Patient Education and Counseling 85 (2011) e53–e58

Contents lists available at ScienceDirect

Patient Education and Counseling

journal homepage: www.elsevier.com/locate/pateducou

Assessment

Measuring pathways towards a healthier lifestyle in the Hoorn Prevention Study: the Determinants of Lifestyle Behavior Questionnaire (DLBQ)

Jeroen Lakerveld [a,*], Sandra D.M. Bot [a,c], Mai J.M. Chinapaw [b], Dirk L. Knol [c], Henrica C.W. de Vet [c], Giel Nijpels [a]

[a] Department of General Practice and the EMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam, The Netherlands
[b] Department of Public and Occupational Health and the EMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam, The Netherlands
[c] Department of Epidemiology and Biostatistics and the EMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam, The Netherlands

ARTICLE INFO

Article history:
Received 12 July 2010
Received in revised form 13 December 2010
Accepted 6 January 2011

Keywords:
Theory of planned behavior
Structural equation modeling
Determinants of lifestyle behavior
Diabetes mellitus
Cardiovascular diseases

ABSTRACT

Objective: We developed the Determinants of Lifestyle Behavior Questionnaire (DLBQ) to measure determinants of lifestyle behavioral change according to the Theory of Planned Behavior (TPB) in adults at high risk of diabetes type 2 (T2DM) and cardiovascular diseases (CVD). The aim of the current study was to test the validity of the DLBQ.
Methods: From February to September 2008, a cross-sectional survey was conducted in the region West-Friesland (The Netherlands) among 622 adults, aged 30–50 years at high risk of T2DM or CVD participating in a lifestyle intervention trial. Structural equation modeling techniques were used for confirmatory factor analysis and to test correlations between the TPB constructs.
Results: The results demonstrate the factorial validity of the DLBQ in this population. The theoretical factor structure of the DLBQ is supported, and 41–56% of the variance in intentions to improve lifestyle behaviors is explained.
Conclusions: The DLBQ proves to be a valid instrument for measuring important determinants of the intention to change three lifestyle behaviors in adults at high risk of T2DM and CVD.
Practice implications: The identified 'key-determinants' of the TPB that seem to contribute to an increased intention to change behavior could be of value in designing future lifestyle interventions.

1. Background

Diabetes mellitus type 2 (T2DM) and cardiovascular diseases (CVD) are associated with lifestyle dependent risk factors such as overweight, reduced physical activity, smoking and an unhealthy diet [1–3]. Changing these risk factors has the potential to postpone or prevent the development of T2DM and CVD. Lifestyle behavioral change interventions are likely to be more successful when they focus on theory-based determinants [4]. The Theory of Planned Behavior (TPB, see Fig. 1) [5] has been used extensively to identify correlates and determinants of health behavior [6,7].

We used the TPB as part of a framework in the development of the Hoorn Prevention Study. The Hoorn Prevention Study is a randomized clinical trial designed to deliver and evaluate a cognitive behavioral program aimed at lifestyle changes in adults at high risk of T2DM and CVD [8].

In order to justify the theoretical background of lifestyle intervention studies based on the TPB framework and to evaluate the impact of the program on determinants of behavioral change, it is of importance to measure the TPB constructs. These constructs (as displayed in Fig. 1) are hypothetical variables; they cannot be observed directly but must instead be inferred from observable responses and are thus called *latent variables*. Via those latent variables it is possible to develop and assess TPB questionnaires that are specific to the target population [9].

Validated questionnaires that measure the TPB constructs (latent variables) of physical activity, dietary behavior and smoking in adults at high risk of T2DM or CVD were not available. Therefore we developed the Determinants of Lifestyle Behavior Questionnaire (DLBQ). The aim of this study was to test the ability of the DLBQ to measure determinants that precede intentions to change three lifestyle behaviors in adults at high risk of T2DM and CVD.

* Corresponding author at: Department of General Practice and the EMGO Institute for Health and Care Research, VU University Medical Center, v.d. Boechorststraat 7, 1081 BT Amsterdam, The Netherlands. Tel.: +31 20 444 8395; fax: +31 20 444 8361.
E-mail address: j.lakerveld@vumc.nl (J. Lakerveld).

0738-3991
doi:10.1016/j.pec.2011.01.014

2. Methods

2.1. Sample

Respondents were men and women participating in The Hoorn Prevention Study, a randomized clinical trial designed to deliver and evaluate a cognitive behavioral program aimed at lifestyle changes in adults at high risk of CVD and T2DM [8]. For the analyses we used baseline data. In the first step of the recruitment procedure 8193 inhabitants, 30–50 years of age living in several municipalities in the semi-rural region of West-Friesland, The Netherlands received an invitation from their general practitioner to measure their own waist circumference with a tape measure. Individuals with abdominal obesity (male waist $\geq$ 101 cm, female waist $\geq$ 87 cm) were invited to participate in the second step of the screening, which included assessment of blood pressure, obtaining a blood sample, anthropometric measurements and filling out a number of questionnaires, among others the DLBQ. T2DM and CVD risk scores were calculated according to the ARIC [10] and the SCORE [11] formulae, respectively. Age was standardized to 60 years to address the problem of high relative but low absolute risk in younger persons. When the outcome on one or both of these formulae was >10 (indicating a high risk of developing T2DM and/or CVD) individuals were randomly assigned to the intervention group (n = 314) or the control group (n = 308). All persons gave their informed consent prior to their inclusion in the study, and the Medical Ethics Committee of the VU University Medical Center in Amsterdam has approved the study.

2.2. Instrument

The DLBQ contains items on attitudes, subjective norms, perceived behavioral control (PBC) and intentions, based on the recommendations of Ajzen [9]. Questionnaires from other current studies at our research institute were used to develop the DLBQ. The DLBQ consists of three parts, representing three different lifestyle behaviors: physical activity, dietary behavior and smoking. A two-component structure of the construct attitude (affective/cognitive) and PBC (perceived difficulty/perceived control) was presumed throughout the development process. The translated content of the DLBQ has been appended (see additional files 1–3), with the items categorized by TPB construct. The structure of the three parts (physical activity, dietary behavior and smoking) is similar, but the number of items that are used to measure PBC and intentions differ between the lifestyles to account for specific circumstances that are characteristic for the lifestyle that is assessed. Content validity of instrument items was established in the developmental stage by interviewing five experts in energy balance related behaviors, the TPB, and scale development. As a result of these interviews, a number of changes were made to the questionnaire. This included the addition of questions on behavior-specific situations (e.g. 'I find it difficult to eat healthy food when I am busy', and 'I am able to refrain from smoking even when others offer me a cigarette/cigar'), rescaling of answer categories, adding a specification of 'eating healthier food', providing examples of additional questions or suggestions to rephrase existing questions.

2.3. Data analysis

Negatively worded items were reverse coded so that higher scores theoretically indicate a higher intention to change. Then structural equation modeling (SEM) techniques were used for confirmatory factor analysis (CFA) and to test correlating structures between the TPB constructs [28]. CFA models the relationships between observed items (questionnaire items) and unobserved or latent variables (the TPB constructs) and confirms item inclusion in a construct. Simultaneously, the structural models were built to test the factorial structures of the constructs attitude, subjective norm and PBC and to model the relationships of these constructs with intentions. The latter is similar to regression analysis [12].

In both the models on physical activity and on diet the *weighted least squares* procedure for ordered categorical variables has been used as estimation method [13]. For the model on smoking the *mean and variance-adjusted weighted least squares* estimator for ordered categorical variables was more robust. All SEM analyses were performed using Mplus version 5.2 [14].

2.3.1. Model fit

Model fit was assessed according to multiple indices. The root mean square error of approximation (RMSEA) represents closeness

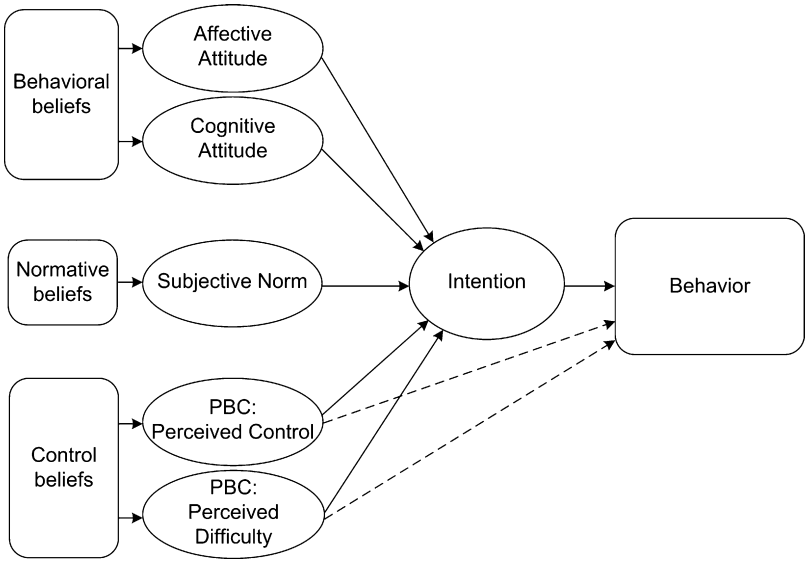

Fig. 1. A schematic representation of the adapted Theory of Planned Behavior with the construct attitude differentiated in cognitive and affective attitude, and perceived behavioral control differentiated in perceived control and perceived difficulty. PBC: perceived behavioral control. *Note*: In this study only the constructs of the Theory of Planned Behavior denoted with ovals are examined.

of fit, and values approximating 0.06 and zero demonstrate close and exact fit, respectively [15,16]. The comparative fit-index (CFI) and Tucker–Lewis index (TLI) values indicate a good fit of the model to the data if they range from 0.95 to 1. Another goodness of fit measure that is often performed for SEM is a chi-square test. However, due to the high power of the test (when the sample size is large), it is not appropriate to evaluate the correctness of SEM models based only on chi-square test outcome [17].

After testing the initial models, an iterative process was applied to increase the model fit, whereby items were allowed to load on more than 1 factor (based on modification indices) or items were excluded, based on Wald tests. The complete standardized solution was used for the presentation of the coefficients between the latent variables and intention.

3. Results

3.1. Sample characteristics

Of the 622 participants of the lifestyle intervention trial, 617 respondents (99%) completed the DLBQ on physical activity and dietary behavior. Slightly less than half the sample (42%) was male. The mean age was 43.7 (SD 5.8). All the smokers (n = 128; 22% of the total sample) filled out the DLBQ-part on smoking (48% male). Most of the missing data in all three sub-lists was observed regarding the subjective norms measure, where items about partner or family did not apply.

3.2. Physical activity

3.2.1. Measurement model

Confirmatory factor analysis showed that one item about cognitive attitude towards being more physically active overlapped with perceived difficulty, which is theoretically plausible (item 6: 'In my opinion, being more physically active is difficult/easy'; Additional file 1) Therefore we allowed that item to load on both factors (Fig. 2). The outcome of the SEM supported the theoretical pre-categorization of all items, and all of the items for the scales were retained for further analysis. The fit-indices of the measurement model were: RMSEA = 0.054, CFI = 0.994 and TLI = 0.992.

3.2.2. Structural model

In the structural equation model, intention was regressed on the traditional TPB components, which accounted for 41% of the variance in intentions to improve physical activity. The final model fitted the data well: RMSEA 0.055, CFI = 0.994 and TLI = 0.991. Affective attitudes (β = 0.48) and perceived control (β = 0.33) were the main determinants with a positive and significant association with intention. Perceived difficulty showed to be negatively associated with intention (β = −0.55). See also Fig. 2, Table 1 and Additional file 1.

3.3. Dietary behavior

3.3.1. Measurement model

As with physical activity, item 6 loaded on both cognitive attitude and on perceived difficulty towards eating healthier ('In my opinion, eating healthier food is difficult/easy'; Additional file 2). Again as this was theoretically plausible, we allowed that item to load on both factors (Fig. 3). The initial model did not fit the data well. The CFA suggested that PBC consisted of three separate but interrelated factors: a factor consisting of two items questioning the perceived ability to overcome specific barriers towards an improved diet (Additional file 2, items 16 "I find it difficult to eat healthy food when I am busy" and 18 "I find healthy food too expensive") appeared next to the factors perceived control and perceived difficulty. The construct perceived difficulty was omitted in the structural model because it reduced the goodness of fit indices. For the same reason, two items were dropped (items 10 and 19). The final measurement model fit was reasonable: RMSEA = 0.081, CFI = 0.989 and TLI = 0.985.

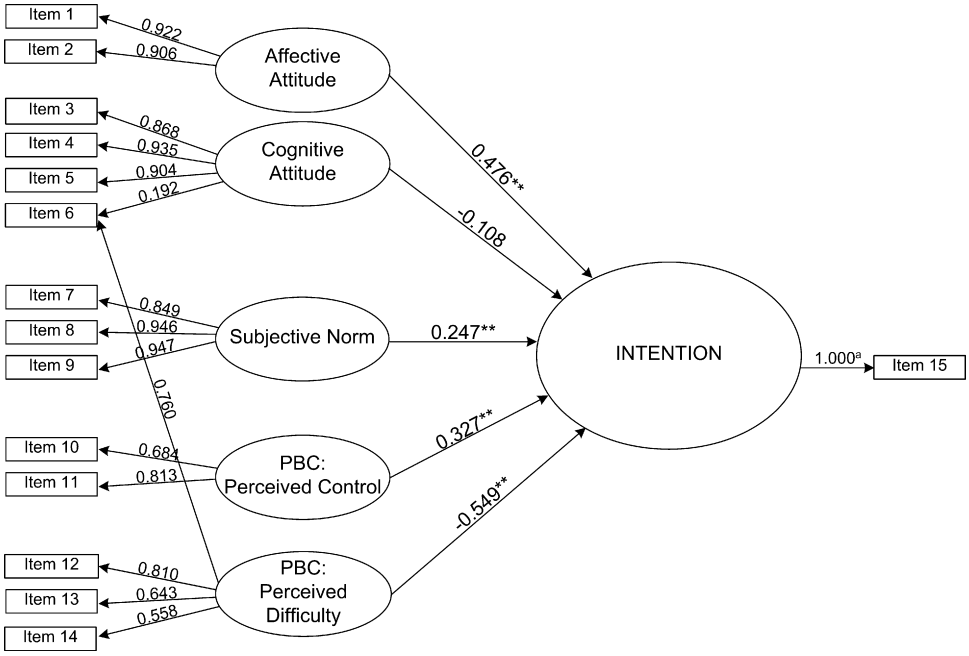

Fig. 2. Final structural equation model of the determinants of the Theory of Planned Behavior as measured with the DLBQ on physical activity (standardized estimates are presented, n = 617). The squares denote the DLBQ items and the ovals denote the constructs of the Theory of Planned Behavior, which are the latent variables. All pathways from latent variables to the items (standardized coefficients) were significant at the $P < 0.001$ level. Significant pathways between the latent variables and intention are indicated with **($P < 0.01$). *Note*: Error terms, thresholds and intercorrelations between TPB constructs not shown. [a]Fixed parameter. DLBQ: Determinants of Lifestyle Behavior Questionnaire; PBC: perceived behavioral control. The intercorrelations between the TPB constructs can be found in Table 1.

Table 1
Intercorrelations for latent variables of the DLBQ on physical activity.

Latent variables	1	2	3	4	5
1. Affective attitude	1.00				
2. Cognitive attitude	0.79	1.00			
3. Subjective norm	−0.33	−0.08	1.00		
4. PBC: perceived control	0.11	0.13	0.17	1.00	
5. PBC: perceived difficulty	0.55	0.11	−0.52	0.18	1.00

DLBQ: Determinants of Lifestyle Behavior Questionnaire; PBC: perceived behavioral control.

Table 2
Intercorrelations for latent variables of the DLBQ on dietary behavior.

Latent variables	1	2	3	4	5	6
1. Affective attitude	1.00					
2. Cognitive attitude	0.83	1.00				
3. Subjective norm	−0.53	−0.25	1.00			
4. PBC: perceived control	0.61	0.45	−0.53	1.00		
5. PBC: perceived difficulty	0.59	0.19	−0.72	0.73	1.00	
6. PBC: barriers	0.46	0.11	−0.59	0.79	0.93	1.00

DLBQ: Determinants of Lifestyle Behavior Questionnaire. PBC: perceived behavioral control.

3.3.2. Structural model

Fifty six percent of the total variance in intention to improve dietary behavior was identified in the structural equation model. The indices of this model remained reasonable: RMSEA 0.076, CFI = 0.991 and TLI = 0.989. Strong positive and significant relationships were demonstrated between perceived control and intentions ($\beta = 0.94$) and, to a lesser degree, between subjective norms and intentions ($\beta = 0.37$). The additive PBC construct about barriers towards eating healthier had a strong and negative association with intention ($\beta = -1.215$). See also Fig. 3, Table 2 and Additional file 2.

3.4. Smoking

3.4.1. Measurement model

One item on attitude towards quit smoking (Additional file 3, item 6) did not load on the construct attitude nor the construct perceived difficulty (as was seen with the two lifestyles described above). This item was therefore excluded in the further analysis. Four other items were omitted in order to enhance the structural model (Additional file 3, items 10, 15, 17 and 19). Model fit indices were: RMSEA = 0.078, CFI = 0.958, TLI = 0.943.

3.4.2. Structural model

The final model remained moderate, possibly due to the relatively small sample size: RMSEA 0.088, CFI = 0.950 and TLI = 0.962. Forty-five percent of the variance in intention to stop smoking was identified ($n = 128$). Subjective norm ($\beta = 0.38$) and cognitive attitude ($\beta = 0.35$) had the highest association with smoking cessation intention. See also Fig. 4, Table 3 and Additional file 3.

4. Discussion and conclusion

4.1. Discussion

This study showed that the DLBQ is able to measure a substantial part of the determinants that precede the intentions to change three lifestyle behaviors in adults at high risk of T2DM and CVD. The results demonstrate the factorial validity of the DLBQ

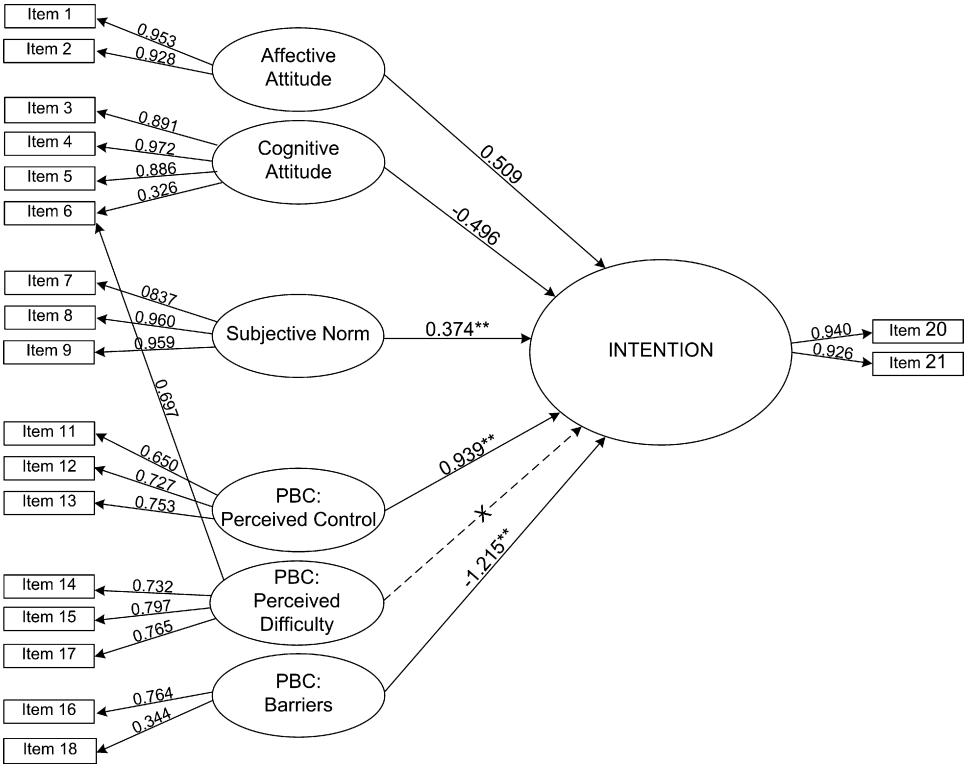

Fig. 3. Final structural equation model of the determinants of the Theory of Planned Behavior as measured with the DLBQ on dietary behavior (standardized estimates are presented. $n = 617$). The squares denote the DLBQ items and the ovals denote the constructs of the Theory of Planned Behavior, which are the latent variables. All pathways from latent variables to the items (standardized coefficients) were significant at the $P < 0.001$ level. Significant pathways between the latent variables and intention are indicated with **($P < 0.01$). *Note*: Error Terms, thresholds and intercorrelations between TPB constructs not shown. DLBQ: Determinants of Lifestyle Behavior Questionnaire. PBC: perceived behavioral control. The intercorrelations between the TPB constructs can be found in Table 2.

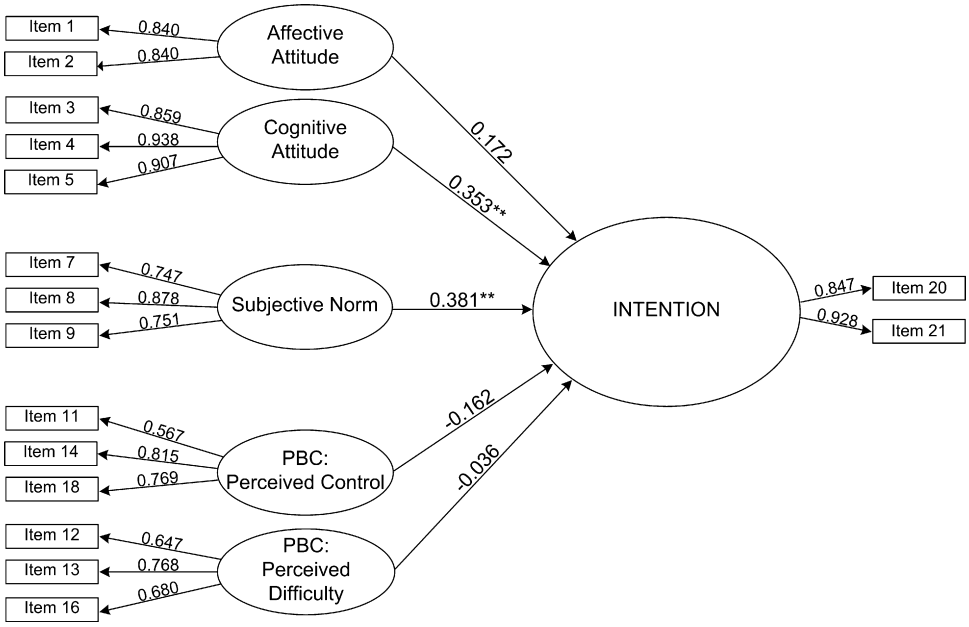

Fig. 4. Final structural equation model of the determinants of the Theory of Planned Behavior as measured with the DLBQ on smoking behavior (standardized estimates are presented. $n = 128$). The squares denote the DLBQ items and the ovals denote the constructs of the Theory of Planned Behavior, which are the latent variables. All pathways from latent variables to the items (standardized coefficients) were significant at the $P < 0.001$ level. Significant pathways between the latent variables and intention are indicated with $^{**}(P < 0.01)$. *Note*: Error terms, thresholds and intercorrelations between TPB constructs not shown. DLBQ: Determinants of Lifestyle Behavior Questionnaire. PBC: Perceived behavioral control. The intercorrelations between the TPB constructs can be found in Table 3.

in this population. Confirmatory factor analysis supported the theoretical factor structure of the DLBQ for nearly all items, and 41–56% of the variance in intentions to improve lifestyle behaviors was explained.

Perceived behavioral control towards eating healthier could be conceived of three in stead of two separate factors, as was suggested by CFA. This third factor (on specific barriers) was not identified for the two other lifestyles (physical activity and smoking). In contrast to our expectations, this extra construct on specific barriers towards eating healthier showed a significant but highly negative association with intention. In addition, the perceived difficulty of being more physically active was also negatively associated with intentions to become more active. An explanation might be found when arguing backwards in the model (from intention to perceived barriers): individuals with a higher intention might be more aware of the barriers that hinder a lifestyle behavioral change. Nevertheless, even if this explanation is true, it would be contrary to the predictions of the TPB.

To a large extent our results are in agreement with earlier research on determinants of physical activity, diet and smoking [18–22]. In line with our findings, the meta-analysis of Armitage and colleagues showed that attitude, subjective norm and PBC accounted for 41-50% of the overall variance in intention, with attitude and PBC having the strongest association [23]. Despite these similar results observed in previous research there also seem to be some differences. For instance: Blue and colleagues found that attitude was significantly associated with intention to eat healthier, and subjective norm was not [18]. Ajzen [24] suggested that the impact of the TPB variables may differ in different target populations and situations. Furthermore, not all of the known literature on TPB models used a two-component model of the construct attitude and PBC, which might also result in different outcomes.

Recent studies [25,26] have indicated that such a two-component approach of the attitude construct yields a better model fit and explains more variance in intention, and evidence for support of such a dual PBC construct has been provided experimentally and by means of a meta-analysis [27].

Our study has several strengths. It concerns a large and well-characterized clinical population and the determinants of multiple health behaviors are assessed. The latter allows an investigation of whether these behaviors have common determinants. The findings could have important implications for behavior change interventions in this area.

Our study also has limitations. First, for SEM, sample size is dependent on the number of observations and should be >200 with complex models requiring larger samples [28]. The sample of 617 for the DLBQ part on physical activity and dietary behavior was considered sufficient. However, for the DLBQ part on smoking there were only 128 observations, which gave considerable difficulty during statistical modeling. This made the model slightly unstable and probably resulted in a lower RMSEA goodness of fit ratio. These results should therefore be interpreted with caution. Second, individuals might not give accurate self-descriptions of undesirable traits [29]. Methods to assess attitudes using reaction time, such as the Implicit Association Test, have generated some controversy but may be able to examine attitudes without specifically asking people to comment on their attitudes [30].

SEM is a particularly effective method for evaluating the underlying structure of a measure because it allows investigators to specify causal relationships among observed and latent variables while simultaneously accounting for measurement error.

Table 3
Intercorrelations for latent variables of the DLBQ on smoking behavior.

Latent variables	1	2	3	4	5
1. Affective attitude	1.00				
2. Cognitive attitude	0.09	1.00			
3. Subjective norm	−0.04	0.35	1.00		
4. PBC: perceived control	0.56	−0.27	−0.11	1.00	
5. PBC: perceived difficulty	0.45	−0.26	−0.11	0.79	1.00

DLBQ: Determinants of Lifestyle Behavior Questionnaire. PBC: perceived behavioral control.

SEM research combines confirmatory and exploratory purposes: a model is tested using SEM procedures, found to be deficient, and an alternative model is then tested based on changes suggested by SEM modification indexes. The models confirmed in this manner are post hoc ones, which may not be stable (may not fit new data, having been created based on the uniqueness of an initial dataset). This problem can be overcome by using a cross-validation strategy under which the model is developed using a calibration data sample and then confirmed using an independent validation sample, or confirm the models in other data sets. Unfortunately, our data did not allow this cross validation procedure due to lack of power.

Although actual behaviors form important 'end constructs' in the model of the TPB, we did not include behaviors in our analyses as this study was intended to test the ability of the DLBQ to measure determinants that precede intentions to change. In the Hoorn Prevention Study, behaviors are measured with other questionnaires [8]. Furthermore, the key-determinants that were found to have a high association with intention may not be interpreted as constructs that predict an increased intention because of the cross-sectional nature of this study. Longitudinal data analysis of the DLBQ would be needed for prediction, and will be performed in this study when follow-up measurements of the Hoorn Prevention Study are completed.

4.2. Conclusion

The DLBQ proves to be a valid instrument and a valuable tool for measuring determinants of lifestyle behavioral change intention in adults at high risk of T2DM and CVD.

4.3. Practice implications

The identified 'key-determinants' of the TPB that seem to contribute to an increased intention to change behavior could be of value in designing future lifestyle interventions.

Competing interests

The author(s) declare that they have no competing interests.

Acknowledgements

The authors thank Anne Marie Plass, Johannes Brug, Laura Welschen and Pepijn van Empelen for helping in the process of development of the DLBQ. The study is funded by the Netherlands Organization for Health Research and Development.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.pec.2011.01.014.

References

[1] Reaven GM. Pathophysiology of insulin resistance in human disease. Physiol Rev 1995;75:473–86.
[2] Willi C, Bodenmann P, Ghali WA, Faris PD, Cornuz J. Active smoking and the risk of type 2 diabetes: a systematic review and meta-analysis. J Amer Med Assoc 2007;298:2654–64.
[3] Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. Lancet 2004;364:937–52.
[4] Brug J, Oenema A, Ferreira I. Theory evidence and Intervention Mapping to improve behavior nutrition and physical activity interventions. Int J Behav Nutr Phys Act 2005;2:2.
[5] Ajzen I. From intentions to action: a theory of planned behavior. In: Action-control: from cognition to behavior. New York: Springer; 1985.
[6] Bogers RP, Brug J, van Assema P, Dagnelie PC. Explaining fruit and vegetable consumption: the theory of planned behaviour and misconception of personal intake levels. Appetite 2004;42:157–66.
[7] de Bruijn GJ, Kremers SP, Schaalma H, van Mechelen W, Brug J. Determinants of adolescent bicycle use for transportation and snacking behavior. Prev Med 2005;40:658–67.
[8] Lakerveld J, Bot S, Chinapaw M, van Tulder M, van Oppen P, Dekker J, et al. Primary prevention of diabetes mellitus type 2 and cardiovascular diseases using a cognitive behavior program aimed at lifestyle changes in people at risk: design of a randomized controlled trial. BMC Endocr Disord 2008;8:6.
[9] Ajzen I. Constructing a TPB questionnaire: conceptual and methodological considerations. http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf; 2009.
[10] Schmidt MI, Duncan BB, Bang H, Pankow JS, Ballantyne CM, Golden SH, et al. Identifying individuals at high risk for diabetes—the Atherosclerosis Risk in Communities study. Diabetes Care 2005;28:2013–8.
[11] Conroy RM, Pyorala K, Fitzgerald AP, Sans S, Menotti A, De Backer G, et al. Estimation of ten-year risk of fatal cardiovascular disease in Europe: the SCORE project. Eur Heart J 2003;24:987–1003.
[12] Streiner DL. Building a better model: an introduction to structural equation modelling. Can J Psychiatry 2006;51:317–24.
[13] Wirth RJ, Edwards MC. Item factor analysis: current approaches and future directions. Psychol Methods 2007;12:58–79.
[14] Mplus [Los Angeles: Muthén and Muthén; 2007.
[15] Browne MW, Cudeck R. Alternative ways of assessing model fit. In: Bollen KA, Long JS, editors. Testing structural equation models. Newbury Park: Sage; 1993. p. 136–62.
[16] Hu L, Bentler PM. Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. Struct Equat Model 1999;6:1–55.
[17] Saris WE, Satorra A. In: Saris WE, Galhofer IN, editors. Characteristics of structural equation models which affect the power of the likelihood ratio test. London: MacMillan; 1988. p. 220–36.
[18] Blue CL. Does the theory of planned behavior identify diabetes-related cognitions for intention to be physically active and eat a healthy diet? Public Health Nurs 2007;24:141–50.
[19] Conner M, Norman P, Bell R. The theory of planned behavior and healthy eating. Health Psychol 2002;21:194–201.
[20] Hagger MS, Chatzisarantis NL, Biddle SJ. The influence of autonomous and controlling motives on physical activity intentions within the theory of planned behaviour. Br J Health Psychol 2002;7:283–97.
[21] Rise J, Kovac V, Kraft P, Moan IS. Predicting the intention to quit smoking and quitting behaviour: extending the theory of planned behaviour. Br J Health Psychol 2008;13:291–310.
[22] Sjoberg S, Kim K, Reicks M. Applying the theory of planned behavior to fruit and vegetable consumption by older adults. J Nutr Elder 2004;23:35–46.
[23] Armitage CJ, Conner M. Efficacy of the theory of planned behaviour: a meta-analytic review. Br J Soc Psychol 2001;40:471–99.
[24] Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process 1991;50:179–221.
[25] Rhodes RE, Courneya KS. Investigating multiple components of attitude, subjective norm, and perceived control: an examination of the theory of planned behaviour in the exercise domain. Br J Soc Psychol 2003;42:129–46.
[26] Rhodes RE, Blanchard CM, Matheson DH. A multicomponent model of the theory of planned behaviour. Br J Health Psychol 2006;11:119–37.
[27] Trafimow D, Sheeran P, Conner M, Finlay KA. Evidence that perceived behavioural control is a multidimensional construct: perceived control and perceived difficulty. Br J Soc Psychol 2002;41:101–21.
[28] Kline R. Principles and practices of structural equation modeling, 2nd ed., New York: The Guilford Press; 2005.
[29] Paulhus DL. Two-component models of socially desirable responding. J Pers Soc Psychol 1984;46:598–607.
[30] Plessner H, Banse R. Attitude measurement using the Implicit Association Test (IAT). Z Exp Psychol 2001;48:82–4.