Initiation of Health Behavior Change and Its Psychological Determinants in Prehypertensive People: An Exploratory Study

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Abstract

Objective: This study explored the relationship of risk perception with change in health behaviors and social cognitive theory (SCT) constructs. Additionally, this study evaluated the feasibility, utility, and practice of self blood pressure monitoring (SBPM). *Design*: Adults with prehypertension, ages 45-62 ($N = 23$) completed the Risk Perception Survey for Developing Hypertension (RPS-DH) and Health Belief Survey (HBS) during the screening portion of Dash-2-Wellness (D2W), a lifestyle modification intervention. Participants were randomized into one of two treatment groups, Dash-2-Wellness Plus (D2W Plus) or Dash-2-Wellness Only (D2W Only). Both groups were given dietary counseling regarding the DASH diet and encouraged to monitor their physical activity using a pedometer. The D2W Plus group also engaged in SBPM. *Results*: Moderate correlations were found between composite risk perception and change in step count ($r = -.47$, $p = .03$), and change in systolic blood pressure ($r = .42$, $p = .04$). Baseline risk perception was not related to SCT variables, with few exceptions. High levels of compliance ($M = 90.36\%$, $SD = 12.62$) were reported for SBPM. *Conclusions*: Findings indicate that risk perception may play a limited role in motivating change in continuous health behaviors, particularly in asymptomatic conditions. Additionally, the nature of the risk reduction offered by the behavior may also influence its association with risk perception as a motivator for change. Findings suggest that SBPM is a feasible and useful behavior. Reports regarding positive affect and ease of machine use in regards to this behavior may increase the likelihood of regular compliance.

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A majority of deaths in the world are caused by non-communicable diseases (NCDs), many of which require lifestyle modification for treatment (World Health Organization, 2004). A major risk factor for multiple NCDs, including ischematic and other types of heart disease, stroke, hypertensive disease, and renal disease, is high blood pressure (Izzo, 2007; Lawes, Vander Hoorn, & Rodgers, 2008). Worldwide about 7.6 million adult deaths a year are due to non-optimal blood pressure (systolic blood pressure greater than 115 mmHg in adults 30 years or older) (Lawes et al., 2008).

Prehypertension

In 2003, the Seventh Report from the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) defined "prehypertension" as having a blood pressure of 120 to 139/ 80 to 89 mmHg (Chobanian et al., 2003). The distinction of a prehypertensive range by the JNC7 was meant to highlight the increased level of cardiovascular risk associated with blood pressure levels that had, in the past, been considered acceptable (Elliott & Black, 2007). Recent studies have found that common cardiovascular risk factors, such as obesity, raised levels of LDL cholesterol and triglycerides, and reduced levels of HDL cholesterol, are also associated with prehypertension (Grotto, Grossman, Huerta, & Sharabi, 2006; Jago et al., 2006). Indeed, individuals with prehypertension are 1.65 times more likely to have at least one other adverse cardiovascular risk factor than those with normotension (Greenlund, Croft, & Mensah, 2004).

The first line of treatment suggested by the JNC7 for prehypertension is therapeutic lifestyle change, including weight loss, diet, and exercise (Chobanian et al., 2003). Studies have shown that such nonpharmacologic treatments can have a significant impact on blood pressure reduction (e.g.Whelton et al., 1998). However, maintaining these lifestyle changes has been difficult, with evidence of erosion over time. One area where the difficulty of behavior maintenance has been clear is in treatment-induced weight loss. On average, those who complete a behavioral weight loss program will lose 9% of their body weight. However, Perri suggests that approximately half of the weight lost will be regained within one year, while nearly all of it will be regained within 5 years

(2002). The contrast between the success of steady initial change with the lapse and relapse difficulties faced in the maintenance of weight loss suggests that different processes may be at work during these phases. These different processes have been central to stage-theory frameworks for behavior change, such as the one suggested by Rothman (2000). Primary determinants of Rothman's stages of regulatory behavior change include constructs borrowed from Bandura's social cognitive theory (SCT), a frequently used theory of behavior change (Bandura, 1986).

Social Cognitive Theory

Social cognitive theory proposes that specific psychosocial factors work in concert to have a causal impact on behavior change. In SCT self-efficacy beliefs, in cooperation with personal goals, outcome expectations, social support, and perceived impediments and facilitators, regulate and motivate human behavior and behavior change (Bandura, 2004). Additionally, the variables of SCT have been shown to be predictive of various health behaviors in the general population, and in individuals with high blood pressure and hypertension; although research with this population is limited (Burke, Beilin, Cutt, Mansour, & Mori, 2008; Lee & Laffrey, 2006; Martin et al., 2008).

Social support from family, friends, co-workers, or others can have a positive impact on an individual's health to the extent that it promotes their efficacy to engage in certain health behaviors (Bandura, 1997). In recent research, social support was shown to have a significant effect on nutrition (Anderson, Winett, & Wojcik, 2007) and physical activity (Anderson, Wojcik, Winett, & Williams, 2006), with effects mediated by the influence of social support on self-efficacy and on self behavior (Anderson et al., 2006, 2007).

Self-efficacy, an individuals' belief in their ability to effectively enact a behavior, is the primary determinant of behavior in SCT. In regards to nutrition, higher self-efficacy has been associated with higher consumption of fiber, fruits, and vegetables, with the effect being indirect through self-regulation and negative outcome expectations (Anderson et al., 2007). Self-efficacy has also been associated with higher levels of physical activity (Anderson et al., 2006). In a randomized control trial of a lifestyle modification study that focused on weight loss, diet, and exercise in a group of individuals with hypertension, change in self-efficacy was found to be a mediator of

dietary change and physical activity at post-intervention (Burke et al., 2008). Another study, investigating the personal, interpersonal, and environmental factors that influenced the decision to engage in physical activity in older adults with borderline hypertension, found that self-efficacy not only served as a mediator, but also had a significant direct effect (Lee & Laffrey, 2006).

Outcome expectations are the perceptions one has in regards to the expected costs and benefits a behavior will afford. The anticipated results of one's actions, outcome expectations can be positive or negative. Different forms of outcome expectations have been shown to have a significant impact on various health behaviors. Studies investigating outcome expectancies in relation to nutritional behavior found physical outcome expectations to be strong predictors of healthy patterns of food shopping and consumption (Anderson, Winett, & Wojcik, 2000), and negative outcome expectations to have a negative effect on quality of food purchases and consumption (Anderson et al., 2007). Additionally, in an investigation of the relationship between outcome expectancies and weight loss, it was found that more favorable expectations were positively associated with better short-term weight loss (Finch et al., 2005).

In SCT self-regulation occurs through self-monitoring, goal setting, evaluative judgment, self-appraisal, and affective self-reaction (Bandura, 1991). Bandura notes that a large portion of self-regulation depends on accurate and consistent self-monitoring as it assists people in setting realistic goals and informs their progress towards reaching those goals. Self-regulatory nutrition behaviors, including the use of strategies to decrease fat and to increase fruits, vegetables, and fiber, and planning and tracking healthier eating, have been found to lead to lower levels of fat, and higher levels of fruits, vegetables, and fiber in food purchases and consumption (Ammerman, Lindquist, Lohr, & Hersey, 2002; Anderson et al., 2007), and decreases in overall calorie intake (Foreyt & Goodrick, 1993). Self-regulation strategies have also been associated with greater motivation in and involvement with physical activity (Anderson et al., 2006; Umstattd, Wilcox, Saunders, Watkins, & Dowda, 2008). Specifically, people who intentionally make arrangements and set aside time for exercise have been found to be more physically active (Anderson et al., 2006). This relationship has held in research investigating both moderate and

vigorous physical activity, and in young as well as older adults (Hortz & Petosa, 2008; Petosa, Suminski, & Hortz, 2003; Umstattd et al., 2008).

Self-blood pressure monitoring (SBPM) is a specific self-regulatory behavior that can improve blood pressure (Cappuccio, Kerry, Forbes, & Donald, 2004; Halme, Vesalainen, Kaaja, & Kantola, 2005; McManus et al., 2005; Ohkubo et al., 1998) and prognostic ability for fatal and non-fatal cardiovascular events, as well as for "masked" hypertension (Fagard, Van Den Broeke, & De Cort, 2005; Ohkubo et al., 1998). Self-blood pressure monitoring includes multiple elements of self-regulation including monitoring, recording, tracking, and planning.

Rothman's Stages of Regulatory Behavior Change

In his stage-model, Rothman outlines how SCT manifests itself at different stages of behavior change (Rothman, Baldwin, & Hertel, 2004). Specifically, Rothman (2000) proposed that the psychological factors that impact one's behavior are dynamic throughout the change process, which is made up of four distinct phases: initial response, continued response, maintenance, and habit, each of which involves its own set of cognitive and behavioral processes (Rothman et al., 2004). In the initial response phase, when the decision is first made to change one's behavior, a cost/benefit analysis takes place comparing different behavioral alternatives, their related expected outcomes, and a person's belief in their ability to obtain those outcomes. If this analysis shows that the outcomes of the new behavior are more favorable than those afforded by one's current behavior, behavioral initiation is likely to occur (Rothman, 2000).

Rothman postulates that the initiation phase and the continued response phase focus on obtaining preferred future outcomes by reducing the discrepancy between current and desired behavior. In the continued response phase, the effort to establish a new behavior stems from a reliable performance of the desired behavior, which produces initial rewards, sustains self-efficacy beliefs, and maintains outcome expectations (Rothman et al., 2004). However, during this phase, these positive determinants are in constant tension with the unpleasant demands of the behavior change process; individuals' expectations of preferred future outcomes must now be reconciled with their actual performance of the new behavior as they attempt to gain a sense of mastery. Although, it should be noted that Rothman's perspective is primarily built upon his

experience with traditional behavioral weight loss interventions, which almost inevitably results in relapse or lapse, which may not be the case for other approaches to nutrition and physical activity change.

The last two phases of Rothman's behavior change process are maintenance and habit. By the time an individual reaches the maintenance phase, they have already successfully performed the target behavior, and are sustaining that performance. During this phase there is a continuous evaluation of the costs and benefits associated with that behavior, and it is the perceived value of the behavior and the satisfaction of the results of that behavior that are the primary determinants of the maintenance phase (Rothman et al., 2004). The habit phase occurs once the behavior has become a part of a self-sustaining pattern. At this point continuous evaluation is no longer necessary, and people are confident in their ability to successfully complete the behavior. While these are important phases of Rothman's model, the initiation and continued responses phases were the focus of this study.

While Rothman includes self-efficacy and outcome expectancies in the initiation and continued response phases of behavior change, he does not include them as determinants of maintenance or habit. Researchers are currently investigating the role of various psychological factors throughout the behavior change process in order to lend support to this theory. For example Linde, Rothman, Baldwin, and Jeffery (2006) recently found self-efficacy to be predictive of weight control behavior during the "treatment" phase of the weight loss program, but no during follow-up. Better understanding of the specific psychological processes at each stage of behavior change could help researchers to better tailor interventions to differentially emphasize these variables at different phases of behavior change.

Rothman's borrowing of key constructs from SCT is not an uncommon practice. Indeed, many theories of health behavior include similar constructs, operating under different names (Bandura, 2004; Williams, Anderson, & Winett, 2005). Bandura notes that one such overlap is the use of "perceived severity" and "susceptibility to disease" in the health belief model (Becker, 1974), which in terms of SCT, are expected negative physical outcomes (2004). Perceived severity and susceptibility have also been cited as other terms for dimensions of the psychosocial variable of perceived risk (Brewer et al.,

2007; Brewer, Weinstein, Cuite, & Herrington, 2004; Weinstein, 1993). In following this logic, risk perception would also, in terms of SCT, be seen as a negative physical outcome expectancy, and as an outcome expectancy, possibly play a determining role in Rothman's initiation and continued response phases.

Risk Perception

The congruency of one's health risk perception (a person's degree of understanding about health risk issues; (Fischoof, Bostrom, & Quadrel, 1993) with one's actual risk, is believed to be a prerequisite for effective management of disease (Cockburn & Pit, 1997; Lewis, Robinson, & Wilkinson, 2003). Empirical studies of risk perception indicate mixed results regarding its' impact on health behavior change. Research examining risk perception's association with single event behaviors (e.g. vaccination and mammograms) found a positive, if small, association (Brewer et al., 2007; Harrison, Mullen, & Green, 1992; Leventhal, Kelly, & Leventhal, 1999; McCaul, Branstetter, Schroeder, & Glasgow, 1996). A recent meta-analysis regarding the role of risk perception and vaccination behavior (Brewer et al., 2007) suggested moderate effects of perceived likelihood of contracting the targeted disease on vaccination rates across 12 studies with 6,958 participants (r = .26) and, of perceived susceptibility to the target disease across 5 studies with 2,543 participants (r = .24). However, studies investigating risk perception and continuous health behaviors, e.g. physical activity, produced non-significant results (Luszczynska & Tryburcy, 2008; Renner, Spivak, Kwon, & Schwarzer, 2007). These differing results indicate that the role of risk perception in motivating behavior change may differ as a function of the type of behavior.

This study investigated the roles of initial and changed risk perception for developing hypertension in the initiation and continued effort of adopting several health protective behaviors (i.e. increased physical activity, increased fruit and vegetable consumption, and SBPM) among adults with prehypertension volunteering for a larger diet and exercise study, Dash-2-Wellness (D2W). In addition, this study examined how risk perception at behavior-change initiation and continued response related to other social cognitive variables, how it influenced adherence to SBPM recommended in one D2W study condition, and how SBPM related to changes in diet and exercise among involved participants.

Dash-2-Wellness

Dash-2-Wellness was a ten-week intervention designed to improve nutrition and physical activity levels among adults with prehypertension and high normal blood pressure. Participants were overweight to obese (Body Mass Index [BMI]: weight(lb)/height(in)^2 x 703: 25-40), and had a systolic blood pressure between 115-139 mmHg or a diastolic blood pressure of 80-89 mmHg. Participants were randomized into one of two treatment groups, D2W Plus, the intervention group, or D2W Only, the control group. During the intervention phase, both groups of participants were asked to follow the Dietary Approaches to Stop Hypertension (DASH) diet (Vogt et al., 1999), which includes a high intake of fruits (4-6 servings/day) and vegetables (4-6 servings/day), and low sodium and sugar intake, along with an emphasis on whole grains, lean meats, and low-fat dairy. Participants were also given a pedometer, the Accusplit® Eagle 120XL Activity Pedometer, with which to monitor their daily step count.

In addition to the DASH diet and a specific step-count program (i.e. with set goals), participants in the D2W Plus group were provided with weekly feedback and goal-setting, as well as instruction in problem solving related to diet, exercise, and blood pressure via electronic communication. Dash 2 Wellness Plus participants were also asked to self-monitor their blood pressure by taking and recording their blood pressure four times daily, twice consecutively in the morning, and twice consecutively in the evening using the Omron automatic Blood Pressure Monitor (Model HEM-&12C).

After the ten-week intervention, participants in D2W Plus group and the D2W group made similar increases in fruit and vegetable intake (M = 2.10, SD = 1.73 servings/day and M = 1.02, SD = 2.24 servings/day, respectively; p = .25). Participants in the D2W Plus group, however, made greater increases in daily steps (M = 2,900.14, SD = 1903.83 steps/day) compared to D2W Only participants (M = 636.39, SD = 1,653.26 steps/day; p = .01). Additionally, D2W Plus participants achieved greater decreases in systolic blood pressure (M = -15.14, SD = 4.33 mmHg) compared to D2W Only participants (M = -4.61, SD = 8.28 mmHg; p = .003) and, albeit marginally, in diastolic blood pressure (M = -4.89, SD = 2.97 mmHg vs. M = -2.27, SD = 3.30 mmHg; p = .08). Finally, participants in the D2W Plus group lost more weight (M = -10.54, SD = 8.39 lbs) compared to participants in the D2W Only group (M = -3.23; SD = 5.65 lbs; p = .03)

(Dorough, 2009). Secondary outcome variables included multiple social cognitive constructs relating to nutrition and physical activity. Notably, participants in the D2W Plus group made greater increases in their regulation of calories and fat (M = 1.48, SD = 1.13) compared to the D2W Only participants (M = .40, SD = .67; p = .01), as well as in planning and tracking of healthier foods (M = 1.90, SD = .98 vs. M = .47, SD = .95; p = .004), regulating fiber fruits and vegetables (M = 1.39, SD = .90 vs. M = .28, SD = .85; p = .006), and self-regulation for physical activity (M = 1.96, SD = .83 vs. M = .53, SD = .55; $p < .001$). No other significant differences in change were found between groups on the remaining social cognitive variables.

Method

Design

The current study investigated 1) the levels of risk perception and the relation of risk perception to other social cognitive variables among initiators in the D2W program, 2) the relation of risk perception to behavior change and the relation between change in risk perception and change in other social cognitive variables among participants in the continued response phase of behavior change, and 3) the self mechanisms and affective responses related to SBPM among participants in the D2W Plus condition of the larger study (Dorough, 2009). These goals were achieved by using descriptive data from two samples in the D2W program: 1) 23 adults randomized into one of two treatment groups in D2W (whose psychosocial variables and health behaviors were investigated during the initiation and continued response phases), and 2) 11 adults randomized into the D2W Plus treatment group (whose SBPM behaviors and affective responses were investigated).

Participants

Participants in D2W were recruited through local advertising; including print media ads, posted flyers, and email listservs. Individuals responding to recruitment materials received a brief description of the study and were screened for eligibility via telephone. In total, 97 participants attended the initial screening session, 27 were randomized, and 23 completed the intervention.

The *initiation/continued response sample* (N = 23; see Figure 1) includes participants who were not excluded during the screening process, and who completed the intervention trial. These participants, who contributed data for the study of risk

perception, other SCT constructs, and behavior change, included men (n = 7) and women (n = 16) ages 45 to 65 (M = 54.30, SD = 5.50) who were overweight to obese (BMI: M = 31.48, SD = 4.09). Twelve of these participants reported engaging in no regular physical activity at baseline, eight reported moderate physical activity, but did not meet the American College of Sports Medicine's (ACSM) recommendation of moderate intensity aerobic physical activity for at least 30 minutes five days a week, and three reported engaging in vigorous physical activity and did meet ACSM guidelines for 20 minutes three days a week. Four participants in this sample had high-normal baseline blood pressure levels (systolic pressure from 115-119 mmHg or diastolic 75-79 mmHg), and 19 were prehypertensive (a systolic pressure from 120-139 mmHg or a diastolic pressure from 80-89 mmHg; overall systolic: M = 126.70, SD = 6.20; overall diastolic M = 75.13, SD = 6.01). The majority of these participants identified themselves as Caucasian (95.6%). Subjects with depression as measured by the Beck Depression Inventory (BDI) were excluded from the study; remaining participants were categorized as "not depressed" by the BDI (M = 4.52, SD = 2.95). Prior to arriving for their in-lab screening, it was determined in a phone call assessment that the participants were not taking medications known to influence blood pressure, body weight, or food intake, such as ACE inhibitors or appetite suppressants. More specifically, participants were asked to list any medications they were currently taking, if they had been taking them for a minimum of six months, and if they had experienced weight gain/loss (of up to 10 pounds) or blood pressure fluctuations (more than 6 mmHg) as a result of taking their medication. Therefore, if participants were taking medication known to influence blood pressure, body weight, or food intake, or if they had begun taking any medication that had caused significant weight gain or blood pressure fluctuations in the past 6 months, they were excluded from the study.

The *SBPM subsample* (n = 11; see Figure 1) included participants who were randomized into the D2W Plus treatment group (3 men and 8 women; age: M = 56.55, SD = 4.80; BMI: M = 32.69, SD = 4.19; 1 with high normal blood pressure levels; 10 with prehypertension; overall systolic M = 128.41, SD = 4.75; overall diastolic M = 74.80, SD = 6.25), and did not differ from the individuals in the D2W Only group in terms of demographic variables. The D2W Plus treatment group did, however, differ

from the D2W Only treatment group in terms of baseline levels of regulation of calories and fat (t [21] = 2.51, p = .02) and regulating fiber, fruits, and vegetables (t [21] = 2.48, p = .02). Specifically, D2W Only participants indicated at baseline that they engaged in behaviors to regulate calories and fat more frequently (M = 3.31, SD = .73) than individuals in the D2W Plus group (M = 2.52, SD = .78), and to regulate fiber, fruits and vegetables (M = 3.78, SD = .82 vs. M = 3.00, SD = .67). This indicates that in the 2 months prior to enrollment, participants in the D2W Plus group may have been engaged in these regulatory tasks less than the D2W Only group.

Procedure

A standard consort flow diagram of the following procedure can be seen in Figure 1. Additionally, the schedule of assessments can be found in Table 1. Interested participants who did not take medications that affected their weight or blood pressure attended up to three screening sessions. In the first screening session researchers obtained written consent from participants to have their blood pressure, height, and weight measured, and to complete psychological surveys including the BDI, the Risk Perception Survey for Developing Hypertension (RPS-DH), and the Health Beliefs Survey (HBS). Additionally, participants were asked to complete a brief health history to determine the individual's eligibility in the study. Eligible participants were instructed during the first screening session how to complete the 4-Day Food Intake Record and the 7-Day Step Log, which were returned approximately one week later, at the second session. During the second screening session, participants' blood pressure was measured again, and the RPS-DH and HBS were completed if this had not occurred during the initial session. A third session occurred only if blood pressure stabilization measures were needed; meaning that previous measurements had not provided two readings within a 6mmHg range on two separate days. Twenty-seven participants who met eligibility criteria during the initial screening were then randomized into one of two treatment groups (see Figure 1) in the D2W intervention study; 23 completed the ten-week intervention.

At the end of the ten-week intervention, participants returned for two post-intervention assessments occurring approximately one week apart. During the first post-intervention appointment the RPS-DH and the HBS were administered, and blood pressure, height, and weight were also measured. The 4-Day Food Intake Record and the

7-Day Step Log were given to participants at the first post-intervention session, and returned completed at the second session. Blood pressure was also measured again during the second post-intervention session.

Finally, the lead author conducted individual exit interviews regarding the SBPM behaviors with the D2W Plus group during one of the two post-intervention sessions (see Appendix A). Exit interviews were voice recorded after participants had signed a consent form providing permission.

Measures

Risk perception. The Risk Perception Survey for Developing Hypertension (RPS-DH), a modified version of the Risk Perceptions Survey for Developing Diabetes (RPS-DD; Albert Einstein College of Medicine Diabetes Research Center, 2007), measured multiple risk perception variables at baseline and post-intervention. Specifically, modifications included substituting the word "diabetes" with the word "hypertension". For example, "If I am going to get diabetes, there is not much I can do about it" was changed to "If I am going to get hypertension, there is not much I can do about it." The subscales provided by the RPS-DD (i.e. personal control, optimistic bias, comparative disease risk, and comparative environmental risk) were based on research in instrument development for risk perception, not specifically on diabetes risk (Diefenback & Weinstein, 1993; Walker, Mertz, Kalten, & Flynn, 2003). The original measure has been found to have marginally to moderately adequate internal consistency (Cronbach's α = .68-.84; Walker, 2004). Additionally, during development of the original scale, content and face validity of items was reviewed by a panel of experts in diabetes, risk perception, and health psychology. Scores were calculated using specific guidelines for the previously established RPS-DD. Generally, overall scores for subscales on the risk perception survey are interpreted on a 1-4 scale, with a score of 1 indicating almost no perceived risk, and a score of 4 indicating a high level of perceived risk. Exceptions or extensions of this interpretive scale occur for the personal control and optimistic bias subscales.

The personal control subscale (α = .68; Walker, 2004) measured perceived control over developing hypertension. In general, items on this subscale provided a 1-4 likert response scale. For example for the item "I feel that I have little control over my

health" participants could respond (1) Strongly Agree, (2) Agree, (3) Disagree, or (4) Strongly Disagree. Scoring was reversed for some items in order to conform to the conceptual direction of the subscale. For interpretation of participant scores for this subscale, a score of 1 indicated almost no perceived personal control over developing hypertension, and a score of 4 indicated a high level of perceived personal control over developing hypertension.

The optimistic bias subscale (α = .71; Walker, 2004) measured perceived realism or pessimism about developing hypertension. Items on this subscale were also provided with a 1-4 likert response scale. For the item "Compared to other people of my same age and sex (gender), I am less likely than they are to get hypertension", participants could once again respond with one of the four choices indicated above. Scoring was also reversed on items for this subscale. For interpretation of participant scores for this subscale, a score of 1 indicated lower levels of optimistic bias, while a score of 4 indicated higher optimistic bias regarding developing hypertension.

The comparative disease risk subscale (α = .80; Walker 2004), measured perceived risk across various diseases and conditions. For this subscale participants were asked to rate their own personal health as being at (1) Almost No Risk, (2) Slight Risk, (3) Moderate Risk, or (4) High Risk for a variety of conditions, including arthritis, cancer, and kidney failure. Participants' scores for this subscale were interpreted using the 1-4 scale described above.

The comparative environmental risk subscale (α = .81; Walker, 2004) measured perceived environmental risk. Participants used the same rating scale as described for the comparative disease risk subscale, in regards to being at risk for hazards/conditions such as air pollution, pesticides, and extreme weather. A composite risk scale (α = .84; Walker, 2004) was also computed, based on scores established on items from the various subscales. Interpretations for participants' scores on these subscales were also based on the general 1-4 scale described above.

Social cognitive theory variables. The Health Beliefs Survey, which included measures of self-regulation, social support, self-efficacy, and outcome expectancies related to healthy eating (Food Beliefs Survey, Anderson et al., 2007) and physical activity (Physical Activity Beliefs, Anderson et al., 2006), has been shown to be

predictive of nutrition behavior and physical activity (Anderson et al., 2006, 2007). Factor-based scaled scores for each factor were computed by averaging responses within a scale. The HBS was modified for D2W to include items regarding additional dietary elements of the DASH diet (i.e. eating low-sodium foods) and enjoyment of physical activity.

The nutrition self-regulation portion of the HBS included the following factor based subscales (as reported in Anderson et al., 2007): *regulating calories and fat* (α = .90), *planning and tracking healthier foods* (α = .91), and *regulating fiber, fruits and vegetables* (α = .85), and asked participants what they had done in the past 2 months to eat healthier foods. Response categories for items pertaining to these factors were based on a 1-5 likert scale of how often a participant engaged in a particular behavior. For example, for the item "Work towards the goal to eat more whole grain foods", a participant could respond (1) Never, (2) Seldom, (3) Occasionally, (4) Often, or (5) Repeatedly.

The nutrition social support portion of the HBS included four scales: *family support for eating less fat* (α = .89, Anderson et al., 2007), *friends support for eating less fat*, *family support for eating more fiber, fruits, and vegetables* (family α = .88, Anderson et al., 2007), and *friends support for eating more fiber, fruits, and vegetables*. The design and format of the "friends" social support scales are based on the "family" social support scales, however, the psychometric properties for these scales are not known. These items evaluated a participant's opinion regarding what their friends and family thought and did about eating healthy foods. Response categories for items pertaining to these factors were based on a 1-5 likert scale of how much a participant agreed that their family/friend did something. For example, for the item "My family/friends try to eat more whole-grains every day", a participant could respond (1) Strongly Agree, (2) Disagree, (3) Neither Agree or Disagree, (4) Agree, (5) Strongly Agree.

The nutrition self-efficacy portion of the HBS, which included *self-efficacy for decreasing fat* (α = .89; Anderson et al, 2007), *self-efficacy for increasing fiber, fruit, and vegetables* (α = .90; Anderson et al, 2007), and *self-efficacy for reducing sugar* (α = .76; Anderson et al, 2007), asked participants how certain they were that they could do different things to eat healthier foods all or most of the time, for a long time (until next

year or longer), and across multiple situations. Participants were asked to respond to items such as "How certain are you that you can set as a goal or make plans to eat low fat cheese?" on a 1-10 likert scale with 1 indicating "certain I can not", and 10 indicating "certain I can".

The nutrition outcomes expectations portion of the HBS included both *positive outcome expectations* (α = .89; Anderson et al., 2007) and *negative outcome expectations* (α = .87; Anderson et al., 2007) factors. These scales assessed to what extent participants agreed something would happen when they ate healthier foods, and included items such as "If I eat healthier foods every day, I expect I will have more energy." Response categories were the same 1-5 likert responses used for the nutrition social support section.

The physical activity portion of the HBS included the following factor-based scales reported in Anderson et al., 2006: *physical activity self regulation* (α = .83), which asked participants to indicate in the past month how often they had used certain strategies to successfully walk or do other exercise. This included items such as "In the past month how often did you keep track of how many steps you took each day?" Response categories were the same as those provided for the nutrition self-regulation subscales.

The physical activity social support portion included two scales: *family social support* (α = .71) and *friends social support*. The design and format of the "friends" social support scale is based on the "family" social support scale, however, the psychometric properties of this scale are not yet known. Items asked a participant their opinion regarding what their family and friends do and think about walking or other exercise, such as "The members of my family make time to walk or do other exercise." Response categories were the same as those used for the nutrition social support factors.

The physical activity self-efficacy portion included scales assessing *self-efficacy for integrating physical activity in the daily routine* (α = .89) and *self-efficacy for overcoming barriers to increasing physical activity* (α = .91). These items were phrased similarly to those used in the nutrition self-efficacy section, and the response choices were the same as the ones provided for those scales.

Physical activity outcomes expectations included *positive outcome expectations* (α= .93) and *negative outcome expectations* scales (α = .81). Participants were asked what they expected would happen if they were to take a walk or do other exercise most

days of the week. For example, "If I slowly and steadily build up to walking or doing other exercise most days of the week, I expect I will sleep better." Participants were then asked to rate to what extent this would matter to them. Both response scales were based on a 1-5 likert scale, where 1 indicated "Strongly disagree" or "It will not matter at all" and 5 indicated "Strongly agree" and "It will matter very much."

Blood pressure. Blood pressure was measured in the lab following JNC 7 guidelines (Chobanian et al., 2003), with the participant comfortably seated, legs uncrossed, with their arm supported at heart level, using the mean of two consecutive blood pressure readings within 6 mmHg on two separate days, obtained over a 1 to 2 week period. Blood pressure measurements were taken using a professional non-invasive blood pressure (NIBP) monitor, an automated GE Dinamap Pro Care (Model 120).

Height, weight, & body mass. Participants were weighed in pounds using a high-capacity digital weight scale, the Detecto® High-Capacity Digital Weight Scale (Model 6855). Height was measured in inches using a calibrated Detecto® Dual Reading Eye-Level Physician Scale (Model 338). Measurements were obtained with subjects wearing light indoor clothing, and without shoes. Body mass index was calculated as weight (lb)/height (in)^2 x 703.

Fruit and vegetable intake. Intake of fruits and vegetables was determined through 4-Day Food Intake Records. Participants were instructed in methods to record their food and beverage intake. Measuring spoons, cups, and food models were used by research staff to illustrate portion sizes to participants. Analysis was accomplished with the Nutrition Data System for Research (NDS-R) 2006 nutritional analysis software program (University of Minnesota, Minneapolis, MN). The fruit category included juice, fruits, avocados, fried fruits, and fruit-based savory snacks. The vegetable category contained vegetable juice, dark green vegetables, deep yellow vegetables, other vegetables, and fried vegetables.

Daily step-counts. Step counts were measured using an Accusplit® Eagle 120XL Activity Pedometer and the 7-Day Step Log. The pedometer was chosen based on research supporting the device's reliability, accuracy for providing step counts, and cost efficiency (Schneirder, Crouter, & Bassett, 2004). Participants were instructed to wear

the pedometer and record their daily step count for seven days, which were averaged across all days provided.

Results

Study 1: Initiation of Behavior Change

Baseline risk perception. Participant's responses to the *personal control scale* of the RPS-DH (1 = no control to 4 = high control) were on the end of the scale indicating some high control (M = 3.04, SD = 0.36), while mid-scale responses to the *optimistic bias scale* (1 = no optimistic bias to 4 = high optimistic bias) (M = 2.37, SD = 0.59) indicated some optimism. Additionally, participants' responses on the *perceived disease risk scale* (M = 2.01, SD = 0.29), *perceived environmental risk scale* (M = 1.61, SD = 0.45), and *composite risk scale* (M = 2.20, SD = 0.25), (1 = no perceived risk to 4 = high perceived risk), were all on the end of these scales indicating mid to low perceived risk.

Risk perception and other social cognitive variables. The correlations of baseline risk perception and other SCT variables are presented in Table 2. Risk perception was not related to other SCT variables with few exceptions. Personal control was moderately related to negative outcome expectations for physical activity (r = -.52, p = .01); participants with higher perceived personal control expected fewer negative outcomes from becoming more physically active. Comparative disease risk was moderately correlated with support from family for fiber, fruit, and vegetable consumption (r = -.44, p = .04), and self-efficacy for reducing sugar (r = -.45, p = .04); participants who perceived less support from families and who were less likely to believe they could do the things they needed to do to reduce their sugar consumption were more likely to perceived themselves as at risk for certain diseases. Finally, perceived comparative environmental risk was moderately related to nutrition planning and tracking (r = .44, p = .04), regulating fiber, fruits, and vegetables (r = .46, p = .03), self-efficacy for overcoming barriers to increasing physical activity (r = .52, p = .01), and perceived support from family for increasing fiber, fruit, and vegetable consumption (r = -.46, p = .03). Participants perceiving higher environmental risk were more likely to regulate their dietary intake and feel more able to overcome physical activity barriers, but were less likely to report family support for making some dietary changes.

Study 2: Continued Effort in Behavior Change

Change scores for behavioral and SCT variables were calculated by subtracting baseline scores from post intervention scores. Examination of the data for normality indicated invalid fruit and vegetable data for two participants (i.e. they indicated adding more than 11 servings of fruits and vegetables to their daily intake) and step count data for one participant (i.e. fewer than 700 steps/day). These data points were eliminated from their respective analyses.

Baseline risk perception and change in health behavior. The correlations of baseline risk perception and health behavior change are presented in Table 3. With a few notable exceptions, baseline risk perceptions were not related to change in health behavior. The exceptions were a moderate correlation between composite risk perception at baseline and change in step count at post intervention ($r = -.47$, $p = .03$) (Table 3) and change in systolic blood pressure ($r = .42$, $p = .04$) (Table 4). Lower composite risk perception scores at baseline were related to greater increases in step-counts and greater decreases in systolic blood pressure at post-intervention

Change in risk perception, other social cognitive variables, and health behavior. Significant change occurred for both change in fruit and vegetable intake (t [20] = -3.38, $p = .003$), and change in step count (t [21] = -4.16, $p < .001$), with both significantly increasing. Significant change also occurred in participants' level of perceived personal control (t [21] = -2.99, $p = .007$), indicating an increase in personal control. Significant change did not occur in other risk perception subscales (see Table 5). Finally, significant change occurred in only a few HBS factors, including regulation of calories and fat (t [22] = -4.16, $p < .001$), planning and tracking of healthier foods (t [22] = -4.56, $p < .001$), regulating fiber fruits and vegetables (t [22] = -3.78, $p = .001$), and self-regulation for physical activity (t [22] = -5.80, $p < .001$). Significant change did not occur in other HBS factors (see Table 5). Significant associations were not suggested between any of the significant change variables listed above.

Study 3: Self Blood Pressure Monitoring in Dash 2 Wellness Plus

Self blood pressure monitoring compliance for individuals in the D2W Plus group was evaluated based on participants' completion of tracking forms, completed daily and turned into research staff weekly.

Average SBPM compliance ranged from 66.43% to 100% (*M* = 90.36%; *SD* = 12.62). These compliance levels suggest high acceptability of SBPM among D2W Plus participants. Exit interviews regarding the feasibility and utility of SBPM, as well as behavioral patterns and affect associated with elements of this practice, were coded by a researcher who was blinded to research question and the lead author. The coding was found to have high inter-rater agreement (i.e. 95.54%) and high inter-rater reliability (kappa = .95; $p < 0.01$).

Self blood pressure monitoring behavioral patterns. Participants reported several self-regulating behavioral patterns in their blood pressure monitoring: 91% (10 of 11 participants) reported monitoring their blood pressure in the same location every morning and evening. Additionally, 82% (9 of 11 participants) monitored their blood pressure at approximately the same time every morning and 64% (7 of 11 participants) at the same time every evening. Participants also tended to report that their SBPM consistently occurred in the same "spot" in regards to their regular sequence of behavior in the morning and evening. For example, 72% (8 of 11 participants) reported monitoring their blood pressure as soon as they woke up in the morning; while 27% (3 of 11 participants) reported engaging in SBPM only after they had gotten ready for the day (i.e. showered, gotten dressed, etc). In regards to evening SBPM, 63% (7 of 11 participants) reported monitoring directly before they went to bed, while 27% (3 of 11 participants) reported monitoring prior to eating dinner.

One hundred percent of participants indicated they used some type of relaxation method when they perceived that their home blood pressure readings would be high. These methods most commonly included deep breathing (64%; 7 of 11 participants) and sitting quietly (55%; 6 of 11 participants). Other strategies included progressive muscle relaxation, soothing imagery, following directions given by the research staff more carefully, and "clearing my head". Participants were also asked, as they were becoming familiar with their blood pressure, if they could recognize physiological signs that it would be higher or lower than usual. While 63% (7 of 11 participants) reported that they perceived no physiological signals associated with monitored blood pressure levels, 36% (4 of 11 participants) did endorse this relationship. For example, participants reported that when they felt more tension in their back/neck muscles (1 participant), when they

had a headache (1 participant), or when they were having difficulty drawing a deep breath (1 participant), that their blood pressure would often been higher than usual.

Self blood pressure monitoring feasibility. One hundred percent of participants indicated the blood pressure monitoring equipment was easy to use; only 18% (2 of 11 participants) reported they disliked SBPM or found it unpleasant. However, it should be noted that 36% (4 of 11 participants) received at least one "error" message from the machine at some point during the intervention. When asked to identify any downsides to SBPM, 46% (5 of 11 participants) reported taking the time to do it as the most prominent drawback, while 26% (3 of 11 participants) reported increased difficulty in SBPM while away from their regular environment (e.g. while one vacation or away on business). However, 26% (3 of 11 participants) identified no negative aspects related to SBPM. In addition, 91% (10 of 11 participants) indicated one or more benefits of SBPM. Notably, 45% (5 of 11 participants) of participants found SBPM to be motivating in terms of their diet and exercise behaviors (i.e. monitoring sodium intake better, seeing a connection between the behaviors). Other benefits reported included watching blood pressure levels decrease (27%; 3 of 11 participants) and seeing how diet and/or exercise behavior impacted blood pressure (e.g. a good source of feedback; 27%; 3 of 11 participants). Indeed, 91% (10 of 11 participants) indicated that they felt there was a connection between their diet and/or exercise behaviors and their blood pressure levels. Specifically, 36% (4 of 11 participants) indicated that an increase or decrease in high sodium foods resulted in higher or lower blood pressure readings. It was also volunteered by 3 of 3 participants that they intended to continue to monitor their blood pressure at home after termination of the study. This information was provided spontaneously, and was not part of the structured interview questions.

Discussion

This study explored the role of risk perception in the initiation and continued response of key behavioral treatments for hypertension, as well as its relationship to other social cognitive variables related to behavior change. Additionally, exit interviews were used to evaluate the feasibility, utility, and the subjective experience of SBPM, a novel tool in the regulation of blood pressure.

Multiple theories of health behavior include risk perception as a motivating factor for precautionary action. However, research regarding the strength of this relationship has been inconsistent, suggesting that the association may be dependent on the specific behavior or type of risk assessed (Brewer et al., 2007; Brewer et al., 2004; Weinstein & Nicolich, 1993). Data in the present study regarding initial risk perception levels of those initiating behavior change indicate low levels of perceived environmental risk, disease risk, and composite risk, and correspondingly, moderate levels of optimistic bias and personal control. When compared to data gathered on the original RPS-DD the current data were in the same qualitative ranges as the RPS-DD and the current means were within one standard deviation for the original data (Walker et al., 2003). These findings indicate that other motivators, in addition to risk perception, may have been present in terms of initiating participants' enrollment in the intervention study. Furthermore, participants' levels of optimistic bias and personal control could have served as barriers to high levels of perceived risk.

Multiple theories of health behavior suggest that risk perception and various social cognitive variables influence or interact with each other in motivating health behaviors (Schwarzer, 2001). However, results suggest few associations between baseline risk perception subscales and other social cognitive variables pertaining to diet and physical activity. Baseline environmental risk perception was positively related to baseline planning and tracking of healthier foods, regulation of fiber fruit and vegetables, and self-efficacy for overcoming barriers to increasing physical activity. However, negative associations were found between family social support for eating fiber, fruits, and vegetables and comparative disease risk perception and environmental risk perception. These findings indicate that while increased social support may be associated with reduced levels of particular sources of risk perception, higher levels of certain self-regulatory behaviors may be associated with higher risk perception.

Significant change was observed for both change in step count and change in fruit and vegetable intake at post-intervention. However, contrary to the positive relationship that is often shown between perceived risk and precautionary health behavior (Brewer et al., 2007; McCaul et al., 1996; Weinstein, 1993), change in step count in the current sample was negatively related to baseline composite risk perception. The nature of the

risk reduction afforded by this particular behavior may offer a possible explanation for this inconsistent finding. In the case of this specific health behavior, relapse is possible (i.e. becoming physically inactive), and the precautionary behavior may be only partially effective for mitigating negative outcomes; meaning that there are multiple risk factors contributing to the development of hypertension (Weinstein & Nicolich, 1993). Therefore, the risk reduction afforded by this behavior for this particular condition may not be permanent or complete. Therefore, higher levels of initial perceived risk may be more associated with lower levels of precautionary behavior change. Essentially, risk perception may not be a highly motivating factor for these behaviors, especially in regards to prehypertension, as it is essentially asymptomatic and does not afford immediate health consequences. No associations were suggested between significant change variables of risk perception (e.g. personal control) with change in SCT variables or between significant change variables of risk perception and change in health behaviors.

Finally, findings from the SBPM sample (n = 11) suggest that consistent SBPM is both useful and feasible. Reported compliance of SBPM was high, and difficulty of behavior was reported to be low. While significant associations were not suggested between SBPM and change in other health behaviors (e.g. increase in fruit and vegetable consumption and step count), many participants reported that they believed monitoring their blood pressure regularly served to motivate their diet and physical activity behaviors. This is consistent with other findings connecting SBPM to increased compliance with pharmacologic treatments (Edmonds et al., 1985; Marquez-Contreras et al., 2006). Additionally, while analyses regarding SBPM and overall change in systolic and diastolic blood pressure did not suggest significant associations, the trend of the relationship was negative, consistent with previous findings of consistent SPBM reducing overall blood pressure levels. However, it should be noted that all participants reported using some sort of relaxation technique during SBPM, and one participant even reported that they felt that SBPM provided a “good source of relaxing down time.” Many participants reported SBPM in a room alone, free of noise and distraction. Therefore, simply having a small period of relaxation during both the morning and evening may have had an additional impact on the lowering of D2W Plus participant’s blood pressure

levels. Participants in the D2W Plus group also were able to practice strategies for lowering their blood pressure prior to it being measured, which may have generalized to lower blood pressure readings in the lab as well.

Limitations

The limitations of this study most notably include a small sample size that was predominantly Caucasian. The small sample size served to significantly decrease the statistical power of the analyses performed, therefore decreasing their sensitivity. The limited racial variability within the sample may reduce the generlizability of results to a more diverse general population. The strength of the relationships discussed should be examined in a larger, more representative sample. Additionally, the strength of the relationships regarding risk perception for developing hypertension may have been limited by the lack of availability of an established measure. Modifications to the risk perception measure should be tested further in order to establish their reliability. Finally, this was an exploratory study, whose outcomes were based on descriptive statistics. Due to the exploratory nature of the study, alpha inflation was not controlled for. Therefore, the associations presented should be interpreted with caution. Additionally, when investigating possible associations, inferential statistics were not used, therefore it was not possible to control for treatment effects.

Implications

It was found that moderate levels of baseline personal control and optimistic bias were reported, compared to lower levels of baseline environmental risk, comparative disease risk, and composite risk perception. These findings could indicate a higher level of personal agency, which is often exercised through self-efficacy (Bandura, 1989). This may have served as a counter weight to risk perception. Therefore, it could be important to evaluate the initial motivating constructs that are present in an intervention sample, and then tailor the intervention to that dimension in order to produce the best outcomes. So while risk perception may be a more motivating factor in some populations, or for some situations/conditions, at other times focusing on increasing variables related to personal agency could serve as a more relevant pathway to behavioral initiation. These elevations in personal control and optimistic bias would be consistent with the role of self-efficacy

and outcome expectations as primary determinants in Rothman's initiation phase (Rothman et al., 2004).

A perception of the effectiveness a behavior has on mitigating a negative health outcome has been noted as a factor that affects the risk perception/health behavior relationship (Weinstein & Nicolich, 1993). Behaviors that are brief and offer a permanent and substantial reduction in risk (e.g. vaccinations) may have a more profound relationship with risk perception than those behaviors that are continuous and offer only a partial reduction of actual risk. Although this relationship is important, it may depend on the specific health behavior. Findings from this study support previous findings that risk perception may play a limited role in motivating change in continuous health behaviors, such as physical activity (Luszczynska & Tryburcy, 2008; Renner et al., 2007). This suggests that interventions to modify precautionary health behaviors may be more successful when taking into consideration the nature of the perceived risk reduction afforded by a particular behavior (i.e. single event or continuous).

Lastly, in regards to risk perception, it should be noted that risk perception in regards to developing hypertension was specifically investigated. However, it should not be assumed that a participant's desire to lower their blood pressure was the primary motivation for their enrollment into the D2W intervention trial. All participants were overweight/obese, and many achieved significant weight reductions as a by-product of their health behavior changes. Therefore, weight loss may have been a primary motivating factor in regards to initiation and continued response of certain health behaviors (i.e. dietary changes and physical activity). In light of this possibility, the risk perception for overweight/obesity may have been an appropriate construct to investigate as a motivating factor within this intervention.

Additional findings suggest that SBPM is a feasible and useful behavior. The ease of performing this behavior may increase the likelihood of regular compliance. It is estimated that 25% of adult Americans have prehypertension (Lloyd-Jones et al., 2009). Therapeutic lifestyle changes are a primary factor in the recommended treatment of prehypertension, and have been shown to be effective in controlling blood pressure and reducing the incidence of hypertension (Bavikati et al., 2008; Chobanian et al., 2003). Therefore understanding the cognitive, behavioral, and affective mechanisms involved in

SBPM could help to increase its effectiveness as a single treatment or in conjunction with other therapeutic lifestyle changes.

Future Directions

The results of this study suggest that the relationship between risk perception and precautionary health behaviors may differ based on the specific nature of the behavior. Therefore, it may be important for future interventions to investigate the varying nature of the relationship risk perception has with a precautionary behavior that requires continuous maintenance versus a single action. Additionally, the role of risk perception should be investigated in regards to conditions were there consequences are soon and certain, versus conditions with consequences that are classified as delayed possibilities. Moreover, a continuous evaluation of the relationship of risk perception and behavioral change throughout the stages of behavior change may be beneficial because of the dynamic nature of the relationship. Weinstein and Nicolich indicated, "as members of a population adopt precautions and change their risk status, correlations between perceived risk and risk behavior in this population also change" (p. 236, 1993).

Additionally, it should not be assumed that the construct of risk perception significantly overlaps with other social cognitive constructs. It should be investigated as an individual construct, with unique pathways that may work in concert with other psychosocial variables. Finally, studies examining the relationship between SBPM and other precautionary health behaviors may help people maintain behavioral changes that are critical to reducing their blood pressure, therefore decreasing their overall risk for hypertension and major cardiovascular disease. Future research should look not only at the efficacy of SBPM for lowering blood pressure, but also at what additional gains may be made for those who simply engage regularly in sitting quietly in a relaxed or meditative type state.

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Table 1

Schedule of Assessment Delivery

Session	Information Collected
Baseline session 1	Sociodemographics/ Health history
	Baseline blood pressure measurement
	Baseline weight and height
	Risk perception survey for developing hypertension*
Baseline session 2	Baseline blood pressure measurement
	Health beliefs survey*
	DASH dietary meeting with registered dietician
Baseline session 3	Baseline blood pressure stabilization measurement
Mid-intervention session	Mid-intervention blood pressure measurement
Post-intervention Session 1	Post-intervention blood pressure measurement
	Post-intervention weight and height
	Risk perception survey for developing hypertension*
Post-intervention Session 2	Post-intervention blood pressure measurement
	Health beliefs survey*
	Exit interview for D2W Plus participants*

Note. * Survey may have been administered at session 1 or 2 of relevant intervention meeting.

Table 2

Correlations Between Baseline Risk Perception Subscales and Baseline Social Cognitive Factors

Variables	1	2	3	4	5
1. Personal control (*n* = 23)	-				
2. Optimistic bias (*n* = 23)		-			
3. Comparative disease risk (*n* = 22)			-		
4. Comparative environmental risk (*n* = 23)				-	
5. Composite risk (*n* = 22)					-
6. Regulating calories & fat (*n* = 23)	.21	-.19	.36	.21	.13
7. Planning & tracking (*n* = 23)	.23	-.03	.19	.44*	-.03
8. Regulating fiber, fruits, & vegetables (*n* = 23)	.37	-.06	.20	.46*	.05
9. Fat support (family) (*n* = 23)	-.07	-.14	-.20	-.31	.01
10. Fiber, fruit & vegetable support (family) (*n* = 23)	-.06	.04	-.44*	-.46*	-.07
11. Fat support (friends) (*n* = 23)	.14	.15	-.16	-.32	-.30
12. Fiber, fruit, & vegetable Support (friends) (*n* = 23)	.16	.07	-.16	-.30	-.26
13. Self-regulatory efficacy for decreasing fat (*n* = 23)	.35	.06	-.19	.16	-.01
14. Self-regulatory efficacy for increasing fiber, fruits, & vegetables (*n* = 23)	.13	-.00	-.29	.33	.02
15. Self-regulatory efficacy for reducing sugar (*n* = 23)	.32	.13	-.45*	.07	-.22
16. Positive outcome expectations for healthy eating (*n* = 23)	.01	-.35	-.05	.01	.35
17. Negative outcome expectations for healthy eating (*n* = 23)	-.21	-.01	.25	-.20	.03
18. Self-regulation for physical activity (*n* = 23)	.27	-.30	-.04	.36	-.06
19. Social support for physical activity (family) (*n* = 23)	.25	.07	-.14	-.28	-.40
20. Social support for physical activity (friends) (*n* = 23)	-.10	-.04	.07	.04	-.03
21. Self-efficacy for integrating physical activity in the daily routine (*n* = 23)	.09	.11	-.23	.13	-.21

Variables	1	2	3	4	5
22. Self-efficacy overcoming barriers to increasing physical activity (*n* = 23)	.06	.12	.11	.52*	.07
23. Positive outcome expectations for physical activity (*n* = 23)	-.24	-.11	-.06	-.13	.19
24. Negative outcome expectations for physical activity (*n* = 23)	-.52*	-.14	.08	-.36	.14

Note. Data not presented is inapplicable and cells were excluded from table.

*p<.05. **p<.01.

Table 3

Correlations Between Baseline Risk Perception Subscales and Health Behaviors

Variables	1	2	3	4	5	6	7	8
1. Personal control (*n* = 23)	-							
2. Optimistic bias (*n* = 23)		-						
3. Comparative disease risk (*n* = 22)			-					
4. Comparative environmental risk (*n* = 23)				-				
5. Composite risk (*n* = 22)					-			
6. Change in step count (*n* = 22)	.05	.35	-.34	.12	-.47*	-		
7. Change in fruit & vegetable intake (*n* = 21)	-.33	-.04	.03	-.04	.10	.32	-	
8. SBPM compliance (*n* = 11)	-.26	.11	-.38	-0.33	-.07	.54	.17	-

Note. Data not presented is inapplicable and cells were left blank.

*p<.05. **p<.01.

Table 4

Correlations Between Baseline Risk Perception Subscales and Blood Pressure Readings

Variables	1	2	3	4	5
1. Personal control (*n* = 23)	-				
2. Optimistic bias (*n* = 23)		-			
3. Comparative disease risk (*n* = 22)			-		
4. Comparative environmental risk (*n* = 23)				-	
5. Composite risk (*n* = 22)					-
6. Initial lab reading of systolic blood pressure (*n* = 23)	.13	.31	-.27	.01	-.37
7. Initial lab reading of diastolic blood pressure (*n* = 23)	.13	.29	-.10	-.18	-.24
8. Home systolic blood pressure readings – week 1 (*n* = 11)	-.07	.06	.30	-.22	-.12
9. Home diastolic blood pressure readings – week 1 (*n* = 11)	.28	.14	.32	.40	-.15
10. Change in systolic blood pressure (*n* = 23)	-.08	-.40	.33	-.06	.44*
11. Change in diastolic blood pressure (*n* = 23)	.15	-.36	.31	.10	.32

Note. Data not presented is inapplicable and cells were excluded from table.

*p<.05. **p<.01.

Table 5

Changes in Intervention Variables

Variables	Baseline	Post	Change
Personal control (*n* = 22)	3.05 (.37)	3.41 (.40)	0.36 (.57)**
Optimistic bias (*n* = 22)	2.39 (.60)	2.50 (.51)	0.11 (.58)
Comparative disease risk (*n* = 21)	2.02 (.30)	2.16 (.42)	0.24 (.32)
Comparative environmental risk (*n* = 22)	1.62 (.46)	1.69 (.45)	0.07 (.51)
Composite risk (*n* = 21)	2.18 (.24)	2.10 (.28)	0.24 (.29)
Regulating calories & fat (*n* = 23)	2.93 (.84)	3.85 (.69)	0.91 (1.05)**
Planning & tracking (*n* = 23)	2.06 (.94)	3.16 (.72)	1.10 (1.16)**
Regulating fiber, fruits, & vegetables (*n* = 23)	3.41 (.83)	4.22 (.65)	0.81 (1.03)**
Fat support (family) (*n* = 23)	3.07 (.92)	3.22 (.92)	0.15 (84)
Fiber, fruit & vegetable support (family) (*n* = 23)	2.57 (.92)	2.83 (1.10)	0.26 (1.00)
Fat support (friends) (*n* = 23)	3.29 (.49)	3.26 (.87)	-0.02 (.77)
Fiber, fruit, & vegetable Support (friends) (*n* = 23)	3.11 (.62)	3.04 (.82)	-0.07 (.64)
Self-regulatory efficacy for decreasing fat (*n* = 23)	8.39 (1.11)	8.23 (1.50)	-0.17 (1.07)
Self-regulatory efficacy for increasing fiber, fruits, & vegetables (*n* = 23)	8.48 (1.19)	8.66 (1.07)	0.18 (.86)
Self-regulatory efficacy for reducing sugar (*n* = 23)	8.26 (1.10)	8.27 (1.00)	0.01 (1.03)
Positive outcome expectations for healthy eating (*n* = 23)	4.43 (.45)	4.35 (.45)	-0.09 (.45)
Negative outcome expectations for healthy eating (*n* = 23)	2.79 (.71)	2.61 (.59)	-0.18 (.53)
Self-regulation for physical activity (*n* = 23)	2.75 (1.14)	3.97 (.87)	1.21 (1.00)**
Social support for physical activity (family) (*n* = 23)	3.32 (1.04)	3.39 (.99)	0.08 (1.23)

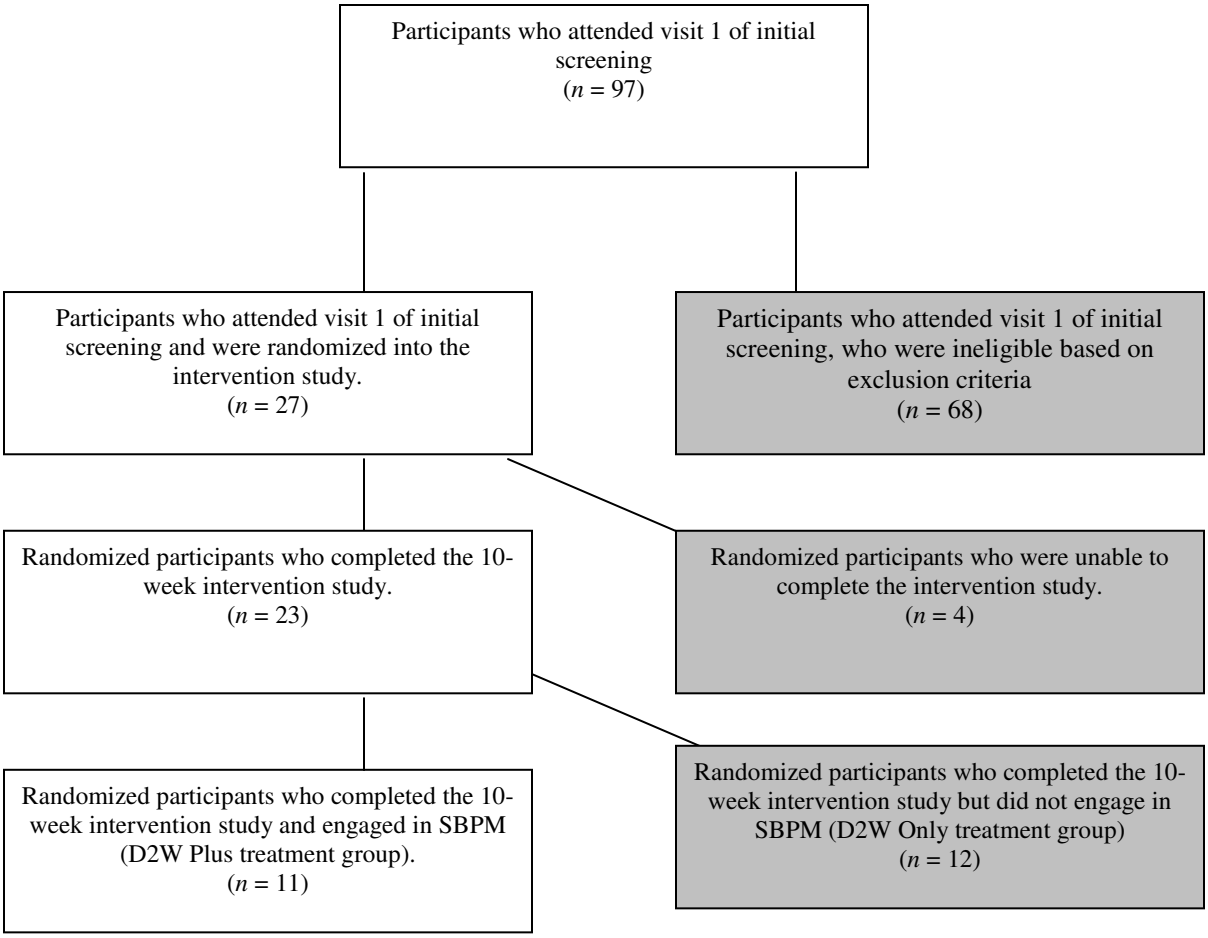
Variables	Baseline	Post	Change
Social support for physical activity (friends) (*n* = 23)	3.52 (.86)	3.45 (.76)	-0.07 (.62)
Self-efficacy for integrating physical activity in the daily routine (*n* = 23)	8.23 (1.10)	7.68 (1.71)	-0.54 (1.45)
Self-efficacy overcoming barriers to increasing physical activity (*n* = 23)	7.70 (1.44)	7.27 (1.89)	-0.43 (1.99)
Positive outcome expectations for physical activity (*n* = 23)	4.54 (.32)	4.39 (.40)	-0.15 (.39)
Negative outcome expectations for physical activity (*n* = 23)	3.20 (.73)	2.96 (.60)	-0.24(.68)
Step count (per day; *n* = 22)	6571.74 (2876.98)	8395.76 (3192.45)	1824.02 (2058.07)**
Fruit and vegetable intake (servings per day; *n* = 21)	4.73 (1.97)	6.21 (2.56)	1.48 (2.01)**
Systolic blood pressure (mmHg)	126.70 (6.20)	117.62 (8.20)	-9.08 (8.30)**
Diastolic blood pressure (mmHg)	75.13 (6.01)	71.12 (7.71)	-4.01 (3.74)**

Note. Values expressed as means (sd)

*$p<.05$. **$p<.01$.

Figure Caption

Figure 1. Participant diagram.


Participants who attended visit 1 of initial screening
(n = 97)
Participants who attended visit 1 of initial screening and were randomized into the intervention study.
(n = 27)
Participants who attended visit 1 of initial screening, who were ineligible based on exclusion criteria
(n = 68)
Randomized participants who completed the 10-week intervention study.
(n = 23)
Randomized participants who were unable to complete the intervention study.
(n = 4)
Randomized participants who completed the 10-week intervention study and engaged in SBPM (D2W Plus treatment group).
(n = 11)
Randomized participants who completed the 10-week intervention study but did not engage in SBPM (D2W Only treatment group)
(n = 12)

Appendix A
Dash 2 Wellness Plus
Home Blood Pressure Interview Form

ID Number:

1. Can you take me through a typical set of home blood pressure recordings?

2. What was your usual response to this procedure and the subsequent recording?

3. What were the benefits of measuring your blood pressure at home each day?

4. What was the downside to measuring your blood pressure at home each day?

5. Was the equipment easy to use, once you became familiar with it?

6. What was difficult about monitoring and recording your blood pressure during the intervention?

7. Tell me about the process of becoming familiar with your blood pressure readings, i.e. when they were higher or lower, could you tell a physiological difference

8. What would you do, if anything, to impact your blood pressure readings once you were able to sense when thy might be a little higher (e.g. try to relax, special breathing)?

9. Did you perceive or notice a connection between your blood pressure and you physical activity or diet?