

# **An Extended Theory of Planned Behavior Intervention for Older Adults With Type 2 Diabetes and Cardiovascular Disease**

**Katherine M. White, Deborah J. Terry, Carolyn Troup,  
Lynn A. Rempel, Paul Norman, Kerry Mummery,  
Malcolm Riley, Natasha Posner, and Justin Kenardy**

A randomized controlled trial evaluated the effectiveness of a 4-wk extended theory of planned behavior (TPB) intervention to promote regular physical activity and healthy eating among older adults diagnosed with Type 2 diabetes or cardiovascular disease ( $N = 183$ ). Participants completed TPB measures of attitude, subjective norm, perceived behavioral control, and intention, as well as planning and behavior, at preintervention and 1 wk and 6 wk postintervention for each behavior. No significant time-by-condition effects emerged for healthy eating. For physical activity, significant time-by-condition effects were found for behavior, intention, planning, perceived behavioral control, and subjective norm. In particular, compared with control participants, the intervention group showed short-term improvements in physical activity and planning, with further analyses indicating that the effect of the intervention on behavior was mediated by planning. The results indicate that TPB-based interventions including planning strategies may encourage physical activity among older people with diabetes and cardiovascular disease.

**Keywords:** physical activity, exercise, diet, healthy eating

Over the past decade, the incidence of chronic diseases such as diabetes and cardiovascular disease (CVD) has risen substantially in developed countries. Between 2004 and 2005, approximately 18% of the Australian population was diagnosed with CVD, placing enormous costs on the health care system (Australian Institute of Health and Welfare, 2006). Similarly, based on findings from the first national diabetes lifestyle study, AusDiab, one in four individuals has diabetes or is at high risk of developing the disease in the next 5–10 years (Diabetes Australia,

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White is with the School of Psychology and Counselling, Queensland University of Technology, Brisbane, Australia. Terry, Troup, and Kenardy are with the School of Psychology, University of Queensland, St. Lucia, Brisbane, Australia. Rempel is with the Dept. of Nursing, Brock University, St. Catharines, ON, Canada. Norman is with the Dept. of Psychology, University of Sheffield, Sheffield, UK. Mummery is with the Faculty of Physical Education and Recreation, University of Alberta, Edmonton, Canada. Riley is with Dairy Australia, Level 5 IBM Centre, Victoria, Australia. Posner is with the School of Health Sciences, University of Birmingham, Edgbaston, Birmingham, UK.

2004). As well as being an independent risk factor for CVD, Type 2 diabetes shares similar risk factors to CVD, and many individuals suffer from symptoms of both diseases. In further evidence for the similarities between CVD and Type 2 diabetes, the American Heart Association states that “from the point of view of cardiovascular medicine, it may be appropriate to say, ‘diabetes is a cardiovascular disease’” (Grundy et al., 1999, p. 1134). Consequently, the need for effective interventions and improved management of these conditions is essential.

It is generally accepted that adherence to healthy eating patterns is central to preventing and optimally managing CVD and Type 2 diabetes (e.g., Vessby, 2000). Dietary guidelines for individuals with diabetes and CVD are usually the same as those for the general population. The *Australian Guide to Healthy Eating* published by the Commonwealth Department of Health and Ageing (2001) recommends daily intake of foods based on three general principles, namely, reducing dietary consumption of fat, with an emphasis on decreasing saturated fat; increasing consumption of carbohydrates, particularly those that are more slowly digested; and increasing intake of vegetables and fruit. There are a plethora of examples of interventions to encourage healthy eating among the general population (e.g., Anderson et al., 1998), including some focusing specifically on older people (e.g., Kelley & Abraham, 2004), with varying degrees of success in meeting their intervention goals.

In addition to healthy eating, improved physical activity is important in preventing and optimally managing CVD and Type 2 diabetes (Kavookjian, Elswick, & Whetsel, 2007; Vessby, 2000; Warburton, Nicol, & Bredin, 2006). As with the general population, individuals with diabetes and CVD are advised to undertake 30 min or more of moderate physical activity during their leisure time on 5 or more days of the week (Australian Government Department of Health and Ageing, 2005). Numerous interventions to improve physical activity levels (Dishman & Buckworth, 1996; Hillsdon, Foster, & Thorogood, 2005; Kahn et al., 2002; Müller-Riemenschneider, Reinhold, Nocon, & Willich, 2008), including some specifically aimed at people diagnosed with diabetes or CVD (Furber et al., 2008; Gleeson-Kreig, 2006; Graham-Clarke & Oldenburg, 1994; Richardson et al., 2007; Steptoe et al., 1999; Wing, Vendetti, Jakicic, Polley, & Lang, 1998), have been developed using a number of different approaches (e.g., pedometer wearing/diary recording, behavior therapy, self-monitoring) to encourage positive changes in people’s physical activity levels. However, although some improvements in people’s physical activity levels have been observed (Page, Harnden, Cook, Turner, 1992; Simons-Morton, Calfas, Oldenburg, & Burton, 1998; Steptoe et al., 1999; Wing et al., 1998), they have typically been, at best, only modest and often not maintained. Furthermore, the randomized controlled trials that specifically target physical activity in individuals at risk for, or with, diabetes or CVD often lack a theoretical basis that specifies the underlying process of decision making for the desired behavior change.

Previous researchers have drawn on a variety of social-cognitive theories such as the theory of planned behavior (TPB; Ajzen, 1991) to engender health-related behavior change (see Hardeman et al., 2002). According to the TPB (Ajzen, 1991), the immediate antecedent of behavior is intention. Intentions are determined by attitude, subjective norm, and perceived behavioral control. Attitudes are an individual’s overall positive or negative evaluation of performing the behavior. Subjective norms represent perceived approval or disapproval from significant others for behavior performance. Perceived behavioral control is the perceived extent to which the behavior is under the person’s control and influences both intentions and

behavior (when estimates of actual control are accurate). Each of the TPB constructs is determined by underlying belief sets focusing on the perceived outcomes of the behavior, beliefs of specific referents, and facilitating and inhibiting factors. Much support has been provided for the TPB across a range of behaviors (Armitage & Conner, 2001) and for health-related behaviors specifically (McEachan, Conner, Taylor, & Lawton, 2011), including healthy eating (e.g., Conner, Norman, & Bell, 2002; Payne, Jones, & Harris, 2004) and physical activity (Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997). In addition, the TPB has been used to predict physical activity (Boudreau & Godin, 2009; Plotnikoff, Lippke, Courneya, Birkett, & Sigal, 2010) and healthy eating (White, Terry, Troup, Rempel, & Norman, 2010) for people diagnosed with Type 1 and Type 2 diabetes or CVD.

Despite this support, some researchers (Gollwitzer, 1993, 1999; Sheeran, 2002) have argued that the TPB (and other social-cognition models) should be expanded to include volitional variables (i.e., self-regulatory strategies that encourage enactment of one's intention) to help predict behavior. In this respect, Norman and Conner (2005) suggest that planning is a key volitional variable that can facilitate the transition from intention to behavior. Thus, specifying where, when, and how a behavior is to be performed may ensure that strong intentions are translated into behavior. In their study examining undergraduate students' physical activity behavior, Norman and Conner found evidence to suggest that the impact of intentions on behavior may be mediated by the extent to which one undertakes planning activities (see also Gutiérrez-Doña, Lippke, Renner, Kwon, & Schwarzer, 2009; Jones, Abraham, Harris, Schulz, & Chrispin, 2001; Luszczynska & Schwarzer, 2003; van Osch et al., 2009). Similarly, experimental work has shown that forming implementation intentions (i.e., specific if-then plans that link an appropriate behavioral response to a situational cue) helps people translate their goal intentions into behavior (Gollwitzer & Sheeran, 2006). Adhering to healthy eating choices and performing physical activity often require a series of preparatory steps. For healthy eating, these include selecting appropriate products, purchasing the items, choosing recipes, and preparing and cooking meals, and for physical activity there are considerations such as what activity to perform, acquiring the relevant clothing and equipment, and making plans with others. Therefore, we examined the role of planning as a potential mediating variable between intentions and behavior in an extended-TPB framework.

Given that the TPB has been shown to strongly predict healthy eating choices and physical activity in a range of contexts and for a variety of populations, and planning appears to play an important role in the intention-behavior relationship, an extended TPB (incorporating planning) should provide a good basis for developing interventions to improve levels of physical activity. In their review of 24 TPB-based behavioral interventions, Hardeman et al. (2002) concluded that the TPB was mainly used to predict intentions and behaviors and less commonly to develop intervention programs. They reported that approximately half the interventions were effective in changing intentions and two thirds in changing behavior, albeit with small effect sizes (where calculable). There are several TPB-informed healthy-eating (Gratton, Povey & Clark-Carter, 2007; Jemmott et al., 2011) and physical activity (Chatzisarantis & Hagger, 2005; Parrott, Tennant, Olejnik, & Poudrierne, 2008) interventions for nonclinical populations; however, only a few TPB interventions have been reported for clinical populations (Jones, Courneya, Fairey, & Mackey, 2005; Kelley & Abraham, 2004).

## The Current Study

The aim of this research was to design, deliver, and evaluate an extended-TPB-based intervention. The intervention specifically targeted people diagnosed with Type 2 diabetes and/or CVD. This study aimed to determine the effect of an intervention targeting people diagnosed with Type 2 diabetes and CVD on healthy eating and physical activity and to compare the effect of the intervention with that of no intervention on outcomes at 1 and 6 weeks postintervention.

The study used an extended TPB for both the development of the content of the intervention and measurement and intervention evaluation. The healthy eating goal of the intervention was based on recommendations in the *Dietary Guidelines for Australians* and the *Australian Guide to Healthy Eating* (Commonwealth Department of Health and Ageing, 2001). These recommendations include using only low-fat dairy products, using mono- or polyunsaturated cooking oil, and trimming all visible fat from meats. The physical activity goal of the intervention was based on the current Australian physical activity recommendations for adults (Australian Government Department of Health and Ageing, 2005), as well as guidelines of The Heart Foundation–Australia and Diabetes Australia, which recommend regular moderate physical activity for individuals with diabetes or CVD. The broad physical activity intervention goal for participants, then, was to undertake 30 min or more of moderate physical activity during their leisure time on 5 or more days of the week (with the 30 min of activity being done in bouts of at least 10 min). However, it is also suggested that sedentary individuals increase their activity levels slowly, and it is recommended that elderly individuals increase their moderate-level activity by no more than 5% per week (Christmas & Anderson, 2000). Thus, a revised target behavior based on previous recommendations (see Terry & Hogg, 1996) was defined as engaging in moderate physical activity on a regular basis (moderate physical activity being defined as any movement that causes a slight but noticeable increase in breathing and heart rate and may cause light sweating in some people, and a regular basis defined as at least three occasions per week).

It was hypothesized that, compared with a waitlist control group, participants in the intervention group would show an improvement in their preintervention to 1-week postintervention ratings for (a) the extended-TPB constructs of attitudes, subjective norm, perceived behavioral control, intentions, and planning in relation to healthy eating and engaging in regular physical activity and (b) self-report assessments of healthy eating and physical activity, and this improvement from preintervention to 1 week postintervention would be maintained at 6 weeks postintervention. It was also predicted that the effects of the extended-TPB intervention on behavior would be mediated by planning.

## Methods

A randomized controlled trial was conducted to evaluate the effectiveness of a 4-week extended-TPB intervention. The university ethics committee and relevant government health-district authorities approved the study.

### Participants

Participants at Time 1 (preintervention) were 183 predominantly older adults diagnosed with Type 2 diabetes or CVD recruited from seven community health

centers in Queensland, Australia. Participants were recruited voluntarily at an advertised information session and provided their informed consent to participate in a 4-week intervention trial designed to encourage healthy behaviors. Of the Time 1 participants, 116 provided data at all three collection points (preintervention, 1 week postintervention, and 6 weeks postintervention) on healthy eating, and 111, on physical activity. The participants were primarily (note there was a small amount of missing data for each demographic variable) older ( $M = 61.17$  years,  $SD = 8.81$ ), White ( $n = 107$ , 99%), married ( $n = 83$ , 76%) women ( $n = 67$ , 61%). Their most commonly reported occupations were retired ( $n = 40$ , 39%) and homemaker ( $n = 32$ , 31%). Half the participants ( $n = 54$ , 49%) reported being diagnosed with Type 2 diabetes only, another 45% ( $n = 49$ ) had been diagnosed with both Type 2 diabetes and CVD, and 6% ( $n = 7$ ) had CVD only. The average length of time since diagnosis was 5.55 years ( $SD = 6.60$ ) for people with Type 2 diabetes and 11.69 years ( $SD = 12.08$ ) for people with CVD.

The flow of participants through the study is shown in Figure 1. Considering responses to the healthy-eating questionnaires, 27% of participants (intervention  $n = 33$ , 25%; control  $n = 11$ , 32%) were lost to follow-up at 1 week postintervention.

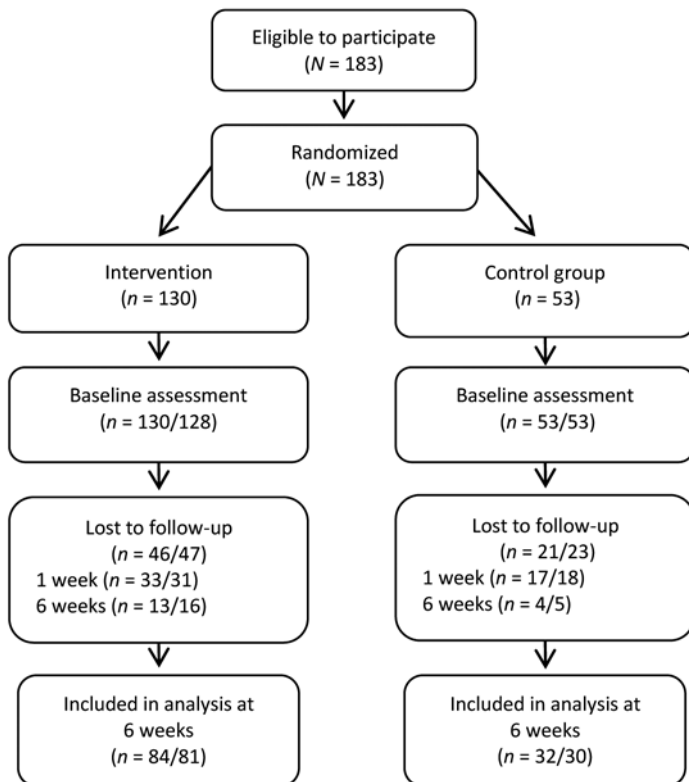


**Figure 1** — Flow of participants through the study. *N*s refer to healthy eating/physical activity.

This number increased to 37% (intervention  $n = 46$ , 35%; control  $n = 21$ , 40%) at 6-week follow-up. For the physical activity questionnaires, 27% of participants (intervention  $n = 31$ , 24%; control  $n = 18$ , 34%) were lost to follow-up at 1 week postintervention, and this number increased to 39% (intervention  $n = 47$ , 37%; control  $n = 23$ , 43%) at 6-week follow-up. No significant differences were found between attrition rates for the intervention and control conditions at either follow-up time point. Moreover, no significant differences were found between completers and noncompleters at either follow-up time point on the demographic factors and preintervention extended-TPB variables.

## Design and Procedure

The design of the study was a 2 (condition: intervention vs. waitlist control) by 3 (time: preintervention vs. 1-week postintervention vs. 6 weeks postintervention) mixed-measures design, with time as the repeated-measures factor. Participants were randomly assigned via a color-coded draw into two groups; two thirds were assigned to an intervention group and one third to the waitlist control group. The uneven design of the two groups was based on the collaborating community health center sites' requiring that their patients or clients benefit from the intervention as early as possible and to avoid a large wait-list group. A preintervention questionnaire assessing the extended-TPB constructs (including planning and past behavior) for healthy eating and physical activity was completed at the information session held 1 week before the intervention. Follow-up questionnaires assessing the extended-TPB constructs, healthy eating, and physical activity were mailed to all participants 1 and 6 weeks after completion of the 4-week intervention. Most of the data-collection period occurred across an annual holiday period (Australian summer encompassing Christmas and New Year).

**Control Group.** Participants in the control group received no intervention during the data-collection phase. They completed the extended-TPB questionnaire at the three data-collection points (preintervention, 1 week postintervention, and 6 weeks postintervention). They were offered the opportunity to attend intervention sessions once all follow-up questionnaires had been returned.

**Intervention Group.** The intervention group received an extended-TPB intervention consisting of weekly 2-hr sessions held over a 4-week period. The intensity of the intervention was based on the ability to be able to engage both participants and facilitators in a brief, cost-effective program that may complement other offerings available to those diagnosed with these chronic conditions. The sessions were facilitated by health professionals (e.g., diabetes educators, physiotherapists) trained in the program's delivery by members of the research team during a 1- or 2-day program, with intervention sessions conducted in a primarily interactive mode with participants. The sessions were group-based; approximately 5–12 participants attended each session across the multiple test sites. Comprehension of the learning in each session was checked by the facilitators at the end of the session to ensure that participants understood the issues that were raised in the workshops. An important component of the extended-TPB intervention was the use of participants' preintervention attitudes and beliefs about healthy eating and physical activity. These beliefs were used as a basis for discussion and to help develop intentions to engage in healthy behaviors.

**Intervention Protocol.** The weekly 2-hr intervention sessions held over a 4-week period covered a series of TPB-related topics. Session 1 explored participants' attitudes and beliefs about healthy eating and physical activity. Preintervention information on the group's overall attitudes and beliefs was used as a basis to consider the perceived advantages (e.g., feeling healthy, losing weight) and disadvantages (e.g., reducing the taste of food, feeling tired) of adhering to healthy eating choices and engaging in physical activity. In Session 2, participants considered the barriers (e.g., cost, lack of time) that prevent them from making healthy eating choices and engaging in regular physical activity, common triggers to unhealthy behaviors, and how unhealthy habits develop. Discussion also focused on the group's overall perceptions of social support from significant others (subjective norms) for adhering to healthy eating choices and performing physical activity. Participants were encouraged to identify people in their lives (e.g., spouse or partner) who affect their eating choices and level of physical activity and to develop strategies for dealing with unsupportive individuals or groups. The focus of Session 3 was the role of planning to enact behavior change. Participants learned and practiced the steps of effective planning (including goal setting) to bring about achievable behavior change. Session 4 completed the intervention with a focus on fostering a sense of control over behavior change. Participants generated strategies to deal with barriers preventing them from meeting their healthy-eating and physical activity goals.

## Measures

In addition to demographic information, the preintervention questionnaire and follow-up questionnaires obtained measures of the extended-TPB constructs in relation to adhering to healthy eating choices (i.e., consuming foods low in saturated fats) and engaging in regular physical activity. Participants completed all measures, as part of a larger questionnaire, at preintervention and 1 and 6 weeks postintervention. All the TPB items were constructed in line with guidelines specified by Ajzen (1991). Some of these measures included negatively worded items to minimize response bias. Items were assessed on 7-point Likert scales from 1 (*strongly disagree*) to 7 (*strongly agree*) unless otherwise stated. The examples that follow are for physical activity in which the target behavior was termed "engaging in moderate physical activity on a regular basis during the next month"; for healthy eating, participants completed identical items in which the target behavior was termed "eating foods low in saturated fats during the next month."

**Intention.** Participants indicated the extent to which they agreed to the following statement: "It is likely that I will engage in moderate physical activity on a regular basis during the next month."

**Attitude.** Attitude was assessed on four 7-point evaluative semantic-differential items: *unpleasant/pleasant*, *good/bad*, *negative/positive*, and *favorable/unfavorable*, the average of which served as a reliable measure of attitude across the three time points (healthy eating,  $\alpha = .82, .88$ , and  $.89$ ; physical activity,  $\alpha = .81, .82$ , and  $.81$ ).

**Subjective Norm.** Subjective norm was assessed using two items: "Most people who are important to me would approve of my engaging in moderate physical activity on a regular basis during the next month" and "Those people who are

important to me would want me to engage in moderate physical activity on a regular basis during the next month.” The two items were averaged to create a subjective norm measure that was correlated significantly ( $p < .001$ ) across the three time points (healthy eating,  $r = .72, .79$ , and  $.72$ ; physical activity,  $r = .59, .87$ , and  $.87$ ).

**Perceived Behavioral Control.** One item assessed perceived behavioral control: “I am confident that I could engage in moderate physical activity on a regular basis during the next month.”

**Planning.** A planning index was formed based on items by Norman and Conner (2005). For healthy eating, participants completed four items asking the extent to which they had planned “what foods to buy to ensure that you eat foods low in saturated fats during the next month,” “how to prepare meals to ensure that you eat foods low in saturated fats,” “where to purchase food to ensure you eat foods low in saturated fats,” and “how you would handle the situation if you don’t feel like eating foods low in saturated fats.” For physical activity, participants completed six items asking the extent to which they had planned “how you will engage in moderate physical activity on a regular basis during the next month,” “what physical activities you will engage in,” “when you will be physically active,” “where you will be physically active,” “who you will be physically active with,” and “how you will handle the situation if you don’t feel like engaging in physical activity.” Items were completed on 7-point Likert scales from 1 (*completely*) to 7 (*not at all*) but reverse-scored so that high values indicated high levels of planning. The items were averaged to form a scale that was reliable across the three time points (healthy eating,  $\alpha = .88, .85$ , and  $.86$ ; physical activity,  $\alpha = .91, .90$ , and  $.91$ ).

**Behavior.** Participants were provided with the relevant definitions of the target behaviors. Eating foods low in saturated fats was defined as eating low-fat dairy products and fat-trimmed meat and using mono- and polyunsaturated oils. Engaging in moderate physical activity was defined as any movement that causes a slight but noticeable increase in breathing and heart rate and may cause light sweating in some people. A regular basis was defined as at least three occasions per week. For both target behaviors, respondents indicated the extent to which they had performed them during the past month (baseline and 6-week follow-up) or past week (1-week follow-up). Responses were rated on a 7-point scale from 1 (*a small extent*) to 7 (*a large extent*). In an effort to improve the accuracy of the behavior measures, a memory prompt required participants to complete a checklist indicating their food consumption (including eating foods low in saturated fats) and recreational activities they had commonly performed (e.g., walking) during the previous week or month.

## Results

### Overview of Data Analysis

To examine the utility of the extended-TPB intervention,  $2$  (intervention, control)  $\times 3$  (preintervention, 1-week follow-up, 6-week follow-up) mixed-measures MANOVAs were performed on the extended-TPB predictor variables, intentions, and self-report behavior for both healthy eating and physical activity. In addition, on the basis of the MANOVA results for physical activity, correlational and regression analyses were conducted to examine the extent to which the extended-TPB predictor

variables including planning mediated any extended-TPB intervention effects on physical activity. Because of the preliminary nature of the study and the relatively small sample size, alpha was adjusted to .10 for the main analyses. Accordingly, all effects at  $p < .10$  were interpreted for the main analyses.

Before the main analyses, two MANOVAs were performed to determine if there were any baseline differences on the extended-TPB measures of healthy eating and physical activity between intervention and control participants, between men and women, or based on diagnosis type (i.e., diabetes only, CVD only, or diabetes and CVD). For healthy eating, these analyses revealed no significant differences as a function of group (intervention or control),  $F(6, 147) = 0.52, p = .80$ ; gender,  $F(6, 147) = 0.50, p = .80$ ; or diagnosis,  $F(12, 294) = 1.31, p = .21$ . For physical activity, the analyses also revealed no significant differences as a function of group (intervention or control),  $F(6, 133) = 0.76, p = .60$ ; gender,  $F(6, 133) = 0.89, p = .51$ ; or diagnosis,  $F(12, 266) = 1.58, p = .10$ . Therefore, a combined sample of men and women and a combined diagnosis-type sample (i.e., a combined sample of the people diagnosed with diabetes only, CVD only, or both conditions) were used in the study's analyses.

### **Utility of the TPB as an Intervention to Promote Healthy Eating and Regular Physical Activity**

For the  $2 \times 3$  MANOVAs, the intervention condition (intervention vs. waitlist control group) was the between-subjects factor, and the within-subject factor was time (preintervention and follow-up at 1 and 6 weeks). The extended-TPB variables and behavior served as the dependent variables. Table 1 displays the extended-TPB measures at preintervention and 1- and 6-week follow-up for healthy eating and physical activity.

#### **Healthy Eating: Main and Interaction Effects**

For healthy eating, there were no significant time or Time  $\times$  Condition effects. There was a significant main effect for condition,  $F(6, 72) = 2.78, p = .017$ , partial  $\eta^2 = .188$ , with significant univariate effects for behavior,  $F(1, 77) = 3.33, p = .072$ , partial  $\eta^2 = .041$ ; intention,  $F(1, 77) = 4.14, p = .045$ , partial  $\eta^2 = .05$ ; and perceived behavioral control,  $F(1, 77) = 9.81, p = .002$ , partial  $\eta^2 = .113$ . The participants in the intervention condition reported higher scores on average across all time points for behavior ( $M = 6.03, SE = .14$ ), intention ( $M = 6.25, SE = .09$ ), and perceived behavioral control ( $M = 6.40, SE = .09$ ) than participants in the control condition ( $M = 5.53, SE = .23$ ;  $M = 5.88, SE = .16$ ; and  $M = 5.85, SE = .15$ , respectively). Given that there was no evidence for the impact of the intervention over time for healthy eating, no further analyses were conducted.

#### **Physical Activity: Main Effects**

For physical activity, there were no significant effects for condition. A significant effect of time was found,  $F(12, 63) = 3.10, p = .002$ , partial  $\eta^2 = .371$ . Univariate analyses revealed significant time effects on intention,  $F(2, 74) = 6.51, p = .002$ , partial  $\eta^2 = .081$ ; perceived behavioral control,  $F(2, 74) = 3.41, p = .036$ , partial  $\eta^2 = .044$ ; and subjective norm,  $F(2, 74) = 8.02, p < .001$ , partial  $\eta^2 = .098$ , although these effects were qualified by significant Time  $\times$  Condition effects.

**Table 1** Descriptive Data Examining Time  $\times$  Condition Effects for Theory of Planned Behavior Measures of Healthy Eating and Physical Activity, *M* (*SD*)

|                              | Group        | Preintervention | 1-week follow-up | 6-week follow-up |
|------------------------------|--------------|-----------------|------------------|------------------|
| Healthy eating, <i>n</i>     |              | 183             | 133              | 116              |
| behavior                     | experimental | 5.78 (1.43)     | 6.20 (1.20)      | 6.10 (1.08)      |
|                              | control      | 5.55 (1.70)     | 5.50 (1.50)      | 5.55 (1.43)      |
| intention                    | experimental | 6.10 (0.92)     | 6.25 (0.99)      | 6.39 (0.70)      |
|                              | control      | 5.95 (0.94)     | 5.85 (0.93)      | 5.85 (0.75)      |
| planning                     | experimental | 5.35 (1.38)     | 5.46 (1.30)      | 5.49 (1.22)      |
|                              | control      | 5.25 (1.61)     | 5.36 (1.30)      | 5.09 (1.49)      |
| perceived behavioral control | experimental | 6.39 (0.64)     | 6.44 (0.70)      | 6.36 (0.76)      |
|                              | control      | 5.75 (1.41)     | 5.95 (1.00)      | 5.85 (0.93)      |
| subjective norm              | experimental | 6.26 (0.85)     | 6.19 (1.21)      | 6.15 (0.98)      |
|                              | control      | 6.00 (0.86)     | 6.00 (0.99)      | 5.60 (0.99)      |
| attitude                     | experimental | 6.19 (1.11)     | 6.42 (.77)       | 6.05 (1.29)      |
|                              | control      | 6.31 (1.03)     | 6.09 (1.03)      | 6.10 (1.02)      |
| Physical activity, <i>n</i>  |              | 181             | 132              | 111              |
| behavior                     | experimental | 4.27 (1.95)     | 4.95 (1.63)      | 4.60 (1.84)      |
|                              | control      | 4.43 (1.69)     | 3.95 (1.69)      | 4.19 (1.81)      |
| intention                    | experimental | 5.87 (1.25)     | 5.98 (1.16)      | 5.84 (1.17)      |
|                              | control      | 6.33 (.58)      | 5.00 (1.41)      | 5.43 (1.12)      |
| planning                     | experimental | 4.61 (1.62)     | 5.22 (1.39)      | 5.05 (1.43)      |
|                              | control      | 4.92 (.96)      | 4.32 (1.26)      | 4.41 (1.64)      |
| perceived behavioral control | experimental | 5.65 (1.36)     | 5.80 (1.24)      | 5.73 (1.31)      |
|                              | control      | 6.00 (0.84)     | 4.90 (1.41)      | 5.38 (1.12)      |
| subjective norm              | experimental | 6.26 (0.77)     | 6.08 (1.04)      | 5.99 (0.97)      |
|                              | control      | 5.98 (0.78)     | 5.19 (1.37)      | 5.40 (1.04)      |
| attitude                     | experimental | 6.02 (1.21)     | 6.25 (0.92)      | 5.94 (1.28)      |
|                              | control      | 5.90 (0.99)     | 5.77 (0.95)      | 5.60 (1.11)      |

### Physical Activity: Interaction Effects

Overall, there was a significant multivariate Time  $\times$  Condition effect,  $F(12, 63) = 1.70$ ,  $p = .089$ , partial  $\eta^2 = .244$ . Univariate tests were conducted to examine these effects in more detail, which revealed significant Time  $\times$  Condition effects on behavior,  $F(2, 74) = 2.81$ ,  $p = .067$ , partial  $\eta^2 = .037$ ; planning,  $F(2, 74) = 6.12$ ,  $p = .004$ , partial  $\eta^2 = .076$ ; intention,  $F(2, 74) = 8.36$ ,  $p < .001$ , partial  $\eta^2 = .101$ ; perceived behavioral control,  $F(2, 74) = 5.79$ ,  $p = .004$ , partial  $\eta^2 = .073$ ; and subjective norm,  $F(2, 74) = 2.64$ ,  $p = .077$ , partial  $\eta^2 = .034$ . There was no significant Time  $\times$  Condition effect on attitude.

These Time  $\times$  Condition interactions were examined further, with corrections to control for the Type 1 error rate (alpha set at .05). For self-reported behavior, there was a significant difference across time in the intervention,  $F(2, 88) = 5.35$ ,  $p = .006$ , partial  $\eta^2 = .108$ , but not in the control condition,  $F(2, 88) = .75$ ,  $p = .475$ , partial  $\eta^2 = .017$ . Pairwise comparisons (using a Bonferroni adjustment with

alpha set at .008) for the simple effects of time in the intervention condition were then conducted. The results showed that preintervention levels of self-reported physical activity increased significantly at the 1-week follow-up. There were no other significant differences. For the planning of physical activities, there was a significant difference across time in the intervention,  $F(2, 91) = 3.67, p = .029$ , partial  $\eta^2 = .075$ , but not the control condition,  $F(2, 91) = 2.43, p = .094$ , partial  $\eta^2 = .051$ . Pairwise comparisons for the simple effects of time in the intervention condition showed that the preintervention levels of planning for engaging in physical activities increased significantly at the 1-week follow-up. There were no other significant differences.

For intention to engage in physical activity, there was a significant difference across time in the control,  $F(2, 92) = 13.05, p < .001$ , partial  $\eta^2 = .221$ , but not the intervention condition,  $F(2, 92) = .71, p = .50$ , partial  $\eta^2 = .015$ . Pairwise comparisons for the simple effects of time in the control condition revealed that preintervention physical activity intention levels reduced significantly between baseline and the 1-week follow-up and between baseline and the 6-week follow-up. There were no other significant differences. For perceived behavioral control, there was a significant difference across time in the control,  $F(2, 91) = 8.80, p < .001$ , partial  $\eta^2 = .162$ , but not the intervention condition,  $F(2, 91) = .56, p = .57$ , partial  $\eta^2 = .012$ . Pairwise comparisons for the simple effects of time in the control condition showed a significant reduction in perceived behavioral-control levels for physical activity between preintervention and 1-week follow-up. No other significant differences emerged. For subjective norm, there was a significant effect of time in the control,  $F(2, 92) = 6.56, p = .002$ , partial  $\eta^2 = .125$ , but not the intervention condition,  $F(2, 92) = 1.87, p = .16$ , partial  $\eta^2 = .039$ . Pairwise comparisons for the simple effects of time in the control condition showed a significant reduction in levels of perceived pressure to engage in physical activity (i.e., subjective norm) between preintervention and 1-week follow-up. There were no other significant differences.

## Physical Activity: Mediation Analyses

Given that all but one of the significant Time  $\times$  Condition interactions for physical activity were the result of changes observed between baseline and 1-week follow-up, further analyses were conducted focusing on the effect of the intervention from preintervention to the 1-week follow-up only. The results revealed a significant Time  $\times$  Condition effect,  $F(6, 101) = 3.93, p = .001$ , partial  $\eta^2 = .189$ . This Time  $\times$  Condition interaction was examined further with Bonferroni corrections. For self-reported behavior, there was a significant difference across time in the intervention,  $F(1, 126) = 9.44, p = .003$ , partial  $\eta^2 = .070$ , but not in the control condition,  $F(1, 126) = 2.17, p = .14$ , partial  $\eta^2 = .017$ . Participants in the intervention condition showed a significant increase in self-reported physical activity at the 1-week follow-up, whereas control participants did not. The next analysis assessed the extent to which the extended-TPB variables at 1 week postintervention, especially planning, mediated the impact of the intervention on the target behavior at the 1-week follow-up, when an improvement in self-reported behavior from preintervention ratings was observed for experimental participants. As shown in Table 2 (showing variables at 1 week postintervention), all extended-TPB predictors were significantly correlated with behavior, with planning emerging as the strongest correlate, followed by intention. Procedures developed by Preacher and Hayes (2008) were

**Table 2** Bivariate Correlations Between the Extended Theory of Planned Behavior Variables and Self-Report Physical Activity at 1-Week Follow-Up (*N* = 132)

|                                 | 1 | 2      | 3      | 4      | 5      | 6      |
|---------------------------------|---|--------|--------|--------|--------|--------|
| 1. Attitude                     |   | .35*** | .43*** | .42*** | .38*** | .27**  |
| 2. Subjective norm              |   |        | .61*** | .57*** | .28**  | .18*   |
| 3. Perceived behavioral control |   |        |        | .81*** | .54*** | .43*** |
| 4. Intention                    |   |        |        |        | .60*** | .54*** |
| 5. Planning                     |   |        |        |        |        | .56*** |
| 6. Self-report behavior         |   |        |        |        |        |        |

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

used to examine the mediational hypotheses. Condition was entered along with all potential mediators (i.e., the extended-TPB variables) simultaneously and the preintervention behavior scores as a covariate. The analyses revealed that condition had a significant effect on behavior, *B* = .80, *SE* = .35, *p* = .02. However, this effect became nonsignificant, *B* = .26, *SE* = .33, *p* = .43, when the extended-TPB variables (i.e., the potential mediators) were controlled for, suggesting mediation (Baron & Kenny, 1986). Using bootstrapping procedures, the total mediated effect was found to be significant, *B* = .53, *SE* = .25, *CI* = 0.121–1.098. Inspection of the individual mediator variables revealed that only planning significantly mediated the effect of condition on behavior, *B* = .25, *SE* = .15, *CI* = 0.041–0.681.

## Discussion

The current study tested the efficacy of an extended TPB-based intervention including planning in relation to healthy eating and physical activity in predominantly older adults diagnosed with Type 2 diabetes and/or CVD. The results of this study provided only some support for the efficacy of the intervention to the extent that, for the intervention participants, there was evidence of significant short-term improvement in self-reported physical activity behavior and degree of planning to engage in such activities after the conclusion of the intervention sessions. In contrast, participants in the control condition maintained only moderate levels of planning and activity during this time. However, intervention participants did not report any significant improvement (or maintenance) in their level of planning and self-reported behavior at the 6-week postintervention follow-up. As a result, these somewhat encouraging findings for physical activity can only be described as temporary as the positive shifts in planning and behavior are potentially reactive to participation in an intervention targeting behavior change.

## **Effectiveness of the Intervention on Social Cognitions and Intention**

There was no evidence that the intervention facilitated change in participants' healthy-eating cognitions or intentions. It is possible that, because diabetes in particular is recognized as a food-related condition, cognitions and intentions were already at or close to desired levels. Inspection of the means for the extended-TPB variables for healthy eating revealed high levels of reported endorsement for the constructs for both conditions across the time points.

In relation to physical activity, although not originally the source of change expected, some support for the efficacy of the extended-TPB intervention was evidenced by stability in people's perceptions of normative pressure from others, control, and behavioral intentions across time for participants in the intervention condition compared with participants in the control condition. The latter participants reported a decrease in scores on these constructs over time (with this decrease significant only in the short term for subjective norm and perceived behavioral control but significant between baseline and both 1- and 6- week follow-up time points for intention). Participants in the control condition perceived less normative pressure and less control and had weaker intentions in relation to physical activity than participants assigned to the intervention condition across time, whereas those in the intervention condition maintained their high levels of perceived normative pressure, a sense of control, and strong intentions in relation to engaging in regular physical activity. This finding may be explained by the timing of the data-collection period across the Australian summer (encompassing Christmas and New Year) holiday period, which traditionally is a time when healthy practices such as physical activity can be compromised by an increase in social activities and changes from one's usual daily routine while on leave or in unfamiliar settings if vacationing. Thus, the intervention may have helped participants maintain their positive cognitions. Contrary to expectation, there was no significant improvement across time on the measure of attitude for intervention, as opposed to control, participants. Across the course of the study, intervention and control participants reported similarly very positive attitudes toward engaging in physical activity, with these very favorable opinions leaving little room for improvement on this construct for participants in either condition.

## **Effectiveness of the Intervention on Behavior**

As was the case for social cognitions and intention, there was no evidence that the intervention served to improve participants' healthy eating behavior over time. As stated previously for cognitions and intention, reports of adherence to healthy eating choices for consumption of foods low in saturated fats for all participants were high, indicating a strong endorsement of recommended dietary guidelines for participants in the current study.

In a vein similar to the findings of Hardeman et al.'s (2002) review of TPB-based interventions, the current study found support for an improvement in reported

physical activity behavior, albeit with a similarly small effect size. As hypothesized, whereas there was no evidence of change for participants in the control condition, there was a significant increase in reported levels of physical activity for intervention participants at the 1-week follow-up. This encouraging finding suggests some efficacy of the intervention in promoting adherence to regular, moderate physical activity, albeit over a short period of time.

## Mediation Effects of Planning

The current study also examined the extent to which the effects of the extended-TPB intervention on behavior would be mediated by planning. According to Norman and Conner (2005), there is some evidence to suggest that the impact of cognitions on behavior is mediated by the extent to which one undertakes sufficient planning to engage in the behavior (Jones et al., 2001; Luszczynska & Schwarzer, 2003; van Osch et al., 2009). The results of the current study revealed that planning mediated the impact of the TPB-based intervention on reported levels of physical activity at 1-week follow-up, indicating that the planning strategies people engage in serve as the means by which the positive impact of the intervention translates into behavioral change. This role for planning highlights the importance of examining variables comprising the factors proposed to serve as proximal facilitators of behavior change (see also Gollwitzer, 1993, 1999, regarding implementation intentions) and points to the value of considering theories that focus on self-regulation (e.g., including planning and goal setting) as a basis for intervention (e.g., the action and coping planning components of the health action process approach model; Schwarzer, 1992).

## Study Strengths and Limitations

The study has a number of strengths as it addressed a number of criticisms noted by Hardeman et al.'s (2002) review of TPB interventions by using the model to inform the intervention, stating explicitly which TPB components were targeted, using a randomized controlled design, and employing standardized measures of TPB constructs as process and outcome measures. Nonetheless, some limitations of the study should be noted. Because of the preliminary nature of the study and the relatively small sample size, marginal effects (adopting a  $p < .10$  significance cutoff) were interpreted for the main analyses because of their theoretical significance but should be considered cautiously, pending replication in future studies. In relation to methodological issues, most of the sample was White and married, bringing into question the generalizability of the findings. In addition, because of time constraints, single-item measures for two of the study's components (intention and perceived behavioral control) were used. However, multi-item measures of these constructs typically have very high levels of internal reliability, suggesting that the use of single items in this context may not have unduly affected issues of reliability. Furthermore, the reliance on self-report data may have inflated people's assessment of their performance of the two health behaviors. Baseline levels on behavior were high, which may indicate social-desirability effects or the selectiveness of the sample in terms of motivation to change. In the case of physical activity, the use of objective measures may provide a more accurate level of people's accumulated physical activity, although self-report measures of physical activity correlate significantly with maximum oxygen consumption (Godin & Shephard,

1997). Nonetheless, the current findings should be replicated using objective measures of physical activity behavior (McAuley & Jacobson, 1991; Westerterp, 2009). It is possible also that the mere measurement effect, whereby merely asking questions about intentions to engage in healthy behaviors increases the performance of healthy behavior (e.g., French & Sutton, 2010; Godin et al., 2010; Godin, Sheeran, Conner, & Germain, 2008; Sandberg & Conner, 2009), may have reduced the size of the intervention effects.

An additional limitation relates to the finding that the reported means on the TPB measures were all high ( $M \approx 6.00$  on a 7-point scale) preintervention. As a result, there was little room for improvement, which meant that the intervention aimed to prevent reductions over time on these variables. However, for planning, the mean preintervention score was closer to the midpoint of the scale, providing greater scope for the intervention to increase levels of planning. It should also be noted that stronger effects may have occurred had all data collection taken place in a nonholiday season, when sedentary and unhealthy eating behavior may be less common. The timing of the data collection may have provided a more conservative test of the intervention and may also explain the reduced intervention effects and the direction of the findings, although this suggestion remains to be tested. It is unclear, then, whether the intervention would have had similar effects at other times of the calendar year. A further limitation when considering the results of the study is the possibility that the effects of the intervention may relate to the impact of other members in any given intervention session, given the group-based nature of the program.

A final limitation is that there was a substantial amount of attrition for participants in the study, which may have affected the power of the analyses. In addition, previous research has indicated that program noncompleters in a physical activity intervention for older adults may be more likely to be of a lower socioeconomic class, overweight, and less physically active (Jancey et al., 2007), although no attrition biases were found in the current study. Future research should continue to assess the utility of the intervention in larger samples comprising other clinical and nonclinical groups of participants to examine the extent to which the findings are generalizable across broader populations. Furthermore, reasons for participant dropout should be collected as a matter of course. Finally, studies should also seek to examine cognitive and behavior change in data-collection periods not coinciding with holiday periods, although these times are noted for their difficulty in maintaining healthy behaviors so are useful to examine in their own right.

## Conclusions

Overall, the results of the study provide some limited, short-term evidence for the efficacy of an extended-TPB-based intervention to increase physical activity among older adults diagnosed with Type 2 diabetes and/or CVD; however, the intervention had no effect on healthy eating. Nevertheless, there are some important implications for health education for diabetes and other chronic conditions. First, the findings suggest that an emphasis on planning strategies (including goal setting) would be most beneficial in encouraging healthy-lifestyle adherence to regular moderate physical activity among this cohort (i.e., developing detailed plans of how to engage in regular moderate physical activity, such as when, where, and with whom).

Second, for physical activity behavior maintenance during often difficult periods for adherence such as holidays, efforts focusing on the perceived approval from others (e.g., partners, families) to be physically active and bolstering one's self-confidence to be able to maintain regular physical activity may prove helpful. It is likely to be less useful to target people's attitudes (i.e., highlighting the benefits and minimizing the costs of regular physical activity), because positive attitudes toward behavioral performance appear to be already established, at least in the current sample. Finally, given that the current intervention only had a short-term effect on physical activity behavior, it may be useful to supplement interventions with "booster" reminders after the completion of the program to maintain early changes in physical activity behavior.

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