including places to obtain free condoms as well as free or low-cost STI/HIV testing. In a meta-analysis assessing the efficacy of computer-based interventions, Noar, Black, and Pierce (2009) and Kiene and Barta (2006) concluded that the most efficacious Internet-based interventions were conducted with young, highly educated college students. Noar et al. (2009) concluded computer-based interventions have been just as efficacious as many in-person interventions in increasing condom use, decreasing numbers of sexual partners, and decreasing incident STI. This is a promising form of intervention delivery, because web-based inter-

ventions have the potential to reach wider audiences who are not motivated to use in-person care, have lower delivery cost than human-delivered interventions, allow for standardization of delivery content, and permit greater dissemination flexibility (e.g., smart phones).

Intervention descriptions. The content for each intervention was presented in discrete modules for each construct in the order presented below.

HBM intervention. In order for *perceived susceptibility* to be an agent of behavior change, participants had to believe that, for them, contracting an STI or HIV or experiencing a pregnancy is a likely consequence of unprotected sex. Participants were thus presented with national and state STI, HIV, and pregnancy statistics in text and graphical format.¹ *Perceived severity* components included pictures of STI-infected male and female genitalia, and long-term consequences were described. Participants were also shown a video clip of a small child throwing a temper tantrum in a public place to enhance the perceived severity of unplanned pregnancy. The emotional (e.g., "Using condoms during sex can eliminate feelings of guilt afterward.") and physical (e.g., "Condoms only break about 2% of the time, at most.") *perceived benefits* of condom use were highlighted. Participants were also presented with condom effectiveness statistics to emphasize the benefits of condom use. Three *perceived barriers* to condom use were addressed. Loss of sensation during intercourse was addressed by instructing participants about how to properly lubricate a condom to increase pleasure for both partners. Difficulties finding and purchasing condoms as well as effectively communicating with a partner were addressed using pictures showing peers pur-

¹ The interventions themselves and all exact measures used in this study are available on request from the first author.

Table 2
Sample Items for Each Construct in the HBM and TPB

Construct	Sample item	Number of items	Alpha
Perceived susceptibility ^a	How susceptible to sexually transmitted diseases do you feel? (1 = <i>very unlikely</i> and 7 = <i>very likely</i>)	12	.857
Perceived severity ^a	How disruptive would an STI be to your health? (1 = <i>not at all disruptive</i> and 7 = <i>very disruptive</i>)	18	.846
Perceived benefits ^a	To what extent do you believe that condoms are effective in preventing the spread of STIs among sexually active people? (1 = <i>very unlikely</i> and 7 = <i>very likely</i>)	8	.895
Perceived barriers ^a	Enjoyable sex is not possible with a condom. (1 = <i>strongly disagree</i> and 7 = <i>strongly agree</i>)	4	.303
Condom attitudes ^a	For me using a condom every time I have sex would be . . . (1 = <i>bad/harmful/etc.</i> and 7 = <i>good/beneficial/etc.</i>)	7	.780
Subjective norms ^a	Most people who are important to me think I should not use condoms. (1 = <i>disagree strongly</i> and 7 = <i>agree strongly</i>)	11	.735
Perceived behavioral control ^a	Whether or not I use a condom in the next month is entirely up to me. (1 = <i>strongly disagree</i> and 7 = <i>strongly agree</i>)	7	.673
Self-efficacy ^b	I feel confident in my ability to use a condom correctly. (1 = <i>strongly disagree</i> and 5 = <i>strongly agree</i>)	15	.879
Intentions ^a	How likely is it that you will buy condoms in the next month? (1 = <i>not at all likely</i> and 7 = <i>very likely</i>)	4	.825

Note. HBM = Health Belief Model; TPB = Theory of Planned Behavior; STI = sexually transmitted infection.

^a Scored on a scale ranging from 1–7, with higher scores representing higher levels of the construct. ^b Scored on a scale ranging from 1–5, with higher scores representing higher levels of the construct.

chasing condoms without embarrassment and successfully negotiating condom use with a partner.

TPB intervention. Attitudes toward condom use information was similar to that presented during the perceived benefits of condom use portion of the HBM intervention. The physical benefits (e.g., “When used properly and consistently, condoms are 98% effective in preventing pregnancy. This means that two couples out of 100 who use condoms will have an unintended pregnancy.”), hedonistic attitudes (e.g., “A condom helps a man last longer before ejaculation.”), and emotional attitudes (e.g., “Condom use shows I respect and care about my partner.”) of condom use were highlighted.

Subjective norms. To elicit social comparison, participants were given three kinds of information: personalized feedback, prototype feedback, and peer norms. Participants were asked how often they used condoms, on a scale from 0–100% of the time, and were then provided feedback comparing them with other university students. Next, they were told that “80% of University of New Mexico students use a condom every time they have sex. Do you use condoms less often, about the same, or more often than the most UNM students?” Prototype feedback included information about the kind of student who uses condoms (e.g., “Students with higher GPAs tend to use condoms more often.”). The intentions portion of the intervention focused on trying to increase participants’ motivation to use condoms. Consistent with research on the importance of implementation intentions (Sheeran, Webb, & Gollwitzer, 2005), participants set a specific safer sex goal and were asked to develop a plan to achieve this goal within the next month.

Due to the conceptual and empirical overlap in PBC and self-efficacy (cf. Ajzen & Madden, 1986; Ajzen, 1991), the same video was used in both interventions to enhance PBC and self-efficacy for condom use. The video included one male and one female college-aged actor discussing concerns about condom use. One

friend taught the other how to correctly put a condom on (using a banana as a penile model) and proper places to carry condoms were discussed.

INFO intervention. The control intervention (INFO) included basic STI information and definitions, modes of STI and HIV transmission, and the effectiveness of condoms at preventing STI and HIV transmission as well as pregnancy.²

Follow-Up Behavioral Assessment

One month after the intervention, participants received an e-mail from the research team. The same questions included in baseline and posttest assessments were included in the follow-up questionnaire. Intentions to use condoms, preparatory condom use behaviors (Bryan, Fisher, & Fisher, 2002), sexual activity, and condom use over the past month were queried.

Results

Data Analysis Plan

First, we replicated prior cross-sectional work by regressing risky sexual behavior at baseline onto the full set of constructs from each model separately. Repeated-measures analyses of variance (ANOVAs) allowed us to assess which constructs were significantly changed by the interventions. Finally, the constructs that exhibited either significant relationships to behavior in the cross-sectional analyses or significant intervention effects were included in a mediational structural equation model (Bryan et al.,

² The interventions themselves and all exact measures used in this study are available on request from the first author.

Table 3
Intercorrelation Matrix

	1	2	3	4	5	6	7	8	9	10
Perceived Susceptibility	—									
Perceived severity	.041	—								
Perceived benefits	.084	.098	—							
Perceived barriers	.126	-.004	-.042	—						
Condom attitudes	-.098	.138*	.258***	-.287***	—					
Subjective norms	.110	.120	.275***	-.232***	.438***	—				
PBC	.025	.134*	.173**	-.186**	.445***	.378***	—			
Self-efficacy	-.163*	.118	.151*	-.550***	.275***	.424***	.443***	—		
Intentions	.039	-.003	.197**	-.178**	.409***	.359***	.538***	.235***	—	
Risky sex	.012	.043	-.110	.095	-.476***	-.329***	-.349***	-.078	-.441***	—
<i>M</i>	2.28	6.12	5.86	2.31	5.41	5.61	5.54	4.37	4.42	12.04
<i>SD</i>	0.91	0.73	1.07	0.93	1.11	4.42	0.88	0.55	1.79	14.57

Note. PBC = perceived behavioral control.

* $p < .05$, two-tailed. ** $p < .01$, two-tailed. *** $p < .001$, two-tailed.

2007) to explore the “active ingredients” of intervention effects on preparatory condom use behavior at follow-up.

Accounting for Variability in Risky Sexual Behavior at Baseline

HBM-behavior link. Risky sexual behavior at baseline (how many times a participant had sex in the past 3 months by how often they used a condom when having sex during those 3 months [reverse coded]) was regressed on the set of HBM constructs (i.e., susceptibility, severity, benefits, barriers, and self-efficacy). The linear combination of HBM constructs was not significantly related to risky sexual behavior at baseline, $R^2 = .016$, $F(5, 182) = .598$, $p = .701$, and none of the individual regression coefficients was significant.

TPB-behavior link. In contrast, the TPB constructs (i.e., attitudes, norms, perceived behavioral control, and intentions) were collectively associated with risky sexual behavior at baseline, $R^2 = 0.328$, $F(4, 212) = 25.86$, $p < .001$. Attitudes toward condom use, $B = -.349$, $t(212) = -5.16$, $p < .001$, and intentions to use condoms, $B = -.281$, $t(212) = -4.13$, $p < .001$, were both significantly and negatively related to risky sexual behavior.

Intervention Effects on Mediators

Pre- and posttest means on program components are given in Table 4 by condition, along with repeated-measures ANOVAs for program effects on each construct. Two planned comparisons were computed: (a) theory-based interventions (TPB and HBM) versus INFO and (b) TPB versus HBM. Thus, the test for intervention effects in both cases was the intervention Contrast $\times$ Time interaction. There was a significant effect favoring the theory-based interventions on attitudes, intentions, and condom use self-efficacy. The HBM intervention had stronger effects on susceptibility, severity, and attitudes, while the TPB intervention had stronger effects on intentions to use condoms.

One-Month Follow-Up

In all, 204 (79.1%) of the 258 participants completed the 1-month follow-up assessment. A series of ANOVAs on rele-

vant pretest measures of condition (TPB vs. HBM vs. INFO) and retention (retained vs. not retained) were conducted to test for differential attrition (Jurs & Glass, 1971). Significant Condition $\times$ Retention interactions indicate variables on which differential attrition may have occurred. Given the number of statistical tests (i.e., nine)- a Bonferroni corrected alpha value of .006 was used as the critical value. There were no Condition $\times$ Retention interactions ($ps > .006$) for any of the constructs examined.

Preparatory Behavioral Outcomes

Three behavioral outcomes were examined during the 1-month follow-up assessment: purchasing condoms, talking to a boyfriend or girlfriend about using condoms, and carrying condoms. Our short follow-up interval resulted in little opportunity for sexual behavior change among many in our sample. Given the utility of the preparatory behaviors construct as an intermediate outcome in cases in which not all the sample has had the opportunity for sexual activity (Bryan et al., 2002), we chose to use this construct as our behavioral outcome variable. The same planned comparisons were again used (TPB and HBM vs. INFO and TPB vs. HBM). Significantly more participants in the theory-based interventions compared with the INFO intervention purchased condoms, $\chi^2(1, N = 204) = 4.46$, $p = .04$ (theory-based: yes = 61.9%, no = 38.1%; INFO: yes = 46.2%, no = 53.8%), and reported carrying condoms more frequently, $F(1, 202) = 4.07$, $p = .045$ (theory-based: $M = 2.53$, $SD = 1.39$; INFO: $M = 2.12$, $SD = 1.22$). However, there was no effect on talking to a boyfriend or girlfriend about using condoms, $\chi^2(1, N = 202) = 0.81$, $p = .37$ (theory-based: yes = 62%, no = 38%; INFO: yes = 55.4%, no = 44.6%). There was a marginal difference between the TPB and HBM conditions for purchasing condoms, $\chi^2(1, N = 204) = 5.47$, $p = .065$ (TPB: yes = 66.2%, no = 33.8%; HBM: yes = 57.7%, no = 42.3%), and a significant difference in carrying condoms, $F(2, 202) = 6.39$, $p = .002$ (TPB: $M = 2.87$, $SD = 1.46$; HBM: $M = 2.21$, $SD = 1.25$). But no difference was found between the TBP and the HBM for talking to a boyfriend or girlfriend about using condoms, $\chi^2(2, N = 202) = 1.21$, $p = .55$ (TPB: yes = 64.7%, no = 35.8%; HBM: yes = 59.4%, no = 40.6%).

Table 4

Pretest and Posttest Means on Program Components and Tests for Program Effects on Mediators

Construct	Cell means by condition			F tests		
	TPB (n = 87)	HBM (n = 88)	INFO (n = 83)	Effect of time	Theory-based vs. control	TPB vs. HBM
Susceptibility ^a						
Pretest	2.14 (0.72)	2.45 (0.98)	2.25 (0.99)	23.35**	3.22	4.39*
Posttest	2.24 (0.85)	2.80 (1.16)	2.38 (1.10)			
Severity ^a						
Pretest	6.23 (0.62)	6.02 (0.72)	6.10 (0.83)	9.79**	.76	6.34**
Posttest	6.21 (0.88)	6.39 (0.61)	6.18 (0.81)			
Benefits ^a						
Pretest	5.77 (1.10)	5.87 (1.14)	5.93 (0.97)	53.35**	3.30	2.03
Posttest	6.29 (0.99)	6.54 (0.69)	6.11 (0.94)			
Barriers ^a						
Pretest	2.24 (0.78)	2.36 (1.08)	2.37 (0.91)	.363	2.02	1.34
Posttest	2.22 (0.96)	2.21 (1.10)	2.45 (1.14)			
Attitudes ^a						
Pretest	5.57 (1.24)	4.92 (0.83)	5.79 (1.06)	187.88**	24.64**	71.52**
Posttest	5.83 (1.29)	5.94 (0.94)	5.93 (1.10)			
Norms ^a						
Pretest	5.61 (0.89)	5.62 (0.75)	5.62 (0.85)	6.74**	2.47	1.33
Posttest	5.83 (0.87)	5.78 (0.91)	5.60 (0.91)			
PBC ^a						
Pretest	5.60 (0.84)	5.44 (0.93)	5.58 (0.87)	22.76**	.021	2.62
Posttest	5.75 (0.80)	5.74 (0.71)	5.76 (0.78)			
Self-efficacy ^b						
Pretest	4.37 (0.55)	4.33 (0.58)	4.41 (0.52)	6.84*	4.84*	2.78
Posttest	4.45 (0.52)	4.45 (0.58)	4.36 (0.56)			
Intentions ^a						
Pretest	4.39 (1.73)	4.23 (1.79)	4.66 (1.86)	56.62**	6.01*	3.48*
Posttest	5.09 (1.73)	4.79 (1.71)	4.98 (1.75)			

Note. F tests for main effect of time and for interaction of Time $\times$ Contrast of Interest. TPB = Theory of Planned Behavior; HBM = Health Belief Model; INFO = information-only intervention; PBC = perceived behavioral control.

^a Scored on a scale ranging from 1–7, with higher scores representing higher levels of the construct. ^b Scored on a scale ranging from 1–5, with higher scores representing higher levels of the construct.

* $p < .05$, two-tailed. ** $p < .01$, two-tailed.

Which Constructs Are “Active Ingredients” of Change?

We estimated a mediational model via path analysis (cf., Bryan, Schmiede, & Broaddus, 2007) using EQS software, wherein there were two exogenous variables representing the two planned contrasts described previously (see Figure 1). Purchasing, carrying, and discussing condom use with a partner were indicators of the latent construct of preparatory behavior (Bryan et al., 2002). With the exception of attitudes toward condom use, there were no significant differences at baseline between conditions, thus the mediators were the posttest values of each mediational construct (Bryan et al., 1996). A difference score (posttest attitudes minus pretest attitudes) was used to test the attitudes' mediator within the context of the model. Mediators that exhibited either significant intervention effects or significant relationships to behavior were included in a hybrid model. To account for the missing data at follow-up, maximum likelihood estimation of missing data was used (cf., Schafer & Graham, 2002), and thus robust estimation of standard errors was conducted for tests of fit and significance of the paths. The fit of this model was adequate, Santorra-Bentler $\chi^2(21, N = 258) = 34.08, p = .036$, CFI = .962, RMSEA = .068, 90% confidence interval [.041, .095]. Paths from intervention contrasts to mediators were consistent with the univariate analyses. Condom use self-efficacy and attitudes were significantly associ-

ated with intentions, and intentions predicted preparatory condom use behaviors at the 1-month follow-up. None of the other constructs was related to intentions or behavior.

Discussion

Consistent with prior work (Wulfert & Wan, 1995), none of the HBM constructs were related to risky sexual behavior, and the full HBM accounted for minimal variance in risky sex (1.6%). In contrast, all four components of the TPB were significantly related to risky sex in the predicted direction at the bivariate level, and the full TPB accounted for 32.8% of the variance in risky sex. The TPB appears to be the better model at explaining past sexual risk behavior. When investigating intervention effects on theoretical mediators, we found that the theory-based interventions, compared with control, changed attitudes, condom use self-efficacy, and intentions. Also, the HBM intervention, compared with the TPB intervention, had a greater effect on perceived susceptibility, severity, and attitudes, while the TPB intervention, compared with the HBM intervention, had a greater influence on intentions. Mediational analyses, however, revealed that only self-efficacy and attitudes were significantly associated with intentions, which then predicted preparatory condom use behavior at follow-up. Overall, it appears that the constructs in the TPB produce stronger effects on condom use preparatory behavior than those in the

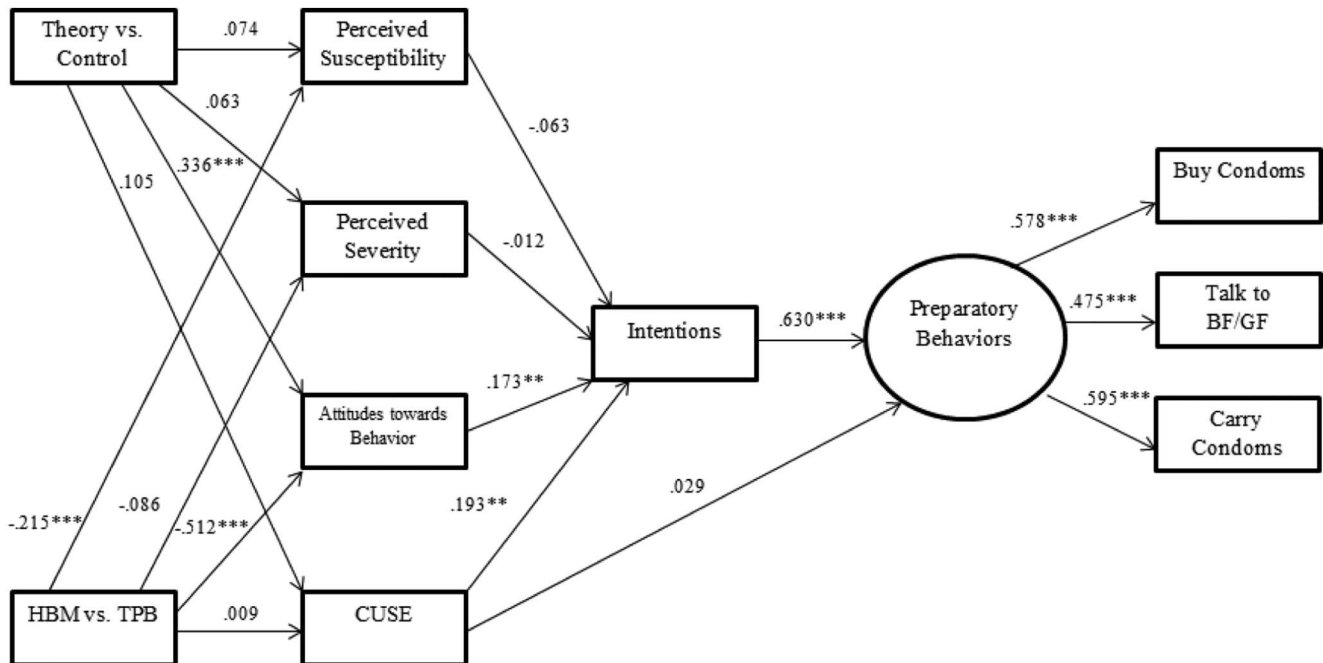


Figure 1. Theory-based versus control hybrid mediational model of program effects. The model was estimated with gender, sexual orientation, and relationship status as covariates, and the substantive findings were unchanged. For simplicity, we present the model without covariates included. Coefficients are standardized path coefficients. The theory versus control contrast was coded as: HBM or TPB = 1 (theory) and information-only (control) = 0. The HBM versus TPB contrast was coded as: HBM = -1, TPB = 1, and information-only = 0. HBM = Health Belief Model; TPB = Theory of Planned Behavior; CUSE = condom use self-efficacy; BF = boy friend; GF = girl friend. ** $p < .01$, two-tailed. *** $p < .001$, two-tailed.

HBM. Additionally, the constructs that were associated with behavior were largely not the same constructs that contributed to behavior *change*, suggesting reconsideration of these theories may be necessary.

Implications for Health Behavior Theory

The theoretically based interventions were able to change some of the mediators postulated by the HBM and the TPB to elicit healthy behavior. Both perceived susceptibility and perceived severity showed greater increases in the HBM compared with the TPB intervention, which was expected, given that both of these constructs are unique to the HBM. But note that although there were significant changes on these constructs, perceived susceptibility was universally low ($M_{\text{overall}} = 2.49$, on a 1–7 scale) and perceived severity was universally high ($M_{\text{overall}} = 6.26$, on a 1–7 scale). Many sexually active individuals are likely to be taking the necessary precautions to prevent the unintended negative consequences of intercourse, and this is corroborated by the finding here that lower perceived susceptibility was related to less risky sexual behavior (VanLandingham, Suprasert, Grandjean, & Sittitai, 1995; Aiken, West, Woodward, & Reno, 1994). Alternatively, low perceived susceptibility scores could indicate misappraisal of risk. This is corroborated by the finding that adolescents and young adults have not yet fully developed the neurocognitive ability to accurately assess the long-term consequences of risk behavior (Cavazos-Rehg et al., 2009). In other HBM studies, perceived

susceptibility and severity did not show a great amount of change and inconsistently predicted behavior (e.g., VanLandingham et al., 1995; Aiken et al., 1994; Garcia & Mann, 2003). Perhaps, susceptibility and severity are rather stable constructs derived from current experience that cannot be manipulated in ways significant enough to elicit behavior change.

Two of the attitudinal components that we suggested were essentially overlapping constructs with different names—perceived benefits and attitudes toward condom use—had very different results. Every intervention (including the control) significantly increased the perceived benefits of condom use, and there was no significant difference between conditions. Although there was also a significant overall effect of time on attitudes, there were significant differences favoring the theory-based interventions compared with control and favoring the HBM intervention compared with the TPB. Our inability to assess the differential effects of the two theory-based conditions on perceived benefits may stem from Weinstein's (1993) and Noar and Zimmerman's (2005) criticisms of the HBM that the constructs are poorly specified and measured, though we found the measure to be highly reliable in this sample ($\alpha = .895$). It is also possible that anything done in an intervention will increase perceived benefits, and it is not a theory-specific construct. Specifically, the benefits items used in this study directly reflected information provided in all three interventions. Attitudes, on the other hand, were measured using a global assessment, encompassing more than "Do you believe condoms

prevent disease?" The assessment of whether condom use is "good" or "bad" likely involves both fact-based benefits ("condoms prevent disease") and affective content ("condom use makes me feel good about myself"). The theory-based interventions had content consistent with the latter notion of attitudes while the INFO intervention did not.

The results of this study speak to a larger and potentially more important concern in health behavior theory research: Current recommendations for the development of theory-based interventions to change behavior suggest that each construct of a particular theory ought to be targeted in an intervention (Peters, Klein, Kaufman, Meilleur, & Dixon, 2013; Williams, Freedman, & Deci, 1998). Our data suggest that this may not be necessary, and, indeed, interventions might instead focus on a few key constructs (e.g., self-efficacy) that seem to produce behavior change. Other theory-based intervention work has shown the mediation of behavior change occurs not through all constructs, but through only one or a few (e.g., Schmiele et al., 2009), suggesting that the current intervention approach of targeting every component of our multicomponent theories may not be the most efficient way to produce behavior change. Our data suggest that, perhaps, a more parsimonious—and potentially more effective—intervention to decrease risky sexual behavior might include only content targeting a "reduced" version of the TPB, namely, attitudes, self-efficacy and PBC, and intentions.

Implications for the Future

Although theory-based interventions are superior to those not guided by theory (Glanz & Bishop, 2010; Noar, 2008), there is still a tremendous amount to be learned about the optimal theory or the optimal combination of constructs from across theories that will most strongly influence behavior change. Further, popular health cognition theories (e.g., HBM and TPB) are limited in their ability to explain spontaneous, emotional, and affectively and socially laden behaviors, such as sexual activity. The inclusion of implicit attitudes could help meaningfully explain health behavior (Gibbons, Gerrard, Blanton, & Russell, 1998; Perugini, 2005; Rydell & McConnell, 2006). Implicit attitudes could potentially help explain the disconnect between explicit attitudes and condom use behavior (Czopp, Monteith, Zimmerman, & Lynam, 2004). For example, Prestwich, Perugini, Hurling, and Richetin (2010) were able to create positive implicit evaluations of a drink by pairing the drink with the self. If researchers were able to create more positive implicit condom use attitudes using a similar technique, perhaps attitudes would emerge as a better mediator of behavior change.

This study also brings up two important questions regarding theory comparison work. First, many of the constructs manipulated here are conceptually and empirically interconnected, so it is reasonable to assume that changing one construct potentially influences others. Particularly in the case of the TPB, given the strong overlap in the constructs, might it be possible to change all of the TPB constructs by intervening on only one? A dismantling study (Shadish, Cook, & Campbell, 2002) in which there were interventions focusing on manipulating a single construct (i.e., attitudes only, norms only, and PBC only) versus combinations of constructs could help to answer this question. Second, the current study did exactly what past reviews have called for (cf. Noar & Zimmerman, 2005; Weinstein, 1993) in terms of theory compari-

son work, and yet many issues were still left unresolved. For example, the oft-touted redundancy of constructs across theories was not empirically verified in our study. Perceived benefits from the HBM and attitudes toward a behavior in the TPB have been argued—we think correctly—to be addressing the same attitudinal beliefs construct (Noar & Zimmerman, 2005). However, they did not show a substantial amount of overlap here. This raises the question of whether there actually is a true difference between the constructs, or are we, as empiricists, able to create an artificial distinction that might in fact be a consequence of measurement effects and question wording? Perhaps, we need a refinement of what, exactly, we are asking in theory comparison work. Are we simply interested in reconciling issues of measurement and semantics across the major theories, or is the goal to determine the best health behavior theory? If the more basic questions of measurement and semantics are not first addressed, then it will be impossible to determine the unique contributions, if any, of each of these theories.

Study Limitations

Individuals in a serious committed relationship comprised nearly 40% of the sample. Predictors of condom use often differ in casual versus serious relationships (cf., Reid & Aiken, 2011), and condom use is extremely difficult to change among those in established long-term relationships. Assessment methods relied on self-report, a limitation shared with other safer-sex intervention research. The perceived barriers scale's reliability was abysmally low ($\alpha = .303$), suggesting that a coherent construct was not adequately captured with this scale. Finally, due to the constraints of the academic year, our follow-up interval was short, and a longer follow-up interval would be desirable in future studies.

Conclusion

Theory-based condom promotion interventions were successful at encouraging preparatory condom use behaviors and at impacting theory-based mediators of behavior change. Given the TPB's relative success in accounting for variance in risky sexual behavior and producing condom use preparatory behavior, perhaps this should be the guiding theoretical framework for future safer-sex behavioral research. Yet the constructs that influenced behavior change were not necessarily the ones more strongly related to current behavior. This suggests that the constructs that appear most useful in explaining behavior (e.g., perceived susceptibility) may not be the same constructs that can be manipulated to produce behavior change (e.g., self-efficacy). These large multicomponent theories may not be the best guides for producing behavior change, and, in fact, more parsimonious theories may be better at eliciting behavior change. This research illustrates the need for rigorous examination of the current health behavior change theories, a willingness to scrutinize their shortcomings, and a readiness to modify and improve theories of health behavior.

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Call for Papers: *Rehabilitation Psychology* Special Issue The Role of Rehabilitation Psychology in Critical Care and Acute Medical Settings

Rehabilitation Psychology plans to publish a special section on The Role of Rehabilitation Psychology in Critical Care and Acute Medical Settings in 2014. We are calling for submission of original manuscript within this broad area. We invite submissions from professionals in all areas of ICU and acute care rehabilitation (e.g. psychology, medicine, physical/occupational therapy, and speech language pathology).

Critical illness affects over 5 million individuals in North America and more around the world individuals who are at risk for a diverse range of physical, psychological and cognitive outcomes. Rehabilitation psychologists are increasingly engaged in the treatment and management of these individuals at the earliest time point in their recovery during intensive care hospitalization and in the acute care environment. In addition, rehabilitation psychologists in acute rehabilitation settings have long known that many of their patients arrive with the impact of their prior intensive care experience affecting their ability to participate and learn in rehabilitation. This special issue is intended to highlight the potential relevance of rehabilitation psychology to critical illness and acute medical care.

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