Does the Theory of Planned Behavior Identify Diabetes-Related Cognitions for Intention to Be Physically Active and Eat a Healthy Diet?

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Blue, C. L. (2007). Does the theory of planned behavior identify diabetes-related cognitions for intention to be physically active and eat a healthy diet? *Public Health Nursing*, *24*(2), 141-150.

Abstract:
Diabetes, a major public health problem, can be prevented or delayed with physical activity and diet modifications, but this requires changing behavior. Understanding the beliefs of persons at risk for diabetes may result in more effective and efficient behavior change interventions.
Objective: To explore the utility of the Theory of Planned Behavior (TPB) and perceived diabetes risk for identifying modifiable diabetes-related beliefs for behavior change.
Design: Descriptive survey based on the TPB and perceived risk.
Sample: Convenience sample included 106 adults at risk for diabetes.
Measurements: Mailed questionnaire with scales to measure TPB variables.
Results: Subjective norm and perceived behavioral control were related to intention to be physically active, and attitude, subjective norm, and perceived behavioral control were related to intention to eat a healthy diet. Perceived diabetes risk was not related to intention to be physically active or eat a healthy diet.
Conclusions: The TPB is a useful theory in explaining physical activity and healthy eating intentions in persons at risk for diabetes. The relationship of perceived diabetes risk and intentions to be physically active and eat a healthy diet needs further investigation.
Key words: diabetes mellitus, diet, physical activity, theory of planned behavior.

Article:

Diabetes has reached epidemic proportions in the United States, and its relevance is expected to continue to increase (Centers for Disease Control and Prevention, 2005). Much of the increase is due to overweight and obesity and physical inactivity (U.S. Department of Health and Human Services [USDHHS], 2001). This pilot study examined the relationships among attitude, social norm, perceived behavioral control, perceived diabetes risk, and intentions to be physically active and eat a healthy diet in persons at risk for diabetes.

The development of diabetes is progressive, resulting in abnormal insulin secretion and insulin action (Pratley & Weyer, 2001). The period between a healthy pancreas and diabetes is called prediabetes and is estimated to affect nearly 12 million overweight persons in the United States (Benjamin, Valdez, Geiss, Rolka, & Narayan, 2003). Thus, assisting people who are at risk for diabetes to prevent or delay diabetes is a major public health goal (American Diabetes Association [ADA] & National Institute of Diabetes, Digestive and Kidney Diseases [NIDDK], 2002; USDHHS, 2000).

Recent randomized controlled trials have shown that modest improvements in physical activity and diet can prevent or delay diabetes (Diabetes Prevention Research Group, 2002; Lindström et al., 2003). The Diabetes Prevention Program showed that a modest weight loss of 5%–7% of body weight and moderate physical activity of 30 min five times a week was almost twice as effective in preventing diabetes as a glucose-lowering drug (Diabetes Prevention Research Group, 2002). However, while studies have found that diabetes could be prevented or delayed with lifestyle changes, considerable effort and number of intervention components were

needed (NIDDK, 2004). Exploring the beliefs about physical activity and healthy eating may be an important step in guiding interventions for community-based practice.

The Theory of Planned Behavior (TPB; Ajzen, 1988) provided the framework for the study. The TPB is an expectancy-value model with emphasis on attitude, subjective norm, perceived behavioral control, intention, and behavior. According to the TPB, the best single predictor of a person's behavior is an intention to perform that behavior. Intentions are in turn a function of the person's attitude (positive or negative evaluation of performing a behavior); the subjective norm (perception of whether relevant others think one should or should not perform the behavior); and perceived behavioral control (perception of the ease or difficulty of carrying out a behavior; Ajzen,1988).

The TPB has been applied to a variety of health-related behaviors, with attitude and perceived behavioral control having the strongest association with intentions and behavior (Armitage & Conner, 2001). Numerous studies have provided support for the TPB to explain physical activity (e.g., Downs & Hausenblas, 2005; Hausenblas, Carron, & Mack, 1997), and diet (Conner, Norman, & Bell, 2002; Sjoberg, Kim, & Reicks, 2004). There are no reports, however, that used the TPB as a framework to examine cognitive factors relevant to physical activity and healthy eating intentions or behaviors of persons at risk for diabetes.

Some researchers have found that if people believe their risk to be high for a particular illness, they are more likely to engage in behaviors to reduce that risk (Fischhoff, Bostrom, & Quadrel, 2002). Perceived risk has therefore been used in many health behavior models such as the Health Belief Model (Strecher, Champion, & Rosenstock, 1997), and the Transtheoretical Model of Behavior Change (Prochaska, DiClemente, & Norcross, 1992). As people who know they are at risk for diabetes may have higher intentions to be physically active and eat a healthy diet, perceived risk for diabetes was added to the TPB for this study.

The following hypotheses were tested:

(1) The TPB and perceived risk will explain a significant portion of the variance in intention to be physically active of persons at risk for diabetes.

(2) The TPB and perceived risk will explain a significant portion of the variance in intention to eat a healthy diet of persons at risk for diabetes.

Methods

A cross-sectional survey design was used to examine the relationships among attitude, subjective norm, perceived behavioral control, and perceived risk for diabetes and intentions to be physically active and to eat a healthy diet.

Sample and recruitment

Approval from the University Institutional Review Board was obtained before subject recruitment. A convenience sample of 106 adults was recruited from a Midwestern community via posters and newspaper advertisements. Subjects were self-identified as at risk for developing diabetes using ADA's risk factors (family history of diabetes, overweight, and diabetes during pregnancy; National Diabetes Information Clearing House, 2004). Interested adults were directed to call the author, who explained the study, answered questions, and screened them for inclusion using the Diabetes Risk Test (ADA, 2003). Persons who scored 10 or above on this test but had not been diagnosed with diabetes, were 21 years or older, and English speaking were eligible for the study. Those who agreed to participate were instructed to return the completed questionnaire in the enclosed addressed, stamped envelope. Return of the questionnaire implied consent for the study. Participants received a $10 gift card as compensation for their time.

Measures

Dependent variables were the intention to be physically active and to eat healthy foods. The former was operationalized with 3 items (intend, try, and plan) that included closed-ended (Likert-style) questions, e.g., "I intend to get moderate or vigorous physical activity for at least 30 min on most days of the week over the next 2 months." The latter was also operationalized with 3 items (intend, try, and plan) that included closed-ended (Likert-style) questions, e.g., "I will try to eat a healthy diet each day in the next 2 months."

The four independent variables for each of the two behaviors were attitude, subjective norm, perceived behavioral control, and perceived diabetes risk. TPB variables were the direct and the indirect measures of each of the three TPB constructs—attitude, subjective norm, and perceived behavioral control as defined by the TPB (Ajzen, 2002). Items for scales assessing beliefs about physical activity and diet were developed specifically for this study according to steps suggested by Ajzen (2002) and were scored on 5-point Likert-style scales. The indirect behavioral belief measure was operationalized with 16 items for physical activity, e.g., "Moderate or vigorous physical activity helps me control my weight" and 10 items for health eating, e.g., "Eating a healthy diet improves my overall physical health." The direct measures of attitude were 5-point semantic differential scales using six bipolar adjectives, e.g., "My getting at least 30 min of moderate or vigorous physical activity on most days of the week during the next 2 months would be unpleasant/pleasant" and "My eating a healthy diet from now to 2 months from now would be very foolish/very wise."

The indirect normative belief measure was operationalized with 6 items for physical activity, e.g., "My spouse or partner thinks that I definitely should not/definitely should be physically active for at least 30 min on most days of the week in the next 2 months," and 6 items for healthy eating, e.g., "My spouse or partner thinks I definitely should not/definitely should eat a healthy diet." The direct measures of subjective norm were 3 items asking about the influence of important others in the respondent's decision about being physically active, e.g., "What do the people in your life whose opinions you value think that you should do about getting moderate or vigorous physical activity for at least 30 min on most days of the week in the next 2 months" and 4 items asking about the influence of important others in the respondent's decisions about healthy eating, e.g., "Most people who are important to me think I should eat a healthy diet."

The indirect measure of perceived behavioral control, the control belief measure, was operationalized with 10 items for physical activity, e.g., "Having time would make my being physically active easier" and 10 items for healthy eating, e.g., "Keeping healthy foods available would make it easier to eat healthy foods." The direct measures of perceived behavioral control were 1 item for physical activity, e.g., "For me to get moderate or vigorous physical activity would be very difficult/very easy" and 6 items for healthy eating, e.g., "How much control do you feel you have over eating a healthy diet in the future?" Psychometric properties of the scales and evidence of validity and reliability have been reported (Blue & Marrero, 2006; Blue, Marrero, & Black, in press).

Diabetes risk was measured with 3 items adapted from Champion's (1999) susceptibility to breast cancer scale: "It is likely that I will get diabetes," "My chances of getting diabetes in the next few years are great," and "I feel I will get diabetes sometime during my life." Responses were from 1, strongly disagree, to 5, strongly agree. Higher scores indicated stronger perceived risk for diabetes.

Data analysis

Two models were examined. One model examined the relationships among TPB constructs, perceived diabetes risk, and intention to be physically active (Fig. 1); a second model examined the relationships among TPB constructs, perceived diabetes risk, and intention to eat a healthy diet (Fig. 2). Other than differences in the behavior foci, the models were the same. Structural equation modeling using the LISREL 8 program was used to examine the relationship of the measures with the constructs and the relationships among the TPB constructs. The measurement model included two measures for each attitude, subjective norm, and perceived behavioral control construct and three measures each for diabetes risk and intention.

Results

Intention to be physically active

The first hypothesis tested, the TPB and perceived risk will explain a significant portion of the variance in intention to be physically active of persons at risk for diabetes, was supported by the data. The amount of variance explained in intention to be physically active was 63%. The standardized λ coefficients for the physical activity measures were from .39 (behavioral belief measure) to .96 (intention measure) and significant, meaning that the measures were good indicators of their underlying constructs (Fig. 1). The coefficients of .35 for subjective norm and .43 for perceived behavioral control on intention to be physically active were significant. Study participants who perceived greater influence from important referents and greater control over physical activity reported a stronger intention to be physically active. Neither attitude nor perceived diabetes risk was related to intention to be physically active. The Critical N was 113, slightly larger than the sample size of 106. The χ^2 fit statistic was 53.10 (*df* = 42, p =.12), Goodness of Fit Index and Normed Fit Index were both .93, and the Standardized Root Mean Residual was .05, supporting a good model fit.

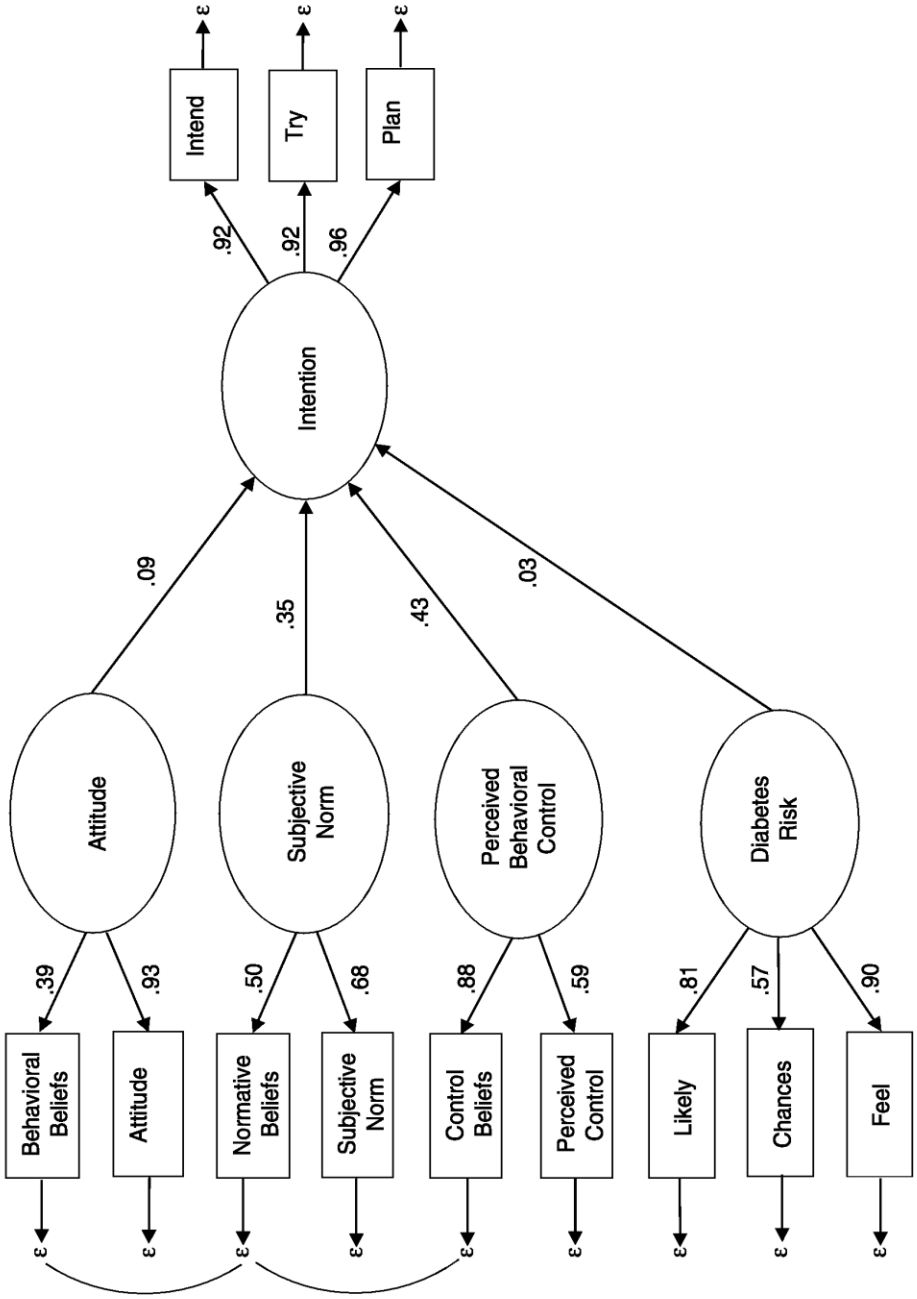

Figure 1. Final Measurement and Structural Model for the Theory of Planned Behavior, Perceived Diabetes Risk, and Physical Activity Intention.

Note. The ovals denote the constructs, and the rectangles denote the variables measured with error (ε). The exogenous or independent constructs were allowed to covary. Error terms were correlated between the behavioral belief and normative belief measures and the normative belief and control belief measures.

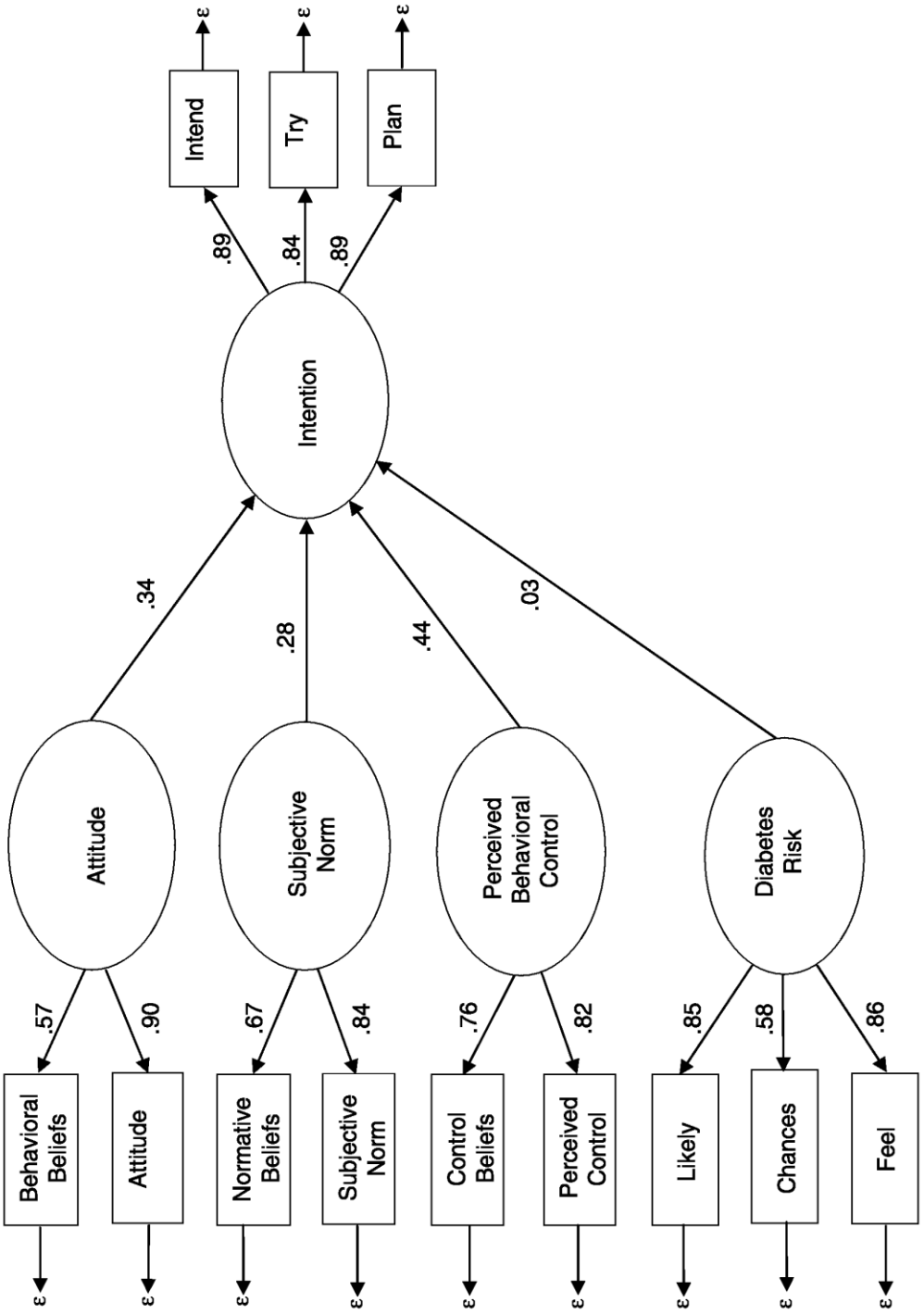

Figure 2. Final Measurement and Structural Model for the Theory of Planned Behavior, Perceived Diabetes Risk, and Healthy Eating Intention.

Note. The ovals denote the constructs, and the rectangles denote the variables measured with error (ε). The exogenous or independent constructs were allowed to covary.

Intention to eat a healthy diet

The second hypothesis tested, the TPB and perceived risk will explain a significant portion of the variance in intention to eat a healthy diet of persons at risk for diabetes, was also supported by the data. The amount of variance in intention explained by the model was 76%. The standardized λ coefficients for the healthy eating measures were from .57 (behavioral belief measure) to .90 (attitude measure) and significant, meaning that the measures were good indicators of their underlying constructs (Fig. 2). The coefficients of .28, .34, and .44 for subjective norm, attitude, and perceived behavioral control, respectively, on intention to eat a healthy diet were significant. The study participants who expressed more favorable attitudes toward eating a healthy diet, perceived greater influence from important referents, and perceived greater control over their diet reported a stronger intention to eat healthy foods. Perceived diabetes risk was the only construct that did not have a significant relationship with healthy eating intention. The Critical N was 99, smaller than the sample size of

106. The χ^2 fit statistic of 52.00 (*df* = 39, p 5.08), Goodness of Fit and Normed Fit Indexes of .93, and the Standardized Root Mean Residual of .05 supported a good model fit.

Discussion

Epidemiologic and clinical studies have shown that physical activity and diet reduce the risk of developing diabetes. This pilot study was the first to use the TPB for identifying beliefs about physical activity and healthy eating intentions of persons at risk for diabetes. Perceived behavioral control explained the majority of the variance in both physical activity and healthy eating intentions. This has also been found in other TPB studies of physical activity (Armitage, 2005; Blue, Wilbur, & Marston-Scott, 2001) and dietary behaviors (Conner et al., 2002; Sjoberg et al., 2004). Behavioral and environmental barriers have been found to have a significant influence on weight loss efforts with diet and physical activity in other studies (French, Story, & Jeffery, 2001; Jeffery et al., 2000). The finding that attitude was not associated with intention to be physically active differed from the findings of other studies (Blue et al., 2001; Conn, Tripp-Reimer, & Maas, 2003). However, as in other studies, attitude was related to intention to eat a healthy diet (Brekke, Sunesson, Axelsen, & Lenner, 2004; Conner et al., 2002; Nejad, Wertheim, & Greenwood, 2004).

Subjective norm was related to both physical activity and healthy eating intentions. In other studies, subjective norm has not been a significant variable either (Blue et al., 2001; Conn et al., 2003; Conner et al., 2002), although Nguyen, Otis, and Potvin (1996) found subjective norm to be associated with intention to eat a low-fat diet. These differences in findings are consistent with Ajzen and Fishbein's (1980) view that people's beliefs about behaviors and the importance they place on these beliefs differ. Thus, for persons at risk for diabetes, social influence may be an important determinant in physical activity and diet.

Perceived diabetes risk, however, was not found to be associated with intentions to be physically active or to eat a healthy diet in this sample of persons at risk for diabetes. Research has revealed that people tend to be optimistic about personal risk for disease (Kreuter & Strecher, 1995; O'Brien, Fries, & Bowen, 2000; Polley, Jakicic, Venditti, Barr, & Wing, 1997; Satterfield, Johnson, Slovic, Neil, & Schein, 2000), and perceived diabetes risk has been found to be low, despite the presence of risk factors (Adriaanse et al., 2003). Even persons who have been diagnosed with type 2 diabetes have been found to perceive their diabetes as slightly serious and were slightly worried about its threat to their future health (Clark & Hampson, 2001). Nevertheless, it is also possible that risk perceptions of the participants in this study were inaccurate. Research using a more specific risk judgment measure has shown that higher risk judgments encourage people to engage in risk-reducing behavior and that engaging in risk-reducing behavior led people to reduce their risk judgments (Brewer, Weinstein, Cuite, & Herrington, 2004).

Although a large portion of variance in both physical activity intention and healthy eating intention was explained by the variables, the focus of the TPB is on intrapersonal environments of individuals (Rimer, 2002). A criticism of the TPB is that it does not consider political, economic, or environmental barriers and therefore may be limited in scope. However, the premise of the TPB is that people's cognitions are formed from situations in the person's environment and that variables external to the model affect behavior indirectly through the variables specified in the theory (Ajzen & Fishbein, 1980; Ajzen, 1988). The formative research to develop questionnaire belief items from the study population results in a "snapshot" of the cognitive foundation of the behavior of a particular population and thus "grounds" the data in the study population (Ajzen, 2002). In addition, the formative research results in specific aspects of the person's environment that are salient to the behavior and this information may include social, political, and environmental factors. Future research may consider situational, political, economic, and environmental factors that may influence physical activity or eating behaviors of persons at risk for diabetes to test the premise of the TPB that people's cognitions are formed from situations in the person's environment and variables external to the model affect behavior indirectly through the variables specified in the theory. Situational and environmental factors that may influence both physical activity and diet may include the working environment, available resources, social support, safety issues, and level of deprivation (Booth, Pinkston, & Poston, 2005; Paxton, Sharpe, Granner, & Hutto, 2005; Sisson, 2005). Cultural differences may also be considered as a moderating variable in future research of the

TPB as culture affects physical activity and eating behaviors (Rodriguez-Santos, Berry, & Grey, 2005; Rozin, 2005; Whitt, DuBose, Ainsworth, & Tudor-Locke, 2004).

This study used a purposive sample from the community, limiting the generalizability of study results, and subjects responded to advertisements and may have been more motivated or concerned about diabetes than others in the community who did not respond. In addition, the study sample was small and a majority of subjects in this study were White; the beliefs of other racial and ethnic groups may differ from those expressed here. Testing the TPB with larger samples and diverse populations would further understanding of physical activity and healthy eating behaviors of persons at risk for diabetes. Also, the study was cross-sectional; thus, causal relationships between attitude, subjective norm, perceived behavioral control, and intention could not be established. Examining these constructs over time would provide more information about the effects of beliefs of persons at risk for diabetes on intention and behavior. Longitudinal data might better represent the influence of diabetes risk on physical activity and dietary behaviors. Finally, the study examined intentions to be physically active and eat a healthy diet but did not measure actual activity and dietary behavior. However, behavioral theory proposes that intention is the best predictor of future behavior (Ajzen, 1988).

Future research is needed to test intervention strategies to assist persons at risk for diabetes to move from behavioral intentions targeted to actions that improve their physical activity and diet. This study determined the relative contributions of behavioral beliefs and attitude, normative beliefs and subjective norm, and control beliefs and behavioral control cognitions to explain intentions to be physically active and eat a healthier diet. Therefore, including these beliefs and cognitions to inform the development of intervention content is essential. For this sample of persons at risk for diabetes, an intervention designed to use social influence and to raise perceptions of control over physical activity should be effective in moving them from an intention to be physically active to physical activity behavior at higher levels. To improve diet, the public health nurse could direct the intervention on developing more favorable attitudes toward eating a healthy diet, using social influence, and raising perceptions of control over eating a healthier diet. The content for an intervention would be contingent upon the population's beliefs and cognitions. For example, if the person or target group believes that improving physical activity and diet will not delay or prevent diabetes, the intervention should focus on changing this belief through education. People who are not physically active because they have not found an activity they like to do should be counseled about incorporating physical activity into their daily lives, finding an activity they may enjoy, or being physically active with someone who is important to them such as their spouse or partner or a friend. Similarly, people who believe that a healthy diet will result in being hungry or would make them miss tasty foods they like would benefit from an intervention that focuses on ways to use small, frequent meals to control hunger and ways to substitute tasty healthy foods for unhealthy foods. In addition to focusing on the content of an intervention to taking steps to change behaviors, helping individuals form an "implementation intention" or plan detailing when, where, and how they will accomplish the behavior is essential (Ajzen, 2006). Future research should examine the effectiveness of TPB-driven interventions to help people at risk for diabetes to improve their physical activity and diet. This research must not only examine behavior change but also examine changes in TPB beliefs and cognitions that are proposed to propel behavior change.

Future research is also needed to more thoroughly assess the relationship of perceived risk on physical activity and dietary behavior. The measures of diabetes risk should include behaviors that would increase or lower the risk to make a more specific assessment of people's perception of their risk for diabetes, e.g., "It is likely that I will get diabetes if I remain physically inactive." Although the TPB is a useful framework for examining the relationships of attitude, subjective norm, and perceived behavioral control and physical activity and healthy eating intentions of persons at risk for diabetes, it may be beneficial in future studies to add the perceived diabetes risk construct to examine risk as a possible moderator of physical activity and healthy eating behaviors.

Conclusions

While further research is needed to replicate these study findings, the data suggest that attitude toward healthy eating and a focus on perceived behavioral control and social influence are important to promote physical

activity and healthy eating in persons at risk for diabetes. This study suggests that the TPB is a useful framework for understanding important beliefs related to physical activity and healthy eating intentions of persons at risk for diabetes. Additional measurement and theoretical efforts are needed to define and measure perceived diabetes risk and specify the nature of its relationship with physical activity and dietary behaviors. This line of research is important to advances in research using theory to understand physical activity and dietary behaviors that can lead to more effective intervention strategies to delay or prevent diabetes.

References

Adriaanse, M. C., Snoek, F. J., Dekker, J. M., Spijkerman, A. M. W., Nijpels, G., van der Ploeg, H. M., et al. (2003). Perceived risk for type 2 diabetes in participants in a stepwise population-screening programme. Diabetic Medicine, 20(3), 210–215.

Ajzen, I. (1988). Attitudes, personality, and behavior. Chicago: Dorsey Press.

Ajzen, I. (2002). Constructing a TPB questionnaire: Conceptual and methodological considerations. Retrieved November 18, 2006, from http:// www.people.umass.edu/aizen/pdf/tpb.measure ment.pdf

Ajzen, I. (2006). Behavioral interventions based on the Theory of Planned Behavior. Retrieved November 6, 2006, from http://www.people. umass.edu/aizen/pdf/tpb.intervention.pdf

Ajzen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behavior (pp. 82– 90). Englewood Cliffs, NJ: Prentice-Hall.

American Diabetes Association [ADA]. (2003). Diabetes risk test. Retrieved November 19, 2006, from http://www.diabetes.org/risk-test/ text-version jsp

American Diabetes Association [ADA], & National Institute of Diabetes, Digestive and Kidney Diseases [NIDDK]. (2002). The prevention or delay of type 2 diabetes. Diabetes Care, ^{2}5(4), 742–749.

Armitage, C. J. (2005). Can the theory of planned behavior predict the maintenance of physical activity? Health Psychology, $_{24(3),}$ 235–245.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. British Journal of Social Psychology, 40(4),471–499.

Benjamin, S. M., Valdez, R., Geiss, L. S., Rolka, D. B., & Narayan, K. M. V. (2003). Estimated number of adults with prediabetes in the U.S. in 2000: Opportunities for Prevention. Diabetes Care, 26(3), 645–649.

Blue, C. L., & Marrero, D. G. (2006). Psychometric properties of the Healthy Eating Belief Scales relevant to persons at risk for diabetes. Journal of Nutrition Education and Behavior, 38(3), 134–142.

Blue, C. L., Marrero, D. G., & Black, D. R. (in press). Physical activity belief scales for diabetes risk: Development and psychometric testing. Health Education and Behavior.

Blue, C. L., Wilbur, J., & Marston-Scott, M. V. (2001). Exercise among blue-collar workers: Application of the theory of planned behavior. Research in Nursing and Health, 24(6), 481–493.

Booth, K. M., Pinkston, M. M., & Poston, W. S. C. (2005). Obesity and the built environment. Journal of the American Dietetic Association, 105(5, Suppl. 1), S110–S117.

Brekke, H. K., Sunesson, Å., Axelsen, M., & Lenner, R. A. (2004). Attitudes and barriers to dietary advice aimed at reducing risk of type 2 diabetes in first-degree relatives of patients with type 2 diabetes. Journal of Human Nutrition and Dietetics, 17(6), 513–521.

Brewer, N. T., Cuite, C. L., Herrington, J. E., & Weinstein, N. D. (2004). Risk perceptions and their relation to risk behavior. Annals of Behavioral Medicine, 27(2),125–130.

Centers for Disease Control and Prevention. (2005). Number of Americans with diabetes continues to increase. Retrieved November 19, 2006, from http://www.cdc.gov/od/oc/media/pressrel/ fs051026.htm

Champion, V. L. (1999). Revised susceptibility, benefits, and barriers scale for mammography screening. Research in Nursing and Health, 22(4),341–348.

Clark, M., & Hampson, S. E. (2001). Implementing a psychological intervention to improve lifestyle self-management in patients with type 2 diabetes. Patient Education and Counseling, 4^{2}(3), 247–256.

Conn, V. S., Tripp-Reimer, T., & Maas, M. L. (2003). Older women and exercise: Theory of planned behavior beliefs. Public Health Nursing, 20(2), 153–163.

Conner, M., Norman, P., & Bell, R. (2002). The theory of planned behavior and healthy eating. Health Psychology, 21(2),194–201.

Diabetes Prevention Program Research Group. (2002). Reduction in the incidence of Type 2 diabetes with lifestyle intervention or metformin. New England Journal of Medicine, 346(6),393–403.
Downs, D. S., & Hausenblas, H. A. (2005). The theories of reasoned action and planned behavior applied to exercise: A meta-analytic update. Journal of Physical Activity and Health, 2(1), 76–97.
Fischhoff, B., Bostrom, A., & Quadrel, M. J. (2002). Risk perception and communication. In R. Detels, J. McEwen, R. Reaglehold, & H. Tanaka (Eds.), Oxford textbook of public health (Vol. 2, 4th ed., pp. 1105–1123). Oxford: Oxford University Press.
French, S. A., Story, M., & Jeffery, R. W. (2001). Environmental influences on eating and physical activity. Annual Review of Public Health, 22, 309–335.
Hausenblas, H. A., Carron, A. V., & Mack, D. E. (1997). Application of the theories of reasoned action and planned behavior to exercise behavior: A meta-analysis. Journal of Sport and Exercise Psychology, 19(1), 36–51.
Jeffery, R. W., Drewnowski, A., Epstein, L. H., Stunkard, A. J., Wilson, G. T., Wing, R. R., et al. (2000). Long-term maintenance of weight loss: Current status. Health Psychology, 19(1, Suppl.), 5–16.
Kreuter, M., & Strecher, V. (1995). Changing inaccurate perception of health risk: Results from a randomized trial. Health Psychology, 14(1), 56–63.
Lindstro¨m, J., Louheranta, A., Mannelin, M., Rastas, M., Salminen, V., Eriksson, J., et al. (2003). The Finnish Diabetes Prevention Study (DPS): Lifestyle intervention and 3-year results on diet and physical activity. Diabetes Care, 26(12), 3230–3236.
National Diabetes Information Clearing House. (2004). Am I at risk for type 2 diabetes? Retrieved November 19, 2006, from http:// diabetes.niddk.nih.gov/dm/pubs/riskfortype2
National Institute of Diabetes and Digestive and Kidney Diseases. (2004). Prevention or delay of type 2 diabetes. Diabetes Care, American Diabetes Association: Clinical Practice Recommendations 2004, 27(Suppl. 1), S47–S54.
Nejad, L. M., Wertheim, E. H., & Greenwood, K. M. (2004). Predicting dieting behavior by using, modifying, and extending the theory of planned behavior. Journal of Applied Social Psychology, 34(10), 2099–2131.
Nguyen, M. N., Otis, J., & Potvin, L. (1996). Determinants of intention to adopt a low-fat diet in men 30 to 60 years old: Implications for heart health promotion. American Journal of Health Promotion, 10(3), 201–207.
O'Brien, A., Fries, E., & Bowen, D. (2000). The effect of accuracy of perceptions of dietary-fat intake on perceived risk and intentions to change. Journal of Behavioral Medicine, 23(5), 465– 473.
Paxton, R. J., Sharpe, P. A., Granner, M. L., & Hutto, B. (2005). Associations of sociodemographic and community environmental variables to use of public parks and trails for physical activity. International Journal ofHealth Promotion and Education, 43(4), 108–116.
Polley, B. A., Jakicic, J. M., Venditti, E. M., Barr, S., & Wing, R. R. (1997). The effects of health beliefs on weight loss in individuals at high risk for NIDDM. Diabetes Care, 20(10),1533–1538.
Pratley, R. E., & Weyer, C. (2001). The role of impaired early insulin secretion in the pathogenesis of Type II diabetes mellitus. Diabetologia, 44(8),929–945.
Prochaska, J., DiClemente, C., & Norcross, J. (1992). In search of how people change: Applications to addictive behaviors. American Psychologist, 47(9),1102–1114.
Rimer, B. K. (2002). Perspectives on intrapersonal theories of health behavior. In K. Glanz, B. K. Rimer, & F. M. Lewis (Eds.), Health behavior and health education (pp. 144–159). San Francisco, CA: Jossey-Bass.
Rodriguez-Santos, G., Berry, D., & Grey, M. (2005). A comparison of clinical factors and health and psychosocial behaviors of Hispanic and African American youth at risk for type 2 diabetes. Hispanic Health Care International, 3(2), 77–85.
Rozin, P. (2005). The meaning of food in our lives: A cross-cultural perspective on eating and wellbeing. Journal of Nutrition and Behavior, 37(Suppl. 2), S107–S112.
Satterfield, T., Johnson, S. M., Slovic, P., Neil, N., & Schein, J. R. (2000). Perceived risks and reported behaviors associated with osteoporosis and its treatment. Women and Health, 31(4), 21–40.
Sisson, S. B. (2005). Taking it to the streets: Physical activity and the built environment: Part one. ACSM's Health and Fitness Journal, 9(6), 8–11,32–34.
Sjoberg, S., Kim, K., & Reicks, M. (2004). Applying the theory of planned behavior to fruit and vegetable consumption by older adults. Journal of Nutrition for the Elderly, 23(4), 35–46.

Strecher, V. J., Champion, V. L., & Rosenstock, I. M. (1997). The health belief model and health behavior. In D. S. Gochman (Ed.), Handbook of health behavior research I. Personal and social determinants (pp. 71–91). New York: Plenum Press.
U.S. Department of Health and Human Services [USDHHS]. (2000). Healthy people 2010 (2nd ed., pp. 5-1–5-40). Washington, DC: U. S. Government Printing Office.
U.S. Department of Health and Human Services [USDHHS]. (2001). The Surgeon General's call to action to prevent and decrease overweight and obesity. Rockville, MD/ Washington, DC: Public Health Service, Office of the Surgeon General/Government Printing Office.
Whitt, M. C., DuBose, K. D., Ainsworth, B. E., & Tudor-Locke, C. (2004). Walking patterns in a sample of African American, Native American, and Caucasian women: The cross-cultural activity participation study. Health Education and Behavior, 31(4, Suppl.), 45S.