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Wrap it up : a comparison of the Health Belief Model and the theory of planned behavior

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Abstract

This study attempts to experimentally manipulate core constructs of the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) in order to increase condom use behavior. A direct comparison of the two models to determine the theory that best explains condom use behavior change will also be attempted. University of New Mexico psychology students (*N* = 280) completed measures on perceived susceptibility, severity, benefits, barriers, condom use self-efficacy, attitudes toward condoms, subjective norms, and perceived behavioral control. Next, they completed one of three randomly assigned computer-based interventions. 218 (77.8%) completed a behavioral assessment one month later. The TPB was best at explaining risky sexual behavior at baseline; it explained 30.6% of the variance while the HBM only explained 1.5% of the variance. The interventions were able to manipulate every predictor but perceived barriers. Mediational analyses of the HBM revealed that intervention type had an effect on perceived susceptibility, benefits, barriers, and condom use self-efficacy, but none of these mediators predicted risky sexual behavior at follow-up. TPB mediators attitudes

toward condom use and subjective norms were influenced by intervention type. Subjective norms and perceived behavioral control predicted intentions, but intentions did not predict behavior at follow-up. This study supports the assertion that theory-based interventions are more effective at changing proposed mediators of behavior; however, it was not successful at eliciting behavior change. In sum, current behavior theories should be rigorously examined and modified if need be to create more comprehensive theories of behavior change.

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The Importance of Theory

The goal of research in health psychology is to determine the cause and process of change in health behavior. 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) because of the stated importance of approaching health behavior questions from the perspective of a theory. Theory serves two principle functions in research: (1) it facilitates a better understanding of the determinants of health behavior and (2) it aids researchers in developing effective interventions to increase health behavior (Noar & Zimmerman, 2005).

Specifically, theory describes what variables are most important, how to measure them, and, in many cases, how the variables are temporally and causally organized to facilitate health behavior (Noar & Zimmerman, 2005). Theory provides an organized framework which helps researchers to focus on explaining and predicting behavior in a systematic manner (Glanz & Maddock, 2000). Without theory, an organized understanding of health behavior is difficult, if not impossible. Further, the evidence to date indicates that interventions designed from the basis of health behavior theory are more successful than those that are not theory-based (Glanz & Bishop, 2010; Noar, 2008). The superiority of theory-based interventions has been established, but these meta-analyses do not answer the important question of whether one theory results in more effective interventions than another, either generally or for particular behaviors. As of Glanz and Bishop's 2010 review of behavioral science theory,

there are very few studies that directly compare the effects of using different theories for various health behaviors. Discovering the theories that fit best with specific problems and contexts ultimately has the potential to lead to more efficacious interventions. An added advantage to theory comparison work is the opportunity to include constructs from multiple theories in the same study. A detailed analysis can then be undertaken to understand which components of which theories seem to be the driving factors in facilitating behavior change (Noar, 2008).

If theory is so fundamental to the understanding of health behavior and health behavior change, what, then, are the principal components of a "good" theory? According to Ogden (2003):

> A good theory should consist of constructs that are sufficiently specific so as to generate hypotheses. Such hypotheses should be testable, and in principle at least, a good theory should be able to be rejected.

Thus, a good theory should (1) include detailed concepts (2) be testable and (3) be falsifiable. It is essential for health psychologists to consider the necessary components of a good theory when choosing a theory to test in a particular health domain or to utilize as a basis for intervention design.

The importance of theory is almost never disputed. While researchers almost universally assert theory as a necessary component of research, there remain significant shortcomings in the theoretical literature (Noar & Zimmerman, 2005; Glanz & Bishop, 2010). Several reviews have focused on the lack of distinctiveness between theories; often times the same concept is included in multiple theories, but is given a different name for each theory (Weinstein, 1993;

Noar & Zimmerman, 2005). This creates the illusion of distinctiveness between theories, when in fact there might be very little. Additionally, health interventions on the whole have only small to moderate effects on behavior change (Webb & Sheeran, 2006), and perhaps this is a result of the lack of agreement concerning the best set of constructs to motivate behavior change.

Current State of the Science of Health Behavior Theory

Currently, the most widely utilized theories of health behavior are the Health Belief Model [HBM (Janz & Becker, 1984)], the Theory of Planned Behavior [TPB (Ajzen & Madden,1986)], and the Social Cognitive Theory [SCT (Bandura, 1998)]. Various authors have commented on the similarity of the constructs within 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). An in-depth investigation of the similarity and differences of these concepts could eventually lead to a unified health belief theory. Noar and Zimmerman (2005) provide an analysis of the similar—if not identical—elements of the HBM, TPB, and SCT. To elucidate the similarities among the constructs, the behavior of condom use will be used to demonstrate each of the components of the theories.

Each of the three theories contains an attitudinal beliefs component, which is essentially the degree to which an individual perceives and weighs the importance of the positive and negative consequences of a given behavior. In the Health Belief Model, the positive side of the attitudinal construct is known as perceived benefits (e.g., condom use will prevent pregnancy), while the negative

side of the attitudinal construct is partially subsumed in the construct known as perceived barriers (e.g., sex doesn't feel as good with a condom). The Theory of Planned Behavior has a more general form of attitudes (e.g., for me, condom use would be….good versus bad, healthy versus unhealthy) that is assumed to be determined by behavioral beliefs (e.g., condom use will prevent pregnancy, sex doesn't feel as good without a condom). Finally, the Social Cognitive Theory describes attitudes as expectancies, and typically divides these expectancies into prevention expectancies (e.g., condom use will prevent pregnancy) and hedonistic expectancies (e.g., sex doesn't feel as good without a condom) (Jemmott, Jemmott, & Fong, 1998; Jemmott & Jemmott ,1991). Clearly, despite the difference in terminology, the exact same individual beliefs are captured in each theory.

Self-efficacy, one's belief in their ability to perform a specific behavior, has become an important component of all three theories. Self-efficacy has garnered substantial attention in health behavior research because it often explains a substantial amount of variance in both intentions and behavior. Casey, Timmerman, Allen, Krahn, and Turkiewicz (2009) conducted a meta-analysis concerning the connection between condom use and self-efficacy. The authors found a positive correlation between self-efficacy and condom use intentions. This suggests condom use is more likely when a person believes it is something they can put into practice. Albarracín, Johnson, Fishbein, and Muellerleile (2001) performed a meta-analysis of the Theories of Reasoned Action and Planned Behavior. Albarracín et al. (2001) concluded that perceived behavioral control,

which some argue is theoretically identical to self-efficacy (Ajzen & Madden, 1986, pg. 457), is a significant predictor of condom use intentions. Both the HBM and SCT simply refer to self-efficacy as self-efficacy (e.g. I feel confident in my ability to put a condom on my partner and I feel confident I could purchase condoms without feeling embarrassed). The TPB identifies it as perceived behavioral control (the degree to which one believes they have control over the behavior). Distinguishing between perceived behavioral control and self-efficacy has become a hotly debated topic within health behavior research. Many, including the creators of the TPB, argue (Ajzen & Madden, 1986; Ajzen 1991; Noar & Zimmerman, 2005), that self-efficacy is largely synonymous with perceived behavioral control. On the other hand, Armitage and Conner (1999) showed significant differences between self-efficacy and perceived behavioral control. They define self-efficacy as "confidence in one's own ability to carry out a behavior". This involves internal resources such as motivation. Armitage and Conner (1999) define perceived behavioral control as "the extent to which people perceive control over more external factors (e.g., availability)". To distinguish between the two concepts, control language is used to assess perceived behavioral control (e.g., how much personal control do you feel you have over using a condom in the next month). To account for these differing perspectives, it is important to include both measures of perceived behavioral control and self-efficacy in order to provide further evidence on this important question.

Normative beliefs are a final example of a similar concept included in each model. Normative beliefs consist of beliefs that others provide support to engage

or not engage in a particular behavior. HBM views this concept as cues from the media or friends and calls it cues to action (e.g., a condom billboard). A cue to action is supposed to help move an individual from wanting to make a health change to actually making the change. The TPB considers normative beliefs subjective norms (e.g., people who are important to me think I should use condoms during sexual activity) and takes into account perceived social pressure to perform a behavior and one's motivation to comply with the pressure. The SCT describes normative beliefs as social support (e.g., my mother would like me to use condoms).

The HBM, TPB, and SCT share many similar constructs, however, each theory also includes 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 emphasized in the other two theories. Examples of perceived susceptibility and severity, respectively, include: 'How susceptible to sexually transmitted diseases do you feel?' and 'Overall, how disruptive would a sexually transmitted disease be in your life?'. Intentions are unique to the TPB. Intentions (e.g., how likely is it that you will carry condoms with you in the next month) are posited to be the most proximal predictor of behavior in the TPB, while attitudes, norms, and perceived behavioral control are the determinants of intentions.

Similar or identical constructs with different names in different theories create fragmented health behavior theory literature, where comparable

knowledge is acquired for each theory, yet seems to add little to the cumulative literature. Additionally, theorists may claim concepts come from different theoretical origins but be measured in essentially the same manner. For example, many of the barriers to condom use identified by the HBM are just as easily conceptualized as facets of self-efficacy from SCT, such as condom negotiation and purchasing condoms. The fact that we do not even have consensus on what to call the most important determinants of health behavior leads to the larger and arguable more important problem: determining the best combination of variables to predict and change behavior. Research must be done to determine the extent of overlap and distinctiveness between concepts within the major health behavior theories. Knowledge could be more easily combined and integrated if a common set of terminology were agreed upon (Noar & Zimmerman, 2005; Weinstein, 1993).

The HBM, TPB, and SCT specify different casual relationships among the important constructs in each. Although many have postulated about the casual relationship, an explicit association has never been stated. Figure 1 is a graphic representation of the HBM.

The original HBM presumes that all four determinants (perceived benefits, barriers, susceptibility, and severity) all contribute equally to health behavior. The TPB, on the other hand specifically states the casual relationship between variables. Figure 2 is a schematic representation of the connection between the fundamental factors of the TPB.

The connection between each determinant will be further explained later. The SCT is more explicit than the HBM, but not as precise as the TPB when describing the connection between the theory variables. Figure 3 diagrams the SCT.

In the SCT a person's individual differences, such as age, gender, and ethnicity directly predict behavior. This connection is influenced by efficacy beliefs. Behavior in turn predicts outcome, which is influenced by outcome expectancies (e.g., social ramifications of an action).

As indicated by Noar and Zimmerman (2005) the HBM, TPB, and SCT each have substantial support within the empirical literature. However, one of the biggest criticisms of health behavior research has been the dearth of testing theories against one another (Weinstein, 1993; Noar & Zimmerman, 2005; Garcia & Mann, 2003). In order for health research to move forward, it is important to understand the degree to which existing models overlap versus the degree to which one theory may outperform the rest in terms of accounting for variance in a particular health behavior or in the design of interventions. Theory-based interventions are better at explaining behavior (Glanz & Bishop, 2010; Noar, 2008), but which theory is best at explaining particular behaviors is still unknown. These are related yet distinct questions. First, understanding which of the existing theories is best at explaining health-related behavior requires empirical testing of the theories against one another, and to date, this is typically accomplished in survey research. Conner and Graham (1993) examined the extent to which the HBM, without self-efficacy, versus the TPB explained condom

use intentions among college students. Through regression analyses Conner and Graham (1993) reported that the TPB generally predicted condom use intentions much better than the HBM without self-efficacy. Conner and Norman (1994) compared the HBM to the TPB as predictors of health screening. The TPB was only slightly better at predicting health screening intentions than the HBM. Collapsing across the two models, Conner and Norman (1994) discovered the best predictors of intentions were attitudes, behavioral beliefs, perceived barriers and benefits, yet none of the constructs were significant predictors of actual behavior. However, behavioral intentions were weakly related to behavior change. Conner and Norman (1994) followed-up with their participants and discovered the predictors of intentions did not significantly predict behavior. Furthermore, Conner and Norman (1994) found intentions were the best predictors of attendance at the screening clinics.

Garcia and Mann (2003) tested the ability of the Health Belief Model, the Theory of Planned Behavior, and the Health Action Process Approach to predict intentions to engage in resisting dieting and performing breast self-exams. The authors discovered that self-efficacy was the best predictor of intention, and that overall the Health Action Process Approach best predicted intentions for the health behaviors tested. While Garcia and Mann's (2003) theory comparison is a step in the right direction, there is still much to be learned in order for health behavior research to move forward. A substantial amount of the theory comparison literature does not use actual behavior as the outcome, but instead

tests the predictors of *intentions* to engage in a particular behavior (Weinstein, 1993).

Wulfert and Wan (1995) conducted a model comparison of the Health Belief Model, Theory of Reasoned Action, and the Social Cognitive Theory assessing condom use among young adults. They assessed condom self-efficacy using three items concerning confidence in using condoms every time, when highly aroused, and resisting unprotected sex. Wulfert and Wan (1995) suggest their findings imply condom use intentions are best explained by self-efficacy beliefs, evaluation of the consequences of condom use, and social norms regarding condoms. They also state these factors are primary components of the SCT, thus their results lend substantial support for the use of this theory. Wulfert and Wan (1995) not only assess intentions to use condoms but behavior as well, a marked improvement to research only examining intentions. They also break down theories into their most important components, something many theorists have called for. Their studies did not manipulate constructs; Wulfert and Wan (1995) did not try to change participants' behavior. They simply measured attitudes and beliefs at different time periods and calculated how well concepts were correlated. This study was correlational; experimental data is practically nonexistent.

Correlational studies reliably show an association between intentions and behavior but as the old maxim states, correlation is not causation, and it is just as possible that prior behavior leads one to have stronger intentions than vice versa (Webb & Sheeran, 2006). In a meta-analysis examining the extent to which

experimentally manipulated changes in behavioral intentions led to behavior change, Webb and Sheeran (2006) reported promising findings. Though their results showed a significant relationship, the intention-behavior connection may not be as strong as previously thought. Webb and Sheeran (2006) reported that successful experimental intention-change interventions lead to small-to-medium changes in behavior. Determining the most predictive components of each theory to elicit the greatest amount of behavior change is the next step in health research.

Weinstein (2007) attributes the lack of rigorous theory comparison within health research to an over reliance on correlational research to explain causal relationships. Garcia and Mann's (2003) study is a perfect example of comparing theories using correlation and regression techniques to determine the best fitting model. The best theory is judged to be the one that accounts for the largest proportion of the variance in intentions and/or behavior. But, again, 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. Health behavior research is desperately in need of strong experimental designs with a focus on comparing models in order to determine the causal relationship of health theories' variables (Weinstein, 2007).

Experimental theory comparisons have a number of advantages over cross-sectional theory comparisons. First, experimental designs overcome the limitation of not being able to draw any causal conclusions regarding

relationships proposed in each theory (Reid & Aiken, in press). Second, experimental designs can help determine which theory best accounts for *changes in behavior*, rather than simply accounting for variance in what is likely to be a highly stable behavior over time. Finally, experimental designs which seek to change constructs theoretically related to behavior and then assess changes in that behavior after the intervention allow for the incorporation of actual behavior instead of intentions. This study intends to empirically compare the effectiveness of two interventions designed on the basis of two of the most widely used health behavior theories: the Theory of Planned Behavior and the Health Belief Model. The SCT will not be used for two reasons. Typically SCT studies include self-efficacy and none of the other constructs mentioned by Bandura (1998). Additionally, there is not a firm agreement regarding which constructs should be used to evaluate SCT. Thus, the HBM and the TPB will be used in this study.

Theory of Planned Behavior (TPB)

The TPB proposes that attitudes, normative beliefs, and perceived behavioral control (described previously) directly influence an individual's intentions to participate in a behavior. Intentions, and under some circumstances perceived behavioral control, are then the most proximal causes of action (Ajzen & Madden, 1986).

Attitudes toward a specific behavior, subjective norms supporting the behavior, and perceived behavioral control over the behavior are related to one another, and are direct predictors of intentions. Perceived behavioral control

(PBC) is the only component that does not necessarily operate through intentions to influence behavior. As mentioned, there are circumstances where PBC can directly influence behavior, and this relationship is perhaps most easily understood through an example. An individual may have positive attitudes toward condom use, their social circle may be highly supportive of condom use and/or consistently use condoms, and the person may thus have strong intentions to use condoms but never does so. Why? If a person does not believe they can successfully put a condom on or navigate condom negotiation with their partner, then everything else is inconsequential and intentions will not be translated into behavior. Lack of PBC over the behavior thus directly influences the behavior, and under these circumstances a condom will not be used during a sexual interaction. Perceived behavioral control can thus directly influence behavior; particularly those that are not under a person's volitional control (Ajzen & Madden, 1986). An important strength of the TPB, and perhaps one reason for its popularity, is this specificity in terms of the hypothesized temporal and causal relationships in the model.

Albarracín et al. (2001) conducted a meta-analytic review of studies using the Theory of Reasoned Action (TRA) and Planned Behavior as models used to describe condom use. The TRA is simply the TPB without perceived behavioral control as a stated component. Perceived behavioral control was added to account for non-volitional behavior the TRA was generally not successful at explaining. The authors analyzed 96 data sets that tested the TRA, TPB, or both. The TRA and TPB variables both accounted for significant variability in condom

use. Attitudes and norms were the most consistent predictors of intentions, and perceived behavioral control was inconsistently related to intentions and unrelated to behavior (Albarracín et al., 2001). Thus, although the structure of the TPB would predict strong relationships between PBC and both intentions and behavior, in the domain of condom use those hypotheses have not always been borne out.

Godin and Kok (1996) had similar results when examining the utility of the TPB to explain health-related behaviors such as smoking, alcohol use, exercising, eating habits, and condom use. The authors found intentions were the best predictor of behavior and perceived behavioral control and attitude toward the behavior were often the strongest predictors of variation in intentions. The variables within the TPB seem to account for significant variation in behavior, but the TPB has many weaknesses as well. The TPB does not take into account either aspects of the context in which the behavior occurs that might lead to relatively more spontaneous actions (e.g., alcohol use; Bryan et al., 2007). Further, many have noted that the TPB does not include a focus on emotion and affect, which are increasingly being recognized as important predictors of health behaviors (e.g., de Ridder and de Wit, 2006). Instead, the TPB emphasizes rational, conscious, and deliberate behaviors. Moreover, there has been an increasing emphasis on the difference between behavior initiation and maintenance which the TPB does not consider (Bennett & Bonzionelos, 2000).

Health Belief Model (HBM)

The Health Belief Model was originally designed to understand why individuals do or do not participate in discrete (rather than continuously occurring) health-related behaviors; namely, vaccination (Rosenstock, 1974). The basic components of the HBM depend primarily on two variables (1) the value of a goal to an individual, and (2) the individual's appraisal of the likelihood of an action achieving that goal (Janz & Becker, 1984). The most recently revised version of the HBM consists of 5 dimensions. Perceived susceptibility refers to how vulnerable individuals feel toward health threats. Perceived severity is a person's assessment of how serious or dangerous a threat may be. Individuals' beliefs about whether a particular action will reduce the threat of illness are perceived benefits. Perceived barriers are beliefs about whether an individual can overcome the negative consequences associated with recommended actions. Self-efficacy, one's perceived ability to take preventive action, was added to the model in 1988 by Rosenstock, Strecher, and Becker (1988). The HBM originally did not include efficacy beliefs because it was designed to explain simple preventative behaviors such as immunizations that required little skill to accomplish. Now that the HBM is being used to describe chronic illnesses and long-term health changes, efficacy beliefs were recognized as a key variable that should be included. According to Rosenstock et al. (1988), lifelong healthy habits require a great deal of confidence that one can alter their current lifestyle, thus the importance of self-efficacy and its inclusion in the HBM. Furthermore, the authors state that perceived barriers have been used as a "catch-all construct"

that included both real barriers to behavior as well as efficacy beliefs, so they believe that greater predictive ability would be brought about by making self-efficacy a distinct component of the HBM.

The HBM has over 50 years of research examining its usefulness for explaining health-related behaviors, and the evidence is somewhat equivocal. In 1984 Janz and Becker conducted a thorough review of the uses of the HBM. After examining 46 studies that used the original Health Belief Model, which did not include self-efficacy, the authors concluded that the strongest predictor of health behaviors was perceived barriers. Perceived barriers and benefits have consistently predicted behavior (Reid & Aiken, in press) while susceptibility and severity have done little to contribute to behavioral prediction. Self-efficacy tends to be the strongest predictor of behavior within the HBM version that includes the construct (Lin, Simoni, & Zemon, 2005).

The HBM has had several criticisms over the years. Many have argued that the HBM is not well specified, meaning it is difficult to know the causal relationships between variables, making it difficult to know what “structure” to test when evaluating the strength of the model (Noar & Zimmerman, 2005; Weinstein, 1993). Some researchers (Ronis, 1992; Jackson & Aiken, 2000) have argued that perceived susceptibility and severity influences perceived benefits, which is a direct predictor of behavior. Ronis (1992) and Jackson and Aiken (2000) have been mildly successful in validating that argument. However, those who claim perceived susceptibility and severity precede perceived benefits do so only using scattered pieces of the HBM and are not consistent across investigators.

Current Study

The current study seeks to utilize an experimental design to compare the efficacy of the Theory of Planned Behavior and the Health Belief Model to change college students' intentions to use and subsequent use of condoms. Young adults are having sex and often times not safely. Adefuye et al. (2009) state college students tend to have multiple sexual partners and inconsistent condom use. They reported approximately only 20%-35% of college-aged students use condoms every time they have sex (Adefuye et al., 2009). Additionally the CDC (2008) reports each year approximately 9.5 million new STI infections are among 15 to 24 year olds. Further, 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 infection (CDC, 2009; Hall, 2008). This population needs theoretically driven interventions to increase condom use.

This paper attempts to add to the empirical health behavior theory comparison literature. There are four goals of this work. First, we will assess which of the two models accounts for more of the variance in behavior at baseline, essentially replicating prior cross-sectional theory comparison work. Second, we will design distinct interventions that target the specific constructs in each of the models, following model development recommendations by Aiken (2010) and West, Aiken, and Todd (1993). Third, we will determine which of the models was more successful at changing condom use behavior among college

students. Fourth, we will conduct extensive mediational analysis to determine which constructs were the "active ingredients" of change in the interventions (c.f., West, Aiken, & Todd, 1993). A strength of this design is of course the experimental design which will allow us to draw stronger causal conclusions than prior correlational model comparisons. In addition, the model comparison work proposed here will help to elucidate the strengths and weaknesses of each theory, ultimately allowing for the development of a more comprehensive knowledge of health behavior (Weinstein, 1993). This research will thus enable a synthesis of knowledge across theories, and hopefully lead to more successful interventions. The current study intends to empirically test the TPB and HBM via brief interventions to increase condom use with college students.

Method

Participants

A total of 286 participants were recruited from introductory psychology courses at the University of New Mexico. 280 participants were used in the analyses. 5 participants were excluded because they had not had vaginal or anal intercourse and one was excluded due to computer error in recording survey responses. Inclusion criteria were that participants must be 18 or older and must have had vaginal or anal intercourse at least once. All procedures were reviewed and approved by the local IRB.

Demographic and sexual history information for the final sample is included in Table 1. The participants (64.63% female, 35.37% male) were 41.1% Caucasian, 4.3% African American, 42.9% Hispanic American, 4.3% American

Indian/Native American, 2.9% Asian or Pacific Islander,2.1% were other racial and ethnic backgrounds, 1.4% were mixed racial and ethnic backgrounds, and 1.1% were unknown. The mean age of participants was 20.54 years (*SD* = 4.268), and they ranged from 18 to 48 years of age.

Procedure

Students were recruited using standard introductory psychology procedures via the online Sona System. Given the sensitive nature of the information gathered during the study, participants were reminded that their responses were confidential and they were encouraged to answer as honestly as possible. They were instructed to skip questions if they did not feel comfortable providing a response. If students decided to participate, they were given a link to a password protected website. A reminder email was sent to participants one day prior to their scheduled study time. Once signed into the website, students completed a baseline series of questionnaires and were randomly assigned to the HBM intervention, the TPB intervention, or an information-only control intervention.

Measures

All constructs contained in the two models were measured. 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 Ajzen and Madden (1986).

Perceived susceptibility. Participants were asked how likely a particular event was: 'How susceptible to sexually transmitted diseases do you feel?' and 'Would you say that you are the type of person who is likely to get a sexually transmitted disease?'. Twelve items were rated on a seven-point Likert scale from 1 (very unlikely) to 7 (very likely). These items were combined into a scale in which higher scores indicated more perceived susceptibility to STDs, HIV/AIDS, and pregnancy, α=.859.

Perceived severity. Students were asked how disruptive the consequences of unprotected sexual intercourse would be to determine perceived severity. Sample items include: 'How disruptive would an STD be to your health?' and 'How disruptive would pregnancy be to your personal relationships?'. Eighteen items were rated on a seven-point Likert scale from 1 (not at all disruptive) to 7 (very disruptive). Higher scores indicated greater perceived severity to unsafe sexual activity, α=.843.

Perceived benefits. Several benefits of condom use were listed according to the HBM. 'To what extent do you believe that condoms are effective in preventing the spread of STDs among sexually active people?' and 'To what extent do you believe that condoms would be effective in preventing you from getting pregnant or impregnating someone?' are two sample items. Eight items were combined into a scale in which higher numbers indicated greater perceived benefits of condom use, α=.890.

Perceived barriers. Participants were also asked to rate the extent to which they agreed with four barriers to condom use on the same scale as the

previous HBM constructs. Sample items include: 'Enjoyable sex is not possible with a condom' and 'Buying condoms is embarrassing'. Greater perceived barriers to condom use were indicated by higher combined scores, α=.359. The correlations among the barrier items were all smaller than .30, indicating a weak relationship between the four statements. The overall construct of perceived barriers to condom use was not adequately captured with this scale. However, the barriers referred to in this scale are important impediments to condom use. Additional research should be conducted to create a barriers scale that sufficiently captures the construct.

Attitude towards condom use. Students were asked seven questions regarding their attitudes toward condoms, α=.797. Each item was assessed using a seven-point Likert scale. Sample items include: 'For me, using a condom would be unhealthy (1) versus healthy (7)' and 'For me, using a condom would be bad (1) versus good (7)'. Note that we chose here to include the direct attitudes measure as opposed to the indirect measure that is the multiplicative index of behavioral beliefs and importance of each belief. Though these are significant precursors to direct attitudes (Reid & Aiken, in press), the intervention was not targeted to and would be unlikely to change the *importance* of each belief for each participant. Thus, for simplicity, we assessed only direct attitudes.

Subjective norms.11 items were rated on a seven-point Likert scale from 1 (disagree strongly) to 7 (agree strongly), α=.749. Participants were asked what their sexual partners, friends, family, and most people think about condom use. This scale consisted of items such as 'Most of my friends use condoms' and

'Most people who are important to me think I should not use condoms'. These items assessed norms as traditionally specified by the TPB that tap into how strongly the individual believes that various individuals want him/her to take a certain action. Consistent with Cialdini and colleagues (e.g., Cialdini, Reno, & Kallgren, 1990), the term "injunctive norms" was used for the norms traditionally included in the TPB and "descriptive norm" was used for the perceived behavioral norms. Injunctive norms were included for consistency with the TPB, and descriptive norms because of evidence that they are a particularly important predictor of behavior among young people (Rivis & Sheeran, 2003). 10 injunctive norm items were used, α=.743, and one descriptive norm item was used ('Most of my friends use condoms during sexual activity.). Both injunctive and descriptive norm items were used in the overall subjective norms scale.

Similar to our decision about attitudes, we chose here to include the direct normative measure as opposed to the indirect measure that is the multiplicative index of normative beliefs of particular referents and motivation to comply with those referents. First, a review and comparative test of the TRA and TPB (Sutton et al., 1999) found only very weak support for the multiplicative assumption of the models, and in Reid and Aiken's (in press) recent model comparison work, these multiplicative normative indices were not retained in the final integrated model, with the exception of partner norms, and then only for women in serious relationships. Thus, for simplicity, we also assessed only direct normative support.

Perceived behavioral control. In an attempt to distinguish between perceived behavioral control (PBC) and self-efficacy, scale items for PBC were modeled after those used by Armitage and Conner (1999). 'Whether or not I use a condom in the next month is entirely up to me' and 'I believe I have the ability to use a condom in the next month.' are two sample items used to assess perceived behavioral control. Seven items were rated on a seven-point Likert scale, α=.690.

Intentions. The final questions relating to the Theory of Planned Behavior concerned participants' intentions to use a condom within the next month. Sample items include: 'How likely is it that you will buy condoms in the next month?' and 'How likely is it that you will use a condom the next time you have intercourse?'. Four items were rated on a seven-point Likert scale from 1 (not at all likely) to 7 (very likely), α=.833.

Condom use self-efficacy scale. Given the prominent role self-efficacy plays in both the Health Belief Model and the Theory of Planned Behavior an additional self-efficacy scale was used. Brien and Thombs (1994) subscales of the Condom Use Self-Efficacy Scale (CUSES) were used to assess individuals' perceptions of his or her ability to use condoms. The Brien and Thombs (1994) version of the CUSES was used because it was developed using a young adult population. Fifteen items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), α=.889. Four subscales were included within the CUSES; these are the mechanics of putting a condom on (α=.897), partner disapproval (α=.852), assertiveness (α=.846), and the influence of

intoxicants on a person's ability to use condoms (α=.818). Sample items from the CUSES include: 'I feel confident in my ability to use a condom correctly' and 'I feel confident that I would remember to use a condom even after I have been drinking'.

Interventions

Two brief computer-based interventions were developed in which the content strictly adhered to the theoretical constructs included in the two theories being tested (c.f., Aiken, 2010). All intervention content was presented entirely via computer. In a meta-analysis assessing the efficacy of computer-based interventions, Noar, Black, and Pierce (2009), as well as Kiene and Barta (2006), concluded that the most efficacious internet-based interventions were conducted with young, highly educated college students. College students could benefit most from computer-delivered interventions because they have higher-level cognitive skills and are familiar with the internet-based format. 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 STD. This is a promising form of intervention delivery more generally, as web-based interventions have the potential to reach wider audiences who are not motivated to utilize in-person care, require lower delivery cost than human-delivered interventions, allow for standardization of delivery content, as well as permit greater dissemination flexibility (e.g., cell phones).

Health belief model intervention.

Perceived susceptibility. In order for perceived susceptibility to be an agent of behavior change, participants must believe that, for them, contracting an STD/HIV or experiencing a pregnancy is a likely consequence of unprotected sex. Following the principles of the HBM, students were presented with national and New Mexico STD/HIV and pregnancy statistics. Sample facts include: 'If you do not use a condom, you have an 80% chance of becoming pregnant/impregnating someone' and 'Women have a 60-80% risk of getting the infection from a single act of vaginal intercourse with a man infected with gonorrhea' (National Institute of Allergy and Infectious Diseases, 2001).

Perceived severity. Perceived severity intervention components included pictures of STD infected male and female genitalia. Specific sexually transmitted diseases shown to participants included Chlamydia, herpes, and syphilis. Long-term consequences of some STDs were also described. Sample facts include: 'Chlamydia and gonorrhea can cause infertility in women' and 'Syphilis can cause permanent heart and brain damage'. Students in the HBM intervention were also shown a clip of a small child throwing a temper tantrum to enhance the perceived severity of unplanned pregnancy.

Perceived benefits. Emotional and physical benefits of condom use were highlighted during the HBM intervention. 'Using a condom during sex makes me feel respected' and 'I don't feel guilt after sex when I use a condom' are examples of the emotional benefits of condom use. Participants were also presented with condom effectiveness statistics to emphasize the physical

benefits of condom use. Sample information includes: “When used properly and consistently, condoms are 98 percent effective in preventing pregnancy” (Advocates for Youth, n.d.).

Perceived barriers. Three perceived barriers to condom use were addressed. Frequently, loss of sensation during intercourse is listed as a reason to abstain from condom use. Thus, participants were instructed on how to properly lube a condom to increase pleasure for both the male and female while wearing a condom. Other commonly cited reasons for not using condoms are difficulties finding and purchasing condoms, as well as effectively communicating with a partner. These two issues were addressed using pictures and a video showing a peer purchase condoms without embarrassment and successfully negotiating condom use with a new and slightly resistant partner. Students in every condition were also given a list of area resources. This included places to get free condoms as well as STD and HIV testing.

Theory of planned behavior.

Attitude towards behavior. Attitude towards behavior information was similar to that presented during the perceived benefits of condom use portion of the HBM intervention. The physical benefits of condom use were highlighted with statements such as “Correct and consistent use of latex condoms can reduce the risk of other STDs, including Chlamydia, genital herpes, gonorrhea and syphilis” (CDC, 2008). Hedonistic attitudes were captured with statements such as ‘A condom helps a man last longer before ejaculation.’ Sample emotional attitudes include ‘I feel better about myself after using a condom.’

Subjective norms. In order to elicit social comparison, participants were given three kinds of information: personalized feedback, prototype feedback, and peer norms. Students were asked about their condom use behaviors. Participants were then provided feedback comparing them to other University of New Mexico students. They received statements such as '87% of UNM students think condoms are effective and should be used every time with every sexual partner' and '80% of UNM students use a condom every time they have sex. You use condoms ___% of the time'. Prototype feedback included information about the kind of student who uses condoms. Sample statements included: 'Students with higher GPAs tend to use condoms more often' and 'Most students do not have sex if they have been drinking'. Statements such as 'Most UNM students feel condoms are necessary' and 'Most UNM students think condoms help make sex last longer' were used to prompt social comparisons.

Intentions. The intentions portion of the intervention focused on trying to increase participants' motivation to use condoms. This was done by having students set a safer sex goal and asking them to set a plan to achieve this goal within the next month.

Perceived behavioral control/self-efficacy. The same video was used in both the HBM and the TPB interventions to enhance PBC/self-efficacy for condom use. The video included one male and one female college student discussing concerns about condom use. One friend taught the other how to correctly put a condom on and proper places to carry condoms were discussed.

Many of the concepts addressed during the self-efficacy video are intertwined with the concept of perceived barriers in the HBM.

Information-only intervention. Important components from the information-only intervention included basic STD information and definitions, modes of STD and HIV transmission, the effectiveness of condoms at preventing STD and HIV transmission as well as pregnancy, and the presentation of a list of area resources for testing and other sexual health services.

Immediate Posttest Outcomes

Following prior research (e.g., Bryan, Aiken, & West, 1996; Schmiege, Broaddus, Levin, & Bryan, 2009), assessments of each of the theoretical constructs were completed by participants a second time immediately following the end of the intervention. This provided an assessment of the extent to which levels of those constructs were impacted by the intervention and allowed for testing of the degree to which changes in those constructs mediate later changes in behavior.

Follow-up

One month after a participant's intervention date, they received an email from the experimenter. This email included instructions directing the student to a website to answer questions regarding their sexual activity and condom use over the past month. We also included questions about intentions to use condoms and preparatory condom use behaviors in order to assess intervention efficacy for those participants who had not been sexually active over the intervening month (Bryan, Fisher, & Fisher, 2002).

Results

Pretest Equivalence of Conditions

Pretest means on program components targeted by the theory-based interventions are given in table 2 for all three conditions, along with tests of pretest equivalence. One difference was found between conditions at pretest: attitudes towards condom use were significantly lower in the HBM condition as opposed to the TPB and information-only conditions, $F(2, 262)=17.38$, $p<.001$.

In general, perceived susceptibility to HIV/STDs was quite low (overall $M=2.26$, $SD=0.92$ on a seven point scale) while perceived severity of HIV/STDs was rather high (overall $M=6.09$, $SD=0.74$ on a seven point scale). Similarly, perceived barriers were quite low while benefits, norms, attitudes, PBC and self-efficacy were quite high in this sample.

Assessing Which Model Accounts for More Variance in Risky Sexual Behavior at Baseline

HBM-behavior link. Collapsing across conditions, correlations between pretest HBM constructs and past condom use are described in table 3. These indices indicate the relative strength of the individual predictors. There were moderate correlations between barriers and all three assessments of condom use, as well as a small correlation between benefits and condom use during a participant's most recent sexual experience.

A multiple regression analysis was conducted to evaluate how well the HBM constructs (i.e., susceptibility, severity, benefits, barriers, and condom use self-efficacy) were collectively associated with risky sexual behavior at baseline.

The linear combination of HBM constructs was not significantly related to risky sexual behavior at baseline, R^2 =.015, $F(5, 195) = .608$, $p = .694$. None of the regression coefficients for susceptibility, severity, benefits, barriers, and condom use self-efficacy were significant (all *ps*>.300).

TPB-behavior link. Collapsing across conditions, correlations between pretest TPB constructs and past condom use are described in table 4. These indices indicate the relative strength of the individual predictors. In contrast to the HBM, all of the TPB constructs have moderate correlations with past condom use behavior.

A multiple regression analysis was conducted to evaluate how well the TPB constructs (i.e., attitudes, norms, perceived behavioral control, and intentions) were collectively associated with risky sexual behavior at baseline. The linear combination of TPB constructs was significantly related to risky sexual behavior at baseline, $R^2 = 0.306$, $F(4, 228) = 25.089$, $p < .001$. To assess the contributions of individual predictors, the *t* ratios for the individual regression slopes were examined. Two of the four predictors were significantly uniquely associated with risky sexual behavior at baseline; these included attitudes towards condom use, $B = -.329$, t (228) = -5.001, $p < .001$, and intentions, $B = -.267$, t (228) = -4.007, $p < .001$.The negative sign of the regression coefficients for attitudes and intentions indicate that higher scores on these constructs were associated with less risky sexual behavior.

Relationship Between the Constructs

Correlations among all variables used for the mediational analyses are provided in table 5. Note the relationships between self-efficacy, attitudes, barriers, and susceptibility. Participants with higher self-efficacy for and more positive attitudes towards condom use as well as fewer barriers perceived *lower* susceptibility to negative consequences of sexual activity, likely because these are the individuals who are more likely to have used condoms and thus actually *are* at lower risk for negative consequences (c.f., Gerrard et al., 1996). There is a moderate correlation between the condom use self-efficacy scale and the Health Belief Model's perceived barriers scale (r = -.546). Similarly, there is a moderate correlation between PBC and self-efficacy (r = .463), suggesting a strong degree of overlap in those relationships. In contrast, the correlation between barriers and PBC was only -.210, suggesting somewhat more distinctiveness between those constructs.

Pretest and Posttest Differences by Condition

Pretest and posttest means on program components targeted by the theory-based interventions are given in table 6 for all three conditions, along with repeated measures ANOVAs for program efficacy. Intervention condition impacted susceptibility, severity, attitudes toward condom use, intentions, and condom use self-efficacy. In general, perceived susceptibility and perceived severity scores were highest at posttest in the HBM condition (M = 2.81; M = 6.37, respectively). Surprisingly, attitudes towards condom use scores were highest at posttest in the HBM condition (M = 5.87). The TPB condition had the

highest posttest intentions scores (*M* = 5.07). Condom use self-efficacy increased in both the TPB and HBM conditions (*M* = 4.46; *M* = 4.47, respectively). There was also a main effect of time for all constructs except for perceived barriers. Participants reported higher degrees of susceptibility, severity, benefits, attitudes, norms, perceived behavioral control, intentions, and condom use self-efficacy on the posttest surveys.

Test for Pretest and Posttest Differences for Relationship Status

Pretest and posttest means on program components are given in table 7 for those in relationships versus not in relationships, along with tests for program efficacy. There was not a significant Relationship Status X Time interaction. However, just as in the analysis collapsing across relationship status, there was a main effect of time for all constructs. Participants reported higher degrees of susceptibility, severity, benefits, barriers, attitudes, norms, perceived behavioral control, intentions, and condom use self-efficacy depending on when the survey was administered (pretest vs. posttest).

There was not a significant Condition X Relationship Status interaction for the program components (*ps*> .200). There was a main effect of relationship status for five program constructs: perceived susceptibility, attitudes toward condom use, perceived behavioral control, intentions, and condom use self-efficacy. Those not in a relationship reported higher susceptibility (*M* = 2.73), more positive condom use attitudes (*M* = 6.07), higher perceived behavioral control (*M* = 5.84), and higher intentions to use condoms (*M* = 5.08). Participants in a relationship reported more condom use self-efficacy (*M* = 4.53).

A repeated measures ANOVA revealed a significant Relationship Status X Condition X Time for perceived susceptibility (p = .048).The three-way interaction was not significant for the remaining program components. Figure 4 has a graphic depiction of the three-way interaction.

One Month Follow-Up

Attrition. In all, 74 of the 94 (78.7%) participants in the TPB condition, 75 of the 95 (78.9%) participants in the HBM condition, and 69 of the 91 (75.8%) participants in the information-only condition completed the one month follow-up assessment. A series of ANOVAs on relevant pretest measures of condition (TPB vs. HBM vs. Information-Only) and retention (retained versus not retained) were conducted to test for differential attrition. Significant Condition X Retention interactions indicate variables in which differential attrition may have occurred. There was not a Condition X Retention interaction (ps>.10) for pretest measures of susceptibility, severity, benefits, barriers, attitudes, norms, intentions, or PBC. There was a significant interaction of Condition X Retention for the CUSES, F (2, 239) 3.137, p = .045. In general, condom use self-efficacy was slightly lower at baseline in those not retained (TPB M = 4.09, SD = .136; HBM M = 4.48, SD = .136; information-only M = 4.24, SD = .129) than for those who were retained (TPB M = 4.46, SD = .070; HBM M = 4.32, SD = .070; information-only M = 4.42, SD = .070). This significant interaction may limit the internal validity of the findings with regard to self-efficacy.

Preparatory Behavioral Outcomes

Three behavioral outcomes were assessed during the one month follow-up assessment: purchasing condoms, talking to a boyfriend or girlfriend about using condoms, and carrying condoms. For the whole sample overall, there was no significant difference among conditions for purchasing condoms, χ^2 (2, *N*= 214) = .324, *p* = .850, talking to a boyfriend or girlfriend about using condoms, χ^2 (2, *N*= 213) = 3.42, *p* = .181, or carrying condoms, *F* (2,211) = .438, *p* = .646.

The same behavioral outcomes were assessed to examine the role relationship status might play in condom use behaviors. Overall, there was not a significant effect of relationship status (in a relationship vs. not in a relationship) on purchasing condoms, χ^2 (1, *N*= 209) = .255, *p* = .613, talking to a boyfriend or girlfriend about using condoms, χ^2 (1, *N*= 208) = .005, *p* = .946, or carrying condoms, *t* (207) = .000, *p* = .999.

Intentions measured at the one-month follow-up were evaluated using the mean of four items assessing intentions to buy condoms, carry condoms, talk to a potential sex partner about condoms, and using condoms. Intentions did not differ, *F* (2,209) = 1.079, *p* = .342, for the TPB condition (*M* = 4.65, *SD* = 1.76), HBM condition (*M* = 4.59, *SD* = 1.81), or the information-only condition (*M* = 4.99, *SD* = 1.66). Intentions also did not differ depending on relationships status, *t* (205) = -1.085, *p* = .279, for those in a relationship (*M* = 4.88, *SD* = 1.77) or those not in a relationship (*M* = 4.61, *SD* = 1.76).

149 participants had had sex at least once during the one month follow-up period. For these participants, there was no difference among conditions for

purchasing condoms, χ^2 (2, *N*= 148) = 2.66, *p* = .264, talking to a boyfriend or girlfriend about using condoms, χ^2 (2, *N*= 148) = 4.24, *p* = .120, or carrying condoms, *F* (2, 145) = .159, *p* = .853.

This same subset of participants who had had sexual intercourse during the follow-up interval were examined to assess the role relationship status might play in condom use behaviors. Overall, there was not a significant condition main effect (all *ps*> .100), relationship main effect (all *ps*> .400), or Relationship X Condition interaction (all *ps*> .200) for any of the behavioral outcomes.

Three preparatory condom use behaviors were examined to assess intervention efficacy for those 64 participants who had not been sexually active during the intervening month. For these participants, there was no difference among conditions for purchasing condoms (42.2% of participants had purchased condoms), χ^2 (2, *N*= 64) = 1.09, *p* = .577, talking to a boyfriend or girlfriend about using condoms (30.2% of participants had talked to their significant other about condoms), χ^2 (2, *N*= 63) = 1.44, *p* = .487, or carrying condoms (54.7% never carried condoms), *F* (2, 61) = 1.09, *p* = .341.

Condom Use and Risky Sexual Behavior

For the whole sample overall, there was no significant difference among conditions for using condoms when having sexual intercourse, *F* (2, 212) = .920, *p* = .400, or risky sexual behavior, *F* (2, 210) = 1.52, *p* = .221. Among the participants, 18.1% never used condoms, 5.1% almost never used condoms, 10.7% sometimes used condoms, 9.3% almost always used condoms, 27.9%

always used condoms when having sex, and 28.8% did not have sex during the one month follow-up period.

The role relationship status might play in condom use and risky sexual behaviors at follow-up was also assessed. Overall, there was not a significant effect of relationship status (in a relationship vs. not in a relationship) on using condoms when having sexual intercourse, t (208) = -.052, p = .958, or risky sexual behavior, t (206) = -.320, p = .750.

Among the 149 participants who had had sex during the one month follow-up period, there was no difference among conditions for using condoms when having sexual intercourse, F (2, 146) = .849, p = .430, or risky sexual behavior, F (2, 144) = 1.10, p = .335. Among the participants who had sex during the one-month follow-up period 26.2% never used condoms, 7.4% almost never used condoms, 13.4% sometimes used condoms, 13.4% almost always used condoms, and 39.6% always used condoms when having sex.

A 3 X 2 within-subjects analysis of variance was conducted to evaluate the effect of intervention condition (HBM, TPB, or information-only) and time (pre-intervention, 1 month follow-up) on risky sexual behavior at follow-up (how many times a participant had sex in the past month X how often they used a condom when having sex during that month-reverse coded). Any participant who had not had sex in the prior month was coded “0” as they were essentially the least risky. The Time main effect was not significant, F (1, 208) = .627, p = .429, nor was the Condition main effect, F (2, 208) = .938, p = .393. The Condition X Time interaction was also not significant, F (2, 208) = .220, p = .802.

Determining Which Constructs are potential "Active Ingredients" of Change in the Interventions

We estimated a series of mediational models via path analysis (c.f., Bryan et al., 2007) using EQS that followed the structure of figures 1 and 2 for the HBM and TPB, respectively. In this case, however, there were two exogenous variables representing the focused contrasts described earlier. The mediators were the posttest values of each mediational construct in the model. The model was then estimated and both the fit of the model and the significance of the path coefficients were examined.

HBM. Because there were no significant pretest differences between conditions, the immediate posttest values on the mediators were included to test the mediational model in figure 5. Note that correlations among the two exogenous contrasts (Active Interventions versus Information-Only Control Intervention and TPB versus HBM) were estimated. In addition, all possible correlations among the mediators were estimated, though are not shown in the figure for simplicity of presentation. To account for the missing data at follow-up, maximum likelihood estimation of missing data was utilized (c.f., Schafer & Graham, 2002) and thus robust estimation of standard errors was conducted for tests of significance of the paths. The fit of this model was adequate, Yuan-Bentler scaled $\chi^2(2, N = 280) = .620$, $p = .734$, CFI= 1.00, RMSEA = .000 (90%CI .00 - .041). There were significant relationships between the contrast comparing the active interventions versus the control intervention and benefits ($p < .01$), barriers ($p < .05$), and self-efficacy ($p < .05$), indicating that participants who saw

one of the two theory-based interventions had higher perceived benefits, lower barriers, and higher self-efficacy for condom use at posttest than those who saw the information-only control intervention. There was no effect of this contrast on perceived susceptibility or severity. The only significant relationship between the HBM versus TPB contrast and the mediators was to perceived susceptibility (p <.001), such that participants who saw the HBM intervention had higher posttest perceived susceptibility to STDs/HIV/pregnancy than participants who saw the TPB intervention. Despite the significant effects of the interventions on the mediators, none of those mediators were associated with risky sexual behavior at follow-up.

TPB. Due to baseline differences in pretest scores on attitudes towards condom use between the conditions, a difference score (posttest attitudes minus pretest attitudes) was used to test the attitudes mediator within the context of the TPB mediational model. Immediate posttest data for the rest of the TPB constructs were used to test the model in figure 6. As in the HBM model, the same two contrasts were utilized to compare experimental conditions, and all possible correlations among the mediators were estimated, though are not shown in the figure for simplicity of presentation. Further, maximum likelihood estimation was utilized to account for missing data. The fit of the model was marginal, Yuan-Bentler scaled $\chi^2(7, N = 280) = 19.725$, $p = .006$, CFI= .953, RMSEA = .089 (90%CI .049-.131). There were significant paths between the theory versus information-only contrast and attitudes towards condom use (p < .001) and norms for condom use, (p < .05). There were also significant paths

between the HBM versus TPB contrast and attitudes ($p < .001$). In terms of the paths from the mediators to intentions, perceived behavioral control and norms paths were significant ($p< .01$). In addition, the path from intentions to risky sexual behavior was not significant. Examination of the standardized residuals suggested one remaining path from the HBM vs. TPB contrast directly to intentions, so this path was estimated. This path was significant ($p < .001$), as were the paths from attitudes ($p < .001$), norms, ($p < .001$), and perceived behavioral control ($p < .001$) to intentions. This is depicted in figure 7. This model was an adequate fit to the data, $\chi^2(6, N = 280) = 9.33$, $p = .156$, CFI=.984, and RMSEA=.055 (90% CI .000 - .105). The $\Delta\chi^2(1, N = 280) = 10.40$, $p = .001$, indicates a significant difference between the two models. The second model where there is a direct path from the HBM vs. TPB contrast directly to intentions is the better fitting model.

Hybrid model. Those mediators that exhibited either significant intervention effects on the mediators or significant relationships of the variable to behavior were included in a final, hybrid model to explore the "active ingredients" of change. This model is depicted in figure 8. The fit of the initial model was marginal, $\chi^2(11, N = 280) = 24.087$, $p = .012$, CFI=.810, RMSEA=.049 (90% CI .000 - .087). Examination of the standardized residuals suggested one remaining path from the HBM versus TPB contrast to intentions, so this path was estimated. This is depicted in figure 9. The path was significant, and this model was an adequate fit to the data, $\chi^2(10, N = 280) = 15.661$, $p = .109$, CFI=.956, and RMSEA=.022 (90% CI .000 - .071). The $\Delta\chi^2(1, N = 280) = 8.43$, $p = .004$,

indicates a significant difference between the two models. The second model where there is a direct path from the HBM vs. TPB contrast directly to intentions is the better fitting model.

Discussion

Overview

This study attempted to create three computer-based interventions to increase condom use intentions and subsequent behavior among a college student population. Two of the interventions were designed to strictly adhere to two of the most popular health behavior change theories utilized in the literature: the Health Belief Model and the Theory of Planned Behavior. Perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and condom use self-efficacy were targeted in the Health Belief Model intervention. Statistics, pictures, and videos were presented to participants in hopes of manipulating the core constructs of the HBM. Attitudes towards condom use, subjective norms, perceived behavioral control, and intentions to use condoms were manipulated in the Theory of Planned Behavior intervention. Statistics, pictures, and videos were also utilized in this intervention in an attempt to change behavior. Additional exercises focusing on condom use goals and goal attainment in the next month were incorporated into the TPB intervention in order to increase condom use intentions. An information-only intervention condition was used as a control comparison group. Those in the information-only condition were presented with basic STD information and definitions, modes of STD and HIV transmission, the effectiveness of condoms at preventing STD and HIV

transmission as well as pregnancy, and a list of area resources for testing and other sexual health services.

This study attempted to experimentally manipulate core constructs of the HBM and the TPB in order to increase condom use behavior. Thus, enabling a direct comparison of the Health Belief Model and the Theory of Planned Behavior in order to determine the theory best at explaining condom use behavior change.

Baseline Behavior

In an analysis of HBM constructs and baseline behavior, none of the constructs were significantly related to risky sexual behavior, and the full HBM only accounted for 1.5% of the variance in risky sex.

The TPB faired much better than the Health Belief Model in explaining risky sexual behavior at baseline. Of the four components evaluated (i.e., attitudes toward condom use, subjective norms, perceived behavioral control, and intentions) each one was significantly related to risky sex at the bivariate level, though only attitudes toward condom use and intentions uniquely predicted risky sexual behavior at baseline in a multivariate model. Higher scores on these constructs were associated with less risky sexual behavior. The full Theory of Planned Behavior accounted for 30.6% of the variance in risky sexual behavior at baseline.

The Theory of Planned Behavior appears to be the better model at explaining past sexual risk behavior. However, according to Weinstein (2007), the majority of theory comparison work has a cross-sectional or prospective design with an over-reliance on correlations and regression to explain behavior

that have generally inflated the accuracy of health behavior theories. The HBM and TPB baseline behavior analyses both suffer from the limitations Weinstein (2007) cites, and in spite of them this study provides evidence that the TPB is a far better model in terms of accounting for variability in risky sexual behavior.

Follow-up Behavior

Unfortunately neither the Health Belief Model nor the Theory of Planned Behavior was successful at explaining risky sexual behavior at follow-up. The HBM and the TPB both emphasize rational, conscious, and deliberate behaviors; many would not describe sexual behavior in the same way. Emotion and affect are becoming recognized as important predictors of less rational behaviors (de Ridder & de Wit, 2006), such as intercourse, and perhaps would have helped explain risky sexual behavior. Participants were asked why they did not use a condom if they reported not using a condom in the past month. Several reasons provided could be described as irrational or emotional. For example, one participant cited the “heat of passion” as a reason condoms were not used. The Health Belief Model and the Theory of Planned Behavior do not adequately address these aspects of human behavior.

In spite of the HBM’s and TPB’s shortcomings mentioned above, numerous studies have shown that intentions predict condom use behavior without the inclusion of affect or emotion (e.g., Bryan, Aiken, and West, 1996; Schmiege et al., 2009). Intervention design differentiates this study from several others that have shown that intentions predict condom use behavior. Noar, Black, and Pierce (2009) found that computer-based interventions were more

efficacious when they were directed at a single gender (i.e., men or women) versus mixed sex groups, tailored to the individual, and had multiple intervention sessions. This study consisted of both males and females, contained minimal tailoring, and only had one intervention session. Unfortunately, the minimalist design of this computer-based intervention study appears to be its downfall; it was not able to elicit condom use behavior change.

Despite the lack of relationship between theoretical constructs and behavior, the theoretically based interventions were able to change some of the mediators postulated to elicit healthy behavior by the HBM and the TPB. Perceived susceptibility and severity were influenced by the theory-based interventions. Both constructs displayed the highest means at posttest in the HBM condition compared to the other two intervention conditions (i.e., the TPB intervention and the information-only intervention). Susceptibility and severity were two constructs uniquely described by the Health Belief Model, so it was expected and desired that these constructs would be influenced by the HBM intervention. Note that while there were significant changes from pretest to posttest for perceived susceptibility scores for this construct remained quite low (HBM M = 2.81) and perceived severity continued to be rather high (HBM M = 6.37). This pattern is true for the other two conditions as well. Those with low perceived susceptibility might already be taking the necessary precautions to prevent unintended negative consequences of intercourse, and consequently do not feel susceptible to them, creating uniformly low susceptibility scores (Vanlandingham et al., 1995; Aiken et al. 1994). Contracting an STD, HIV, or

experiencing an unplanned pregnancy was perceived as very disruptive and a severe consequence both pre- and post-intervention. It did not take a lot of convincing that these were negative consequences of sex that should be avoided. In other studies that use the HBM as the guiding theoretical framework perceived susceptibility and severity do not show a great amount of change and inconsistently predict behavior (e.g., Vanlandingham et al., 1995; Aiken et al. 1994; Garcia & Mann, 2003) Perhaps susceptibility and severity are rather stable constructs that cannot be manipulated in significant enough ways as to elicit behavior change. Future interventions may want to deemphasize these constructs and put valuable time and energy elsewhere to prompt behavior change.

Attitudes towards condom use became more positive from pretest to post-intervention across all three conditions. The HBM condition had the highest attitudes score. The Theory of Planned Behavior and the Health Belief Model attempted to increase positive attitudes towards condom use with a mixture of condom effectiveness statistics and statements concerning the interpersonal dynamics and potential positive consequences of condom use. The TPB focused on the positive consequences of using condoms. For example, “A condom helps a man last longer before ejaculation.” The HBM focused on the positive consequences of condom use, as well as offered solutions for some of the deterrents of condom use. A sample item includes: “One of the most common complaints is that sex doesn’t feel as good with a condom” and a subsequent video tutorial of how to properly apply lubrication to increase pleasure during

intercourse with a condom. The combination of positive consequences and solutions to deterrents appears to have been the most successful strategy for increasing positive attitudes of condom use.

Intentions to use condoms increased post-intervention. The TPB intervention showed the greatest influence on this mediator. This was to be expected given the intentions creating task in the Theory of Planned Behavior intervention. At the end of the TPB intervention participants were asked to create a safer sex goal and a plan to achieve that goal in the next month; the other two interventions did not have an intentions building exercise. Studies have shown that development of intentions serve as a useful tool in eliciting health behaviors (de Ridder & de Wit, 2006), so intentions and intentions building exercises should be incorporated as core components of future intervention and theory development or modification work.

Finally, condom use self-efficacy increased in the two theoretically based interventions. The HBM and the TPB interventions contained video tutorials demonstrating condom use negotiation and proper application of a condom, which helps explain the almost identical post-test condom use self-efficacy scores for the two interventions. Self-efficacy has become universally accepted as an influential predictor of intentions and behavior. The HBM incorporated self-efficacy into its model in the 1980s after a substantial amount of literature discovered it explained a considerable amount of variance in both intentions and behavior. The Theory of Reasoned Action became the Theory of Planned Behavior once perceived behavioral control, or self-efficacy, was incorporated

into the model to better explain behavior. While the Social Cognitive Theory posits a variety of behavior change mechanisms, self-efficacy is continuously used as the only predictor of that theory. At this point in the health behavior literature the importance of self-efficacy is not disputed, it consistently predicts a substantial amount of variance in intentions (Casey et al., 2009; Garcia & Mann, 2003; Wulfert & Wan, 1995). All of the leading behavior change theories have incorporated self-efficacy into modified versions of their theory in order to improve their explanatory and predictive power. Self-efficacy is no longer a theory-specific construct and should be one of the first components added in a more holistic health behavior theory.

Mediational Analyses

HBM. The meditational analysis for the HBM constructs only showed that the influence of the interventions on risky sexual behavior at follow-up was not mediated by HBM constructs of perceived susceptibility, severity, benefits, barriers, or condom use self-efficacy. Although there were some intervention effects on these mediators, none of them were related to risky sexual behavior at follow-up.

TPB. The meditational analysis for the TPB constructs only showed that the influence of the interventions on risky sexual behavior at follow-up was not mediated by TPB constructs (i.e., attitudes toward condom use, subjective norms, perceived behavioral control, and intentions). While the theory-based interventions created more positive attitudes toward condom use and increased condom use norms, those were not the factors related to condom use intentions,

and intentions did not relate to behavior. The HBM vs. TPB contrast revealed a significant association between the HBM intervention and creating more positive attitudes. Though there was no significant mediation of program effects on *behavior,* subjective norms mediated the relationship between the theory driven interventions and changes in *intentions*.

Hybrid Model. Mediators that had significant relationships with intervention type, intentions, or behavior were included in a final hybrid model to try and find the 'active ingredients' of change. Just as in the Health Belief Model and the Theory of Planned Behavior meditational analyses, nothing significantly predicted risky sexual behavior. Significant paths were found from the theory versus control contrast to benefits, barriers, attitudes toward condom use, subjective norms, and condom use self-efficacy. Barriers were decreased and the remaining constructs were increased by theory-based interventions. These findings are further evidence that theory-based interventions are more successful at influencing intended mediators (Glanz& Bishop, 2010; Noar, 2008). A direct comparison of the TPB and HBM interventions revealed that the Health Belief Model significantly impacted susceptibility and attitudes. Fewer perceived barriers predicted greater condom use intentions, while increased attitudes, norms, and perceived behavioral control predicted greater intentions. Lower condom use self-efficacy predicted intentions. Examination of the bivariate relationship between the condom use self-efficacy scale and intentions in table 5 revealed a significant positive relationship between the two constructs. This effect is likely due to suppression due to multicollinearity among the predictors,

most likely among perceived behavioral control and condom use self-efficacy. This finding lends further support to the argument that self-efficacy and perceived behavioral control are essentially the same constructs. There was also a significant direct path from the HBM vs. TPB contrast to intentions, indicating that the TPB intervention had a direct impact on intentions not accounted for by the mediators. A direct comparison of the TPB and HBM interventions revealed that the Theory of Planned Behavior predicted greater condom use intentions.

A final examination of table 6 revealed that, aside from perceived barriers, the core constructs of the HBM and the TPB were influenced to some extent by all three interventions. The mediational analyses revealed that the HBM had a larger impact on attitudes toward condom use than the TPB, which contained attitudes toward a behavior as one if its core constructs. These findings lend support to Noar and Zimmerman's (2005) work arguing that there is a significant amount of overlap among the most popular health behavior theories. There is a lack of distinctiveness among health behavior theories, which makes it difficult, if not impossible, for researchers to truly make content distinctly different for theory-based interventions based on supposedly unique theories.

A general consensus on what to call similar variables and which are the most influential in changing behavior is the only way to move the field of health research forward. Perhaps Fishbein's (2000) integrative model of behavioral prediction should be the blueprint for theory modification since it incorporates the variables that have had the most influence on behavior change in previous models and differentiates between people who have developed intentions, but do

not have the necessary skills to change behavior, or environmental constraints that prevent action from occurring for intervention development.

Implications for the Future

Theory-based interventions were more successful at manipulating mediators than the intervention not guided by theory. Unfortunately, the theory driven interventions were unable to change behavior. Theory-based interventions are superior to those not guided by theory, but there is still a lot to be learned about the relevant predictors of behavior change not included in current theories of health behavior. This study demonstrated that proposed mediators of behavior change can be successfully manipulated through computer-based interventions. Intentions can also be positively influenced through theory-based constructs. However, none of these findings contributed to behavior change during the one-month follow-up. This research highlights the tenuous relationship found in the health behavior literature between proposed mediators of behavior change and actual action. There is still a great deal that the current most popular health theories (e.g., HBM and TPB) cannot explain when it comes to more spontaneous, emotional and affectively driven behaviors, such as sexual activity.

Mediators of change have inconsistently predicted behavior. Connor and Norman (1994) stated that none of the TPB constructs significantly predicted health screening behavior. On the other hand, Bryan, Aiken, and West (1996), as well as Schmiege et al. (2009) reported significant relationships between theoretical mediators and a decrease in risky sexual behavior at follow-up. In general, there is a significant relationship between intentions and behavior. This

relationship is most pronounced in studies that use correlational and regression techniques to predict past behavior, but it still exists on a much smaller scale in the few experimental behavior change studies conducted. Behavior change did not occur in this study and perhaps it was due to the way the interventions were delivered. Both the Bryan, Aiken, and West (1996) and the Schmiege et al. (2009) interventions were held in-person, while this study conducted computer-based interventions. The Connor and Norman (1994) study utilized survey research techniques; it did not have an intervention. In-person interventions allow for impromptu, guided discussions that may make behavior change more relevant and personally tailored than computer-based interventions that were largely one-size-fits-all.

Examination of the intercorrelation matrix of the theoretical constructs measured revealed a moderate correlation between the condom use self-efficacy scale and the HBM perceived barrier's scale as well as perceived behavioral control and the condom use self-efficacy scale. These relationships indicate a significant degree of overlap between the constructs, which reviewers such as Weinstein, 1993 and Noar& Zimmerman, 2005 have commented on. This lack of distinctiveness between theories inhibits researchers' ability to find the best set of constructs to motivate behavior change. The field is at a stand still right now. A general consensus cannot be reached as to what to call similar constructs, there are adamant supporters of one theory versus another, but the work to back-up these assertions does not exist. This study contributed two valuable pieces of information to the health behavior theory literature: (1) the HBM and the TPB

based interventions manipulated both theories core constructs. This indicates that the two theories are trying to describe and change essentially the same mediators, and (2) neither the HBM nor the TPB was more successful at explaining behavior change. The current theories of health behavior are a great start to explaining the predictors of behavior, but are not sufficient or complete enough for researchers to truly understand the motivational and cognitive components of behavior change.

Limitations

Individuals in a serious committed relationship comprised nearly 40% of the study sample. Research has indicated that the predictors of condom use are dramatically different in casual versus serious relationships (c.f., Reid & Aiken, in press) and that condom use is extremely difficult to change among those in established long-term relationships. Including individuals in serious relationships in analyses may have negatively impacted the results of this study. Couples in serious relationships often switch to hormonal birth control as their main form of pregnancy prevention (Bauman, Karasz, & Hamilton, 2007) and do not worry about STD/HIV contraction. This may have made the intervention irrelevant to a large portion of the study sample.

Assessment methods relied on self-report measures, a limitation shared with much safer-sex intervention research.

Conclusions

In sum, theory-based condom promotion interventions were not successful in inducing safer sexual behavior. However, theory-based interventions were

successful at manipulating the mediators posited to explain 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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Appendix

Demographic Information

1. Are you male or female?

2. How old are you?

3. What is your ethnic background (check all that apply)?

White	African-American	Hispanic-American	American Indian/Native American	Asian or Pacific Islander	Other

4. What year in college are you?

Freshman	Sophomore	Junior	Senior	Graduate/Professional School

Sexual Behavior Measures

Remember, when we talk about "sexual intercourse" we mean penis in vagina intercourse or penis in anus intercourse, unless the question specifically asks about a different behavior (e.g., oral sex).

1. Have you ever had sexual intercourse? Yes No

2. Have you ever had oral sex? Yes No

3. How old were you the first time you had sexual intercourse?
_____years

4. Did you use a condom the first time you had sexual intercourse?
YesNo

5. Which of the following is true for you?

The first time I had sex I wanted to	The first time I had sex I wasn't sure I wanted to	The first time I had sex I didn't want to

6. How many sexual partners have you had in your lifetime?
_____partners

7. How much of the time have you used condoms when you've had sexual intercourse?

0%----10%----20%----30%----40%----50%----60%----70%----80%----90%----100%
0% of the time — 50% of the time — 100% of the time

8. How much of the time have you used some other form of birth control when you've had sexual intercourse?

0%----10%----20%----30%----40%----50%----60%----70%----80%----90%----100%
0% of the time — 50% of the time — 100% of the time

9. In the past 3 months, how often have you had sexual intercourse?

Once a Month	Once a Week	2-3 times A week	4-5 times A week	Almost Everyday

10. *In the past 3 months only,* how much of the time have you used condoms when you've had sexual intercourse?

0%----10%----20%----30%----40%----50%----60%----70%----80%----90%----100%
0% of the time 50% of the time 100% of the time

11. *In the past 3 months only,* how much of the time have you used some other form of birth control when you've had sexual intercourse?

0%----10%----20%----30%----40%----50%----60%----70%----80%----90%----100%
0% of the time 50% of the time 100% of the time

12. Please think about the most recent time you had sexual intercourse. Did you and your partner use a condom? Yes No

13. Again, please think about the most recent time you had sexual intercourse. Did you and your partner use any form of birth control? Yes No

14. The most recent time you had sexual intercourse, were you drinking alcohol? Yes No

15. The most recent time you had sexual intercourse, was your partner drinking alcohol? Yes No

16. The most recent time you had sexual intercourse, were you smoking marijuana? Yes No

17. The most recent time you had sexual intercourse, was your partner smoking marijuana? Yes No

18. Still thinking about the most recent time you had sexual intercourse, was this the FIRST time you had had intercourse with THIS partner? Yes No

19. How would you describe the relationship between you and your most recent sexual partner? (circle one answer only)
    a. Someone I just met
    b. Someone who is a casual sexual partner
    c. Someone I'm casually dating
    d. Someone I'm seriously dating, but not in a monogamous relationship

with

e. Someone I'm in a serious monogamous relationship with (includes being engaged or married)

20. What is your sexual orientation?

Heterosexual	Bisexual	Homosexual

21. Have you ever been pregnant (if female) or gotten someone pregnant (if male)? Yes No

22. Have you ever had a sexually transmitted disease? Yes No

23. Are you currently in a romantic relationship? Yes No
(if NO, please skip to next section)

24. How long have you been in this relationship?
_____

25. How would you describe this relationship (circle one)?
    a. We are casually dating
    b. We are steadily dating
    c. We are in a serious committed relationship, but not living together
    d. We are in a serious committed relationship and living together
    e. We are married

Health Belief Model Measures

1	2	3	4	5	6	7
Very Unlikely						**Very Likely**

Susceptibility

-How susceptible to sexually transmitted diseases do you feel?
-What is the chance that you will be exposed to a sexually transmitted disease?
-How likely do you think it is that you will catch a sexually transmitted disease in your lifetime?
-Would you say that you are the type of person who is likely to get a sexually transmitted disease?
-How susceptible to HIV/AIDS do you feel?
-What is the chance that you will be exposed to HIV/AIDS?
-How likely do you think it is that you will contract HIV/AIDS in your lifetime?
-Would you say that you are the type of person who is likely to get HIV/AIDS?
-How susceptible to pregnancy do you feel?
-What is the chance that you will experience an unexpected pregnancy?
-How likely do you think it is that you will become unexpectedly pregnant/impregnate someone in your lifetime?
-Would you say that you are the type of person who is likely experience an unplanned pregnancy?

1	2	3	4	5	6	7
Not at all disruptive						**Very disruptive**

Severity

-How disruptive would an STD be to your health?
-How disruptive would the cost of treating an STD be?
-How disruptive would an STD be to school or work?
-How disruptive would an STD be to your personal relationships?

-How disruptive would it be to sustain permanent physical damage (sterility) as a result of an STD?
-Overall, how disruptive would a sexually transmitted disease be in your life?
-How disruptive would HIV/AIDS be to your health?
-How disruptive would the cost of treating HIV/AIDS be?
-How disruptive would HIV/AIDS be to school or work?
-How disruptive would HIV/AIDS be to your personal relationships?
-How disruptive would it be to sustain permanent physical damage (sterility) as a result of HIV/AIDS?
-Overall, how disruptive would HIV/AIDS be in your life?
-How disruptive would pregnancy be to your health?
-How disruptive would the cost of a pregnancy be?
-How disruptive would a pregnancy be to school or work?
-How disruptive would a pregnancy be to your personal relationships?
-How disruptive would it be to sustain permanent physical damage (sterility) as a result of a pregnancy?
-Overall, how disruptive would a pregnancy be in your life?

Benefits

-To what extent do you believe that the use of condoms will help you stay healthy?
-How beneficial do you believe condom use would be for you if you are sexually active?
-To what extent do you believe that condoms are effective in preventing the spread of STDs among sexually active people?
-To what extent do you believe that condoms would be effective in preventing you from getting an STD?
-To what extent do you believe that condoms are effective in preventing the spread of HIV/AIDS among sexually active people?
-To what extent do you believe that condoms would be effective in preventing you from getting HIV/AIDS?
-To what extent do you believe that condoms are effective in preventing pregnancy among sexually active people?
-To what extent do you believe that condoms would be effective in preventing you from getting pregnant or impregnating someone else?

Barriers

-Enjoyable sex is not possible with a condom
-Buying condoms is embarrassing
-It is hard to talk to my partner about using condoms
-I don’t know how to put a condom on

Theory of Planned Behavior Measures

We are interested in how you feel about condom use. There are many different kinds of sexual activity, but for the following questions, when we talk about "sex" or "sexual activity" we mean penis in vagina intercourse or penis in anus intercourse.

For me, using a condom would be…

Unhealthy	1	2	3	4	5	6	7	Healthy
Harmful	1	2	3	4	5	6	7	Beneficial
Unpleasant	1	2	3	4	5	6	7	Pleasant
Bad	1	2	3	4	5	6	7	Good
Worthless	1	2	3	4	5	6	7	Valuable
Unenjoyable	1	2	3	4	5	6	7	Enjoyable
Punishing	1	2	3	4	5	6	7	Rewarding

We'd like to know how your friends and the people who are important to you feel about condom use.

1	2	3	4	5	6	7
Disagree Strongly			Neither agree or disagree			Agree Strongly

1. Most of my friends use condoms during sexual activity.
2. Most of my family thinks that I should use condoms.
3. Most of my family thinks that I should not use condoms during intercourse.
4. My friends think that I should use condoms.
5. My friends think that I should not use condoms during sex.
6. My doctor thinks that I should use condoms.
7. My doctor thinks that I should not use condoms during intercourse.

8. Most people who are important to me think I should use condoms.
9. Most people who are important to me think I should not use condoms during sex.
10. My partner thinks that we should use condoms.
11. My partner thinks we should not use condoms during sex.

These next questions ask about your confidence in your ability to obtain and use a condom properly.

1	2	3	4	5	6	7
Disagree Strongly			Neither agree or disagree			Agree Strongly

1. I feel confident that I could purchase condoms without being embarrassed.
2. I feel confident that I could talk to my partner about condom use.
3. I feel confident that I could put a condom on properly.
4. I feel confident that I could refuse to have sex if my partner did not want to use a condom.
5. I feel confident that both my partner and I could achieve orgasm while using a condom.

These next questions ask about your plans to use condoms over the next month

1	2	3	4	5	6	7
Not at all likely			Neither likely nor unlikely			Very likely

1. How likely is it that you will buy condoms in the next month?
2. How likely is it that you will carry condoms with you in the next month?
3. How likely is it that you will talk to a potential sex partner about using condoms in the next month?
4. How likely is it that you will use a condom the next time you have intercourse?

Perceived Behavioral Control Measures

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

1. Whether or not I use a condom in the next month is entirely up to me.

1	2	3	4	5	6	7
Very Little Control						Complete Control

2. How much personal control do you feel you have over using a condom in the next month?

1	2	3	4	5	6	7
Not at all						Very much so

3. How much do you feel that whether you use a condom in the next month is beyond your control?

1	2	3	4	5	6	7
Definitely Do Not						Definitely Do

4. I believe I have the ability to use a condom in the next month.

1	2	3	4	5	6	7
Very unlikely to use a condom						Very likely to use a condom

5. To what extent do you see yourself as being capable of using a condom in the next month?

1	2	3	4	5	6	7
Very unsure						Very sure

6. How confident are you that you will be able to use a condom in the next month?

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

7. If it were entirely up to me, I am confident that I would be able to use a condom in the next month.

Condom Use Self-Efficacy Scale

1	2	3	4	5
Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree

Mechanics

1. I feel confident in my ability to put a condom on myself or my partner
2. I feel confident in my ability to use a condom correctly
3. I feel confident I could gracefully remove and dispose of a condom when we have intercourse
4. I feel confident in my ability to put a condom on myself or my partner quickly

Partner's Disapproval

1. If I were to suggest using a condom to a partner, I would feel afraid that he or she would reject me
2. If I were unsure of my partner's feelings about using condoms, I would not suggest using one
3. I would not feel confident suggesting using condoms with a new partner because I would be afraid he or she would think I've had a past homosexual experience
4. I would not feel confident suggesting using condoms with a new partner because I would be afraid he or she would think I have a sexually transmitted disease
5. I would not feel confident suggesting using condoms with a new partner because I would be afraid he or she would think I thought they had a sexually transmitted disease

Assertive

1. I feel confident in my ability to discuss condom usage with any partner I might have
2. I feel confident in my ability to suggest using a condom with a new partner
3. I feel confident that I could suggest using a condom without my partner feeling "diseased"

Intoxicants

1. I feel confident that I would remember to use a condom even after I have been drinking
2. I feel confident that I would remember to use a condom even if I were high
3. I feel confident I could stop to put a condom on myself or my partner even in the heat of passion

Table 1

Demographic and Sexual History Characteristics

Characteristic		M		Test Statistic	*p*
	TPB	HBM	Information-Only		
N	94	95	91		
Gender (% Female)	66	65.3	62.6	$\chi^2(2, N = 280) = 0.247$	0.88
Age	20.50 (4.26)	20.86 (4.97)	20.25 (3.43)	$F(2,277) = .48$	0.62
% Caucasian	34	49.5	39.6	$\chi^2(14, N = 280) = 14.77$	0.39
Sexual Orientation				$\chi^2(4, N = 280) = 4.87$	0.32
% Heterosexual	95.7	93.7	87.9		
% Homosexual	3.2	3.2	7.7		
%Bisexual	1.1	3.2	4.4		
Year In School				$\chi^2(8, N = 279) = 9.49$	0.31
% Freshman	44.7	43.2	51.1		
% Sophomore	28.7	30.5	20		
% Junior	13.8	18.9	16.7		
% Senior	12.8	6.3	8.9		
% Graduate/Professional	0	1.1	3.3		
Relationship Status				$\chi^2(10, N = 273) = 5.83$	0.83
% Casually Dating	4	1.1	2.3		
% Steadily Dating	9.6	8.7	9.2		
% Serious committed relationship, but not living together	39.4	33.7	40.2		
% Living Together	3.2	2.2	3.4		
% Married	0	1.1	0		
% Not in a relationship	42.6	53.3	44.8		
Age at First Intercourse	16.66 (1.68)	16.48 (2.11)	16.38 (1.64)	$F(2,275) = 0.54$	0.58
No. of Lifetime Sexual Partners	5.43 (9.73)	6.98 (6.97)	6.31 (9.28)	$F(2,272) = 0.73$	0.48
% Who used Condoms 100% of the Time	19.1	13.7	22	$\chi^2(20, N = 280) = 18.77$	0.54

Note. Standard deviations are in parentheses.

Table 2

Pretest Means on Program Components & Tests for Pretest Differences

Scale	Cell Mean by Condition			Test Statistic	*p*
	TPB	HBM	Information-Only		
Susceptibility[a]	2.12	2.39	2.26	*F*(2,258)=1.88	0.15
Severity[a]	6.21	5.99	6.06	*F*(2,247)=1.98	0.14
Benefits[a]	5.79	5.89	5.88	*F*(2,260)=.215	0.81
Barriers[a]	2.29	2.31	2.42	*F*(2,270)=.405	0.67
Attitudes[a]	5.61	4.83	5.73	*F*(2,262)=17.38	<.001
Norms[a]	5.61	5.59	5.57	*F*(2,259)=.08	0.92
PBC[a]	5.59	5.4	5.52	*F*(2,263)=.93	0.39
Intentions[a]	4.34	4.16	4.55	*F*(2,270)=.98	0.38
CUSE[b]	4.38	4.35	4.38	*F*(2,242)=.076	0.93

[a]Scored on a 1-7 scale, with higher scores representing higher levels of the construct.
[b]Scored on a 1-5 scale, with higher scores representing higher levels of the construct.

Table 3

Correlations between HBM constructs and past condom use

	Susceptibility	Severity	Benefits	Barriers	Condom Use Self-Efficacy
Overall Condom Use	-.118	.072	.100	-.238**	.306**
Condom Use in the Past 3 Months	.014	.059	.102	-.162**	.177**
Condom Use During Most Recent Sexual Experience	-.028	-.002	.128*	-.193**	.246**
Risky Sexual Behavior at Baseline	-.009	.031	-.095	.080	-.100

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

Table 4

Correlations between TPB constructs and past condom use

	Attitudes	Subjective Norms	Perceived Behavioral Control	Intentions
Overall Condom Use	.475**	.329**	.472**	.435**
Condom Use in the Past 3 Months	.349**	.284**	.408**	.565**
Condom Use During Most Recent Sexual Experience	.399**	.313**	.389**	.401**
Risky Sexual Behavior at Baseline	-.447**	-.328**	-.354**	-.441**

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

Table 5

Intercorrelation matrix

	HBM-Susceptibility	HBM-Severity	HBM-Benefits	HBM-Barriers	TPB-Attitudes	TPB-Norms	TPB-Intentions	PBC	CUSES
HBM-Susceptibility	-	.013	.061	.158*	-.125*	.067	.060	.052	-.174**
HBM-Severity		-	.109	-.030	.162*	.172**	.052	.182**	.119
HBM-Benefits			-	-.028	.258**	.287**	.190**	.153*	.154*
HBM-Barriers				-	-.264**	-.244**	-.182**	-.210**	-.546**
TPB-Attitudes					-	.455**	.409**	.436**	.317**
TPB-Norms						-	.373**	.402**	.423**
TPB-Intentions							-	.550**	.242**
PBC								-	.463**
CUSES									-

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

Table 6

Pretest and Posttest Means on Program Components, Test for Pretest and Posttest Differences by Condition

Scale and test	Cell Mean by Condition			*F*	
	TPB (*n*=94)	HBM (*n*=95)	Information-Only (*n*=91)	Effect of Time	Time X Condition Interaction
Susceptibility[a]					
Pretest	2.09	2.41	2.23	28.79**	3.93*
Posttest	2.27	2.81	2.35		
Severity[a]					
Pretest	6.23	5.98	6.06	10.39**	7.52**
Posttest	6.19	6.37	6.14		
Benefits[a]					
Pretest	5.82	5.87	5.77	57.62**	1.56
Posttest	6.32	6.47	6.09		
Barriers[a]					
Pretest	2.29	2.33	2.43	1.45	1.46
Posttest	2.20	2.16	2.49		
Attitudes[a]					
Pretest	5.63	4.79	5.79	211.65**	75.16**
Posttest	5.84	5.87	5.97		
Norms[a]					
Pretest	5.68	5.59	5.58	4.97*	1.43
Posttest	5.78	5.73	5.58		
PBC[a]					
Pretest	5.61	5.41	5.55	27.16**	2.79
Posttest	5.71	5.72	5.73		
Intentions[a]					
Pretest	4.34	4.17	4.59	63.66**	4.53*
Posttest	5.07	4.70	4.86		
CUSE[b]					
Pretest	4.39	4.35	4.34	6.61*	4.13*
Posttest	4.46	4.47	4.32		

Note. [a]Scored on a 1-7 scale, with higher scores representing higher levels of the construct.
[b]Scored on a 1-5 scale, with higher scores representing higher levels of the construct.
** $p < .01$, two-tailed. * $p < .05$, two-tailed

Table 7

Pretest and Posttest Means on Program Components, Test for Pretest and Posttest Differences for Relationship Status

Scale and test	Cell Mean by Relationship status		*F*	
	Not in relationship (*n*=139)	In relationship (*n*=134)	Effect of Relationship Status at Baseline	Time X Relationship X Condition
Susceptibility[a]				
Pretest	2.52	1.98		3.08*
Posttest	2.77	2.20	14.31**	
Severity[a]				
Pretest	6.07	6.10		.741
Posttest	6.21	6.29	.089	
Benefits[a]				
Pretest	5.82	5.80		1.09
Posttest	6.29	6.28	.017	
Barriers[a]				
Pretest	2.38	2.31		.841
Posttest	2.31	2.22	.639	
Attitudes[a]				
Pretest	5.64	5.17		1.13
Posttest	6.08	5.68	5.70**	
Norms[a]				
Pretest	5.70	5.53		.269
Posttest	5.75	5.64	.573	
PBC[a]				
Pretest	5.66	5.36		.050
Posttest	5.84	5.59	5.07*	
Intentions[a]				
Pretest	4.59	4.06		.043
Posttest	5.05	4.65	4.07*	
CUSE[b]				
Pretest	4.29	4.43		1.29
Posttest	4.31	4.53	9.15**	

Note. [a]Scored on a 1-7 scale, with higher scores representing higher levels of the construct. [b]Scored on a 1-5 scale, with higher scores representing higher levels of the construct.
** $p < .01$, two-tailed. * $p < .05$, two-tailed

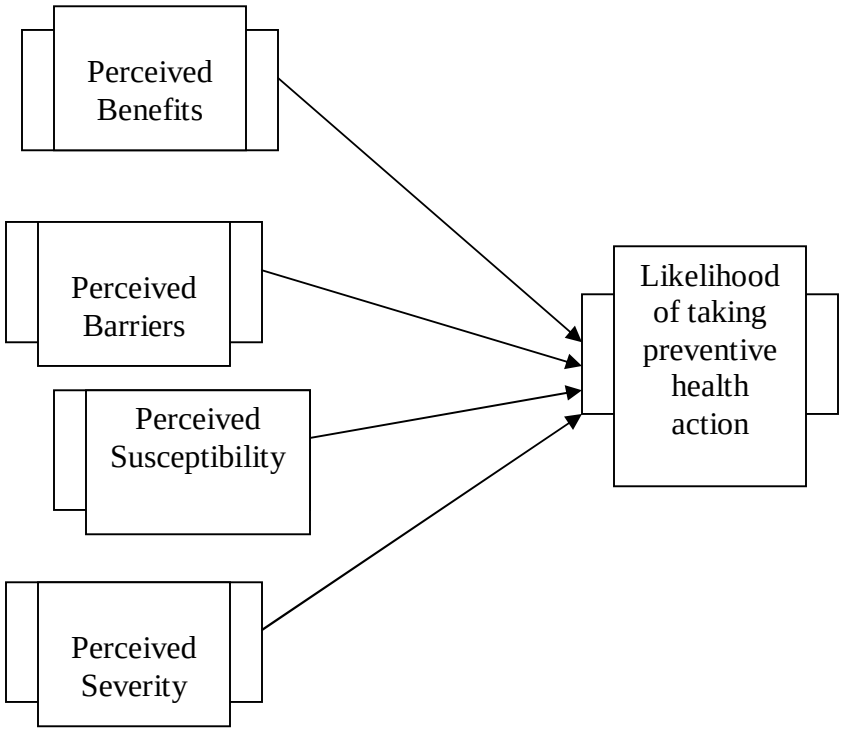

Figure 1. The Health Belief Model

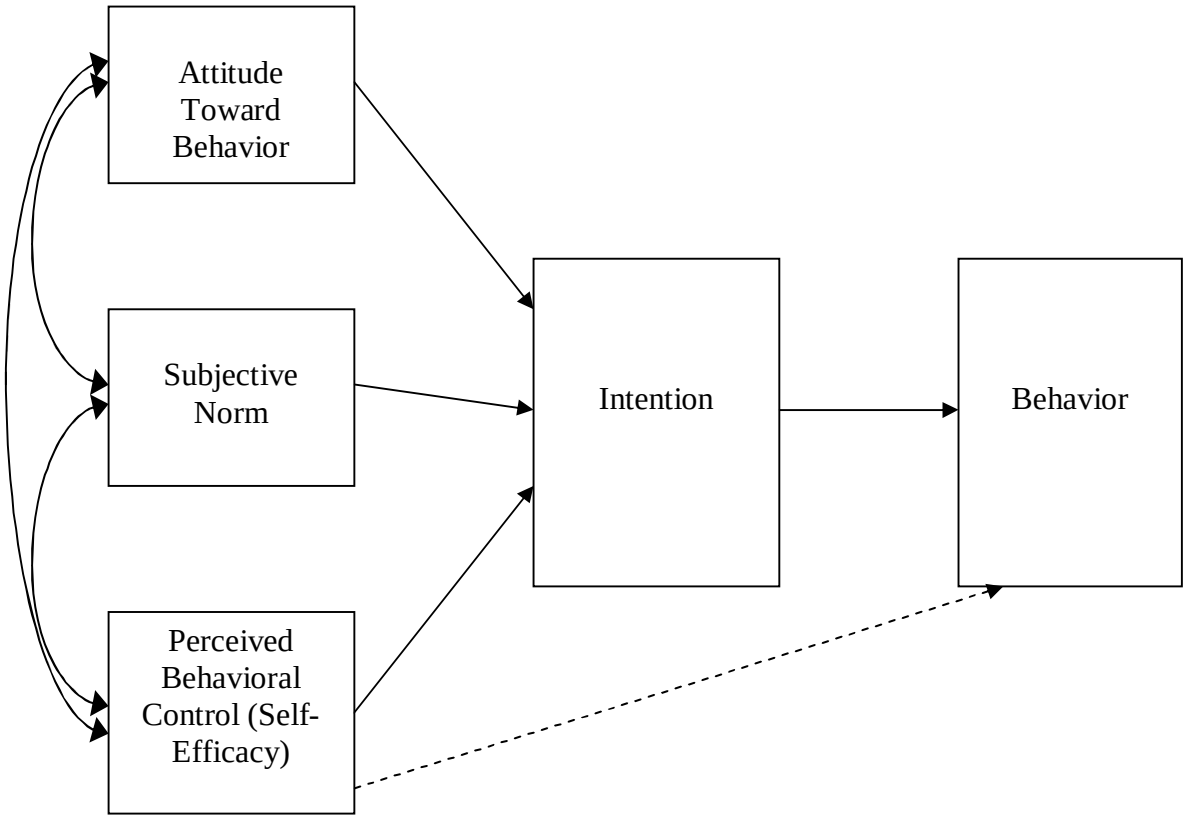

Figure 2. Theory of Planned Behavior.

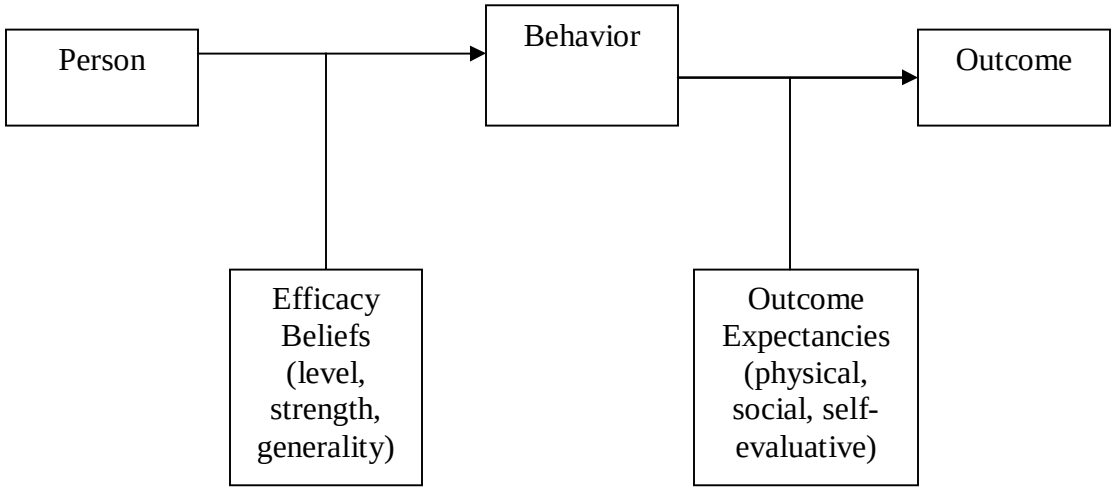

Figure 3. The Social Cognitive Theory

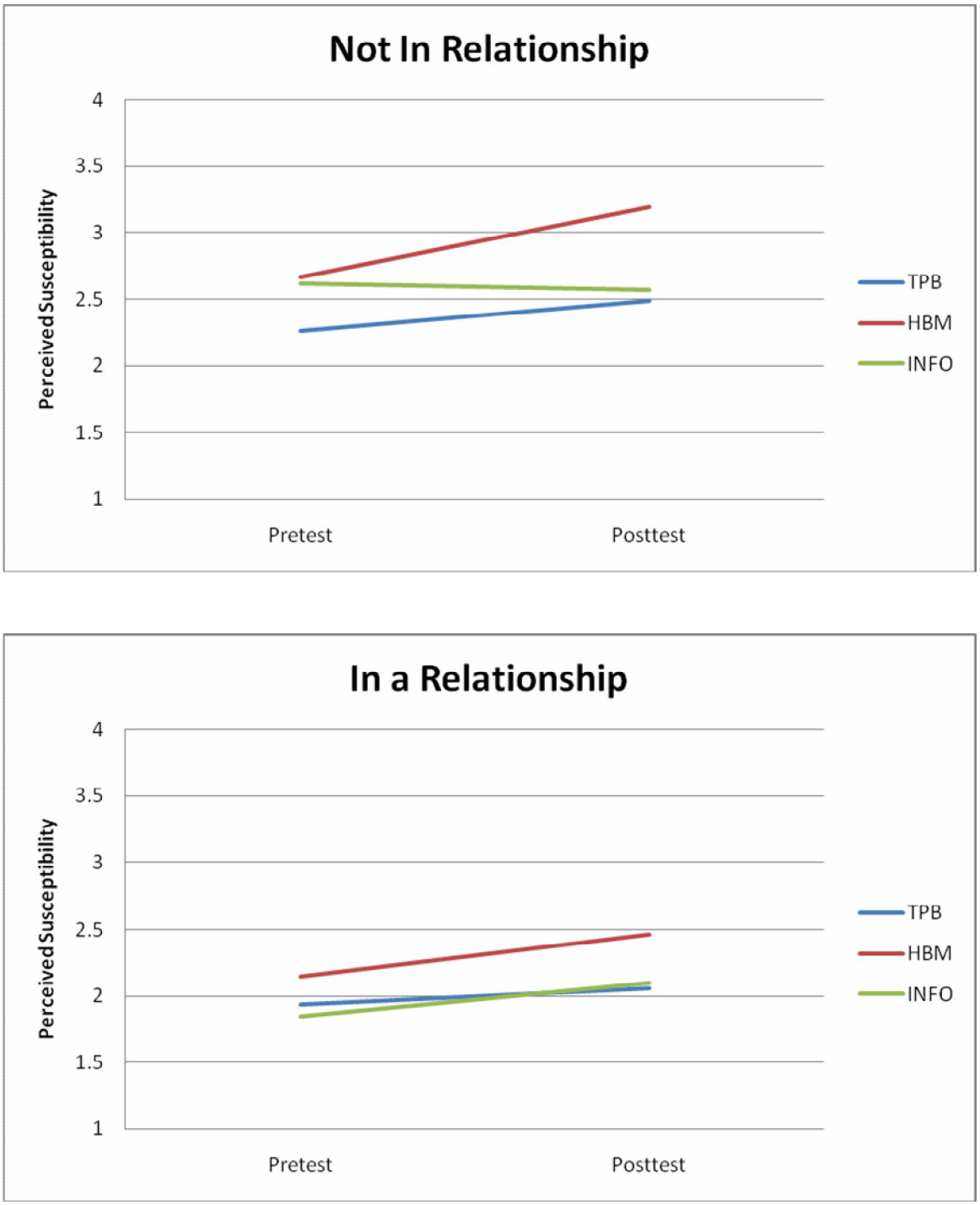

Figure 4. Relationship Status X Condition X Time for perceived susceptibility.

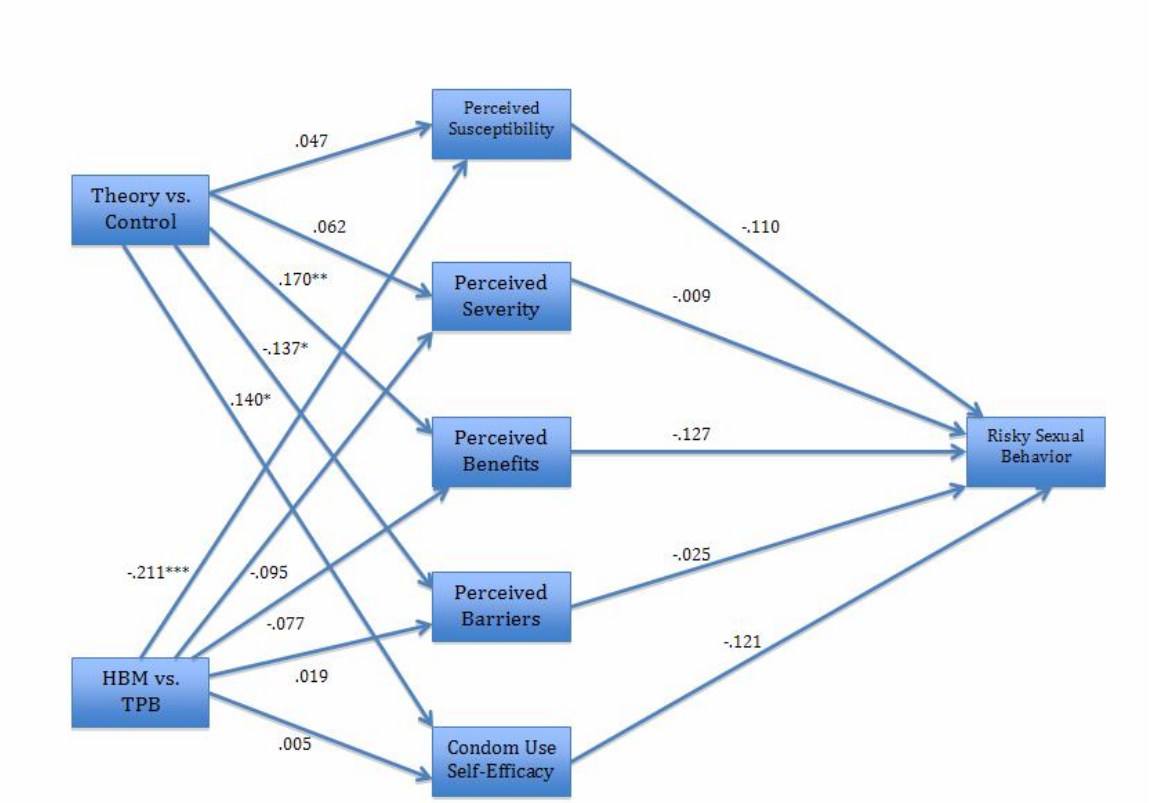

Figure 5. Health Belief Model mediational model of program effects. Coefficients are standardized path coefficients.
Note. The theory vs. control contrast was coded as such: HBM or TPB = 1 (theory) and information-only (control) = 0. The HBM vs. TPB contrast was coded as such: HBM=-1, TPB=1, and information-only=0.
*p<.05, two-tailed. **p<.01, two-tailed. ***p<.001, two-tailed.

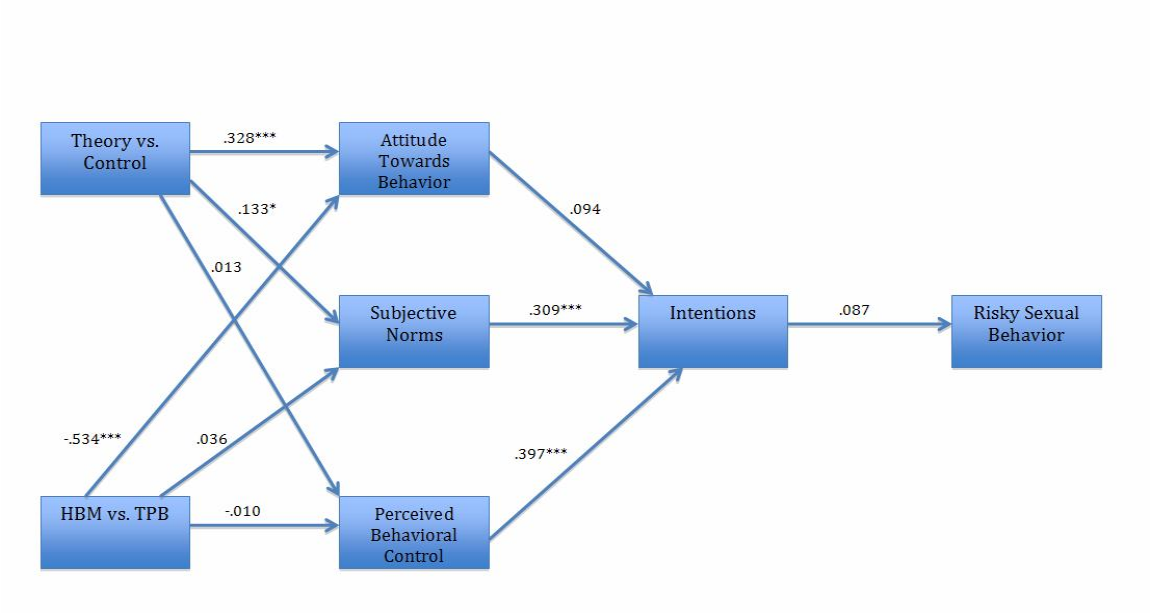

Figure 6. Theory of Planned Behavior mediational model of program effects. Coefficients are standardized path coefficients.
Note. The theory vs. control contrast was coded as such: HBM or TPB = 1 (theory) and information-only (control) = 0. The HBM vs. TPB contrast was coded as such: HBM=-1, TPB=1, and information-only=0.
*p<.05, two-tailed. **p<.01, two-tailed. ***p<.001, two-tailed.

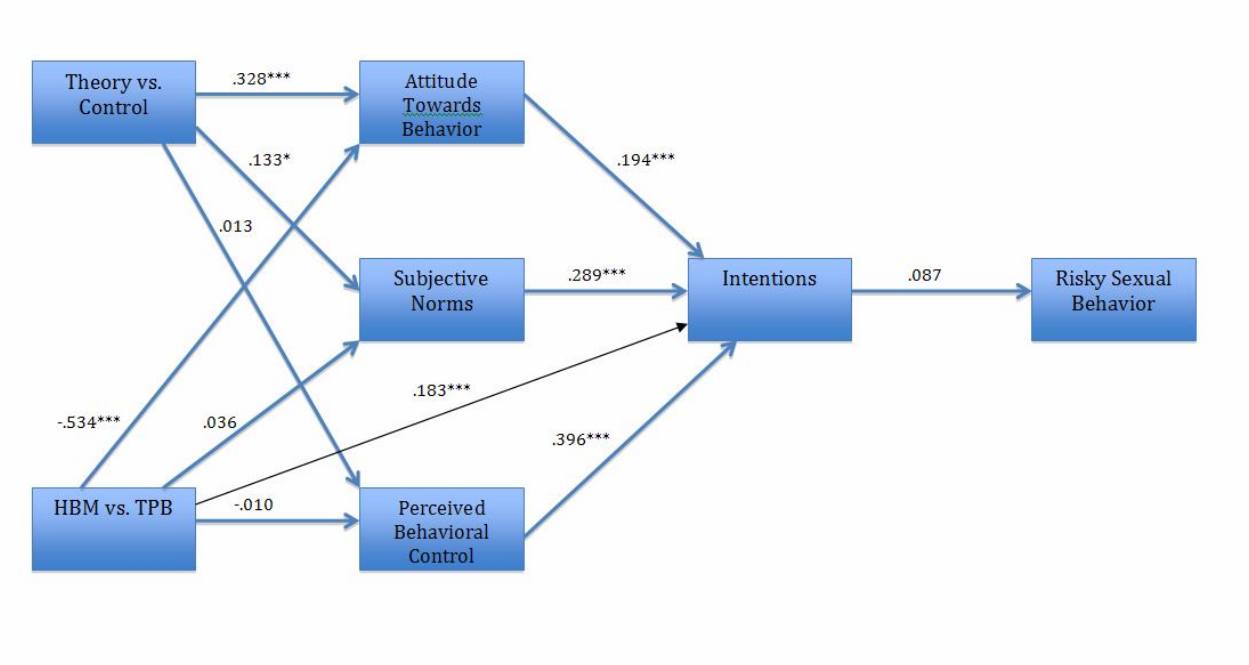

Figure 7. Theory of Planned Behavior plus additional path mediational model of program effects. Coefficients are standardized path coefficients.
Note. The theory vs. control contrast was coded as such: HBM or TPB = 1 (theory) and information-only (control) = 0. The HBM vs. TPB contrast was coded as such: HBM=-1, TPB=1, and information-only=0.
*p<.05, two-tailed. **p<.01, two-tailed. ***p<.001, two-tailed.

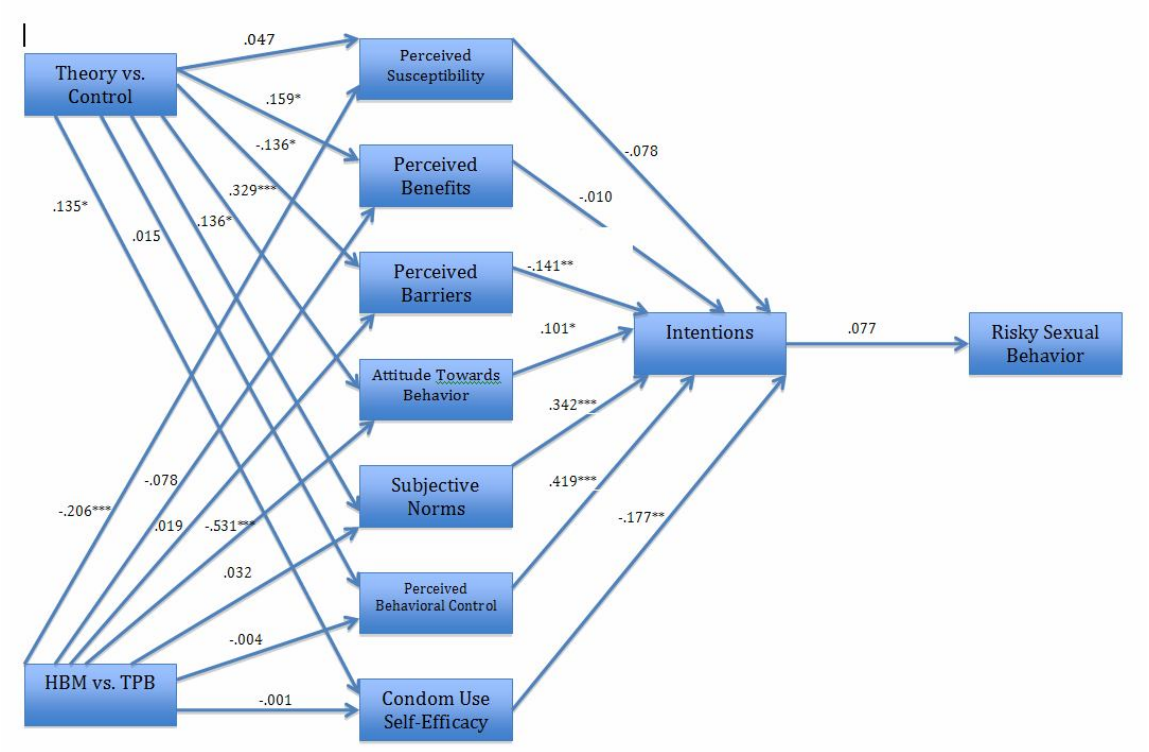

Figure 8. Hybrid Model mediational model of program effects. Coefficients are standardized path coefficients.
Note. The theory vs. control contrast was coded as such: HBM or TPB = 1 (theory) and information-only (control) = 0. The HBM vs. TPB contrast was coded as such: HBM=-1, TPB=1, and information-only=0.
*p<.05, two-tailed. **p<.01, two-tailed. ***p<.001, two-tailed.

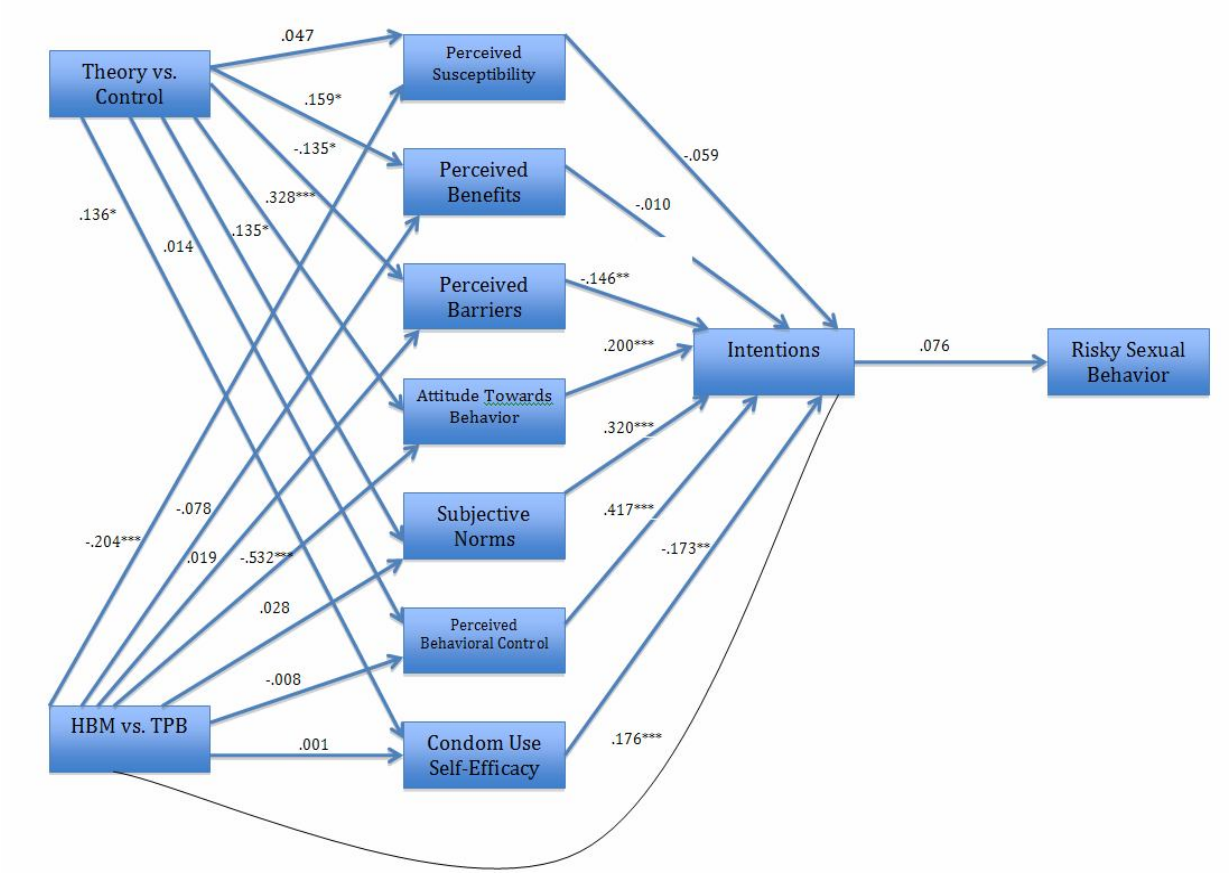

Figure 9. Hybrid model plus additional path mediational model of program effects. Coefficients are standardized path coefficients.
Note. The theory vs. control contrast was coded as such: HBM or TPB = 1 (theory) and information-only (control) = 0. The HBM vs. TPB contrast was coded as such: HBM=-1, TPB=1, and information-only=0.
*p<.05, two-tailed. **p<.01, two-tailed. ***p<.001, two-tailed.