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The Health Behavior Checklist: Factor structure in community samples and validity of a revised good health practices scale

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Abstract

This study examined the factor structure and predictive validity of the commonly used multidimensional Health Behavior Checklist. A three-factor structure was found in two community samples that included men and women. The new 16-item Good Health Practices scale and the original Wellness Maintenance scale were the only Health Behavior Checklist scales to be related to cardiovascular and metabolic risk factors. While the other Health Behavior Checklist scales require further validation, the Good Health Practices scale could be used where more objective or longer measures are not feasible.

Keywords

Health Behavior Checklist, health behavior measurement, predictive validity

Introduction

Given the cost and practical barriers to objective assessments of diet, exercise, and other health behaviors, a valid, brief self-report measure is useful in some research contexts. Previous studies have examined dimensions or taxonomies for diverse health behaviors (e.g. McEachan et al., 2010; Nudelman and Shiloh, 2015), and self-report measures combining items on diet, exercise, smoking, substance use, risk avoidance, information seeking, and use of health care have been developed (e.g. Ingledew and Brunning, 1999; Lauriola et al., 2000; Levant et al., 2011; Sniehotta et al., 2016). One of the most popular of these measures is the Health Behavior Checklist (HBC; Vickers et al., 1990), which was designed to measure four theoretically guided dimensions and has been widely used (e.g. Booth-Kewley and Vickers, 1994; Edmonds et al., 2009; Hagger-Johnson and Whiteman, 2007; Lodi-Smith et al., 2010; Wasylkiw and Fekken, 1999).

However, the HBC was developed nearly 30 years ago using samples of exclusively male, healthy Navy personnel in their late teens or early twenties, so its appropriateness for both men and women, and older people, is unclear.

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To the best of our knowledge, the predictive validity of the HBC with respect to objective health outcomes has not been examined. This study investigated the multidimensional structure of the HBC in two older community samples. The predictive validity of the original theoretically guided scales (Vickers et al., 1990) and the new scales based on the exploratory factor structures obtained here was examined by correlating them with objective biomarkers assessed subsequent to the HBC. Given the differences in sample characteristics, exploratory analyses were expected to produce different factor structures to the theoretically guided structure reported by Vickers et al. (1990).

Many of the HBC items refer to behaviors that require self-control and planning (e.g. "I limit my intake of foods like coffee, sugar, and fats," "I see a dentist for regular check-ups"), so may be confounded with the personality trait of conscientiousness, which is associated with better health outcomes (Shanahan et al., 2014). In one of the samples in this study, women and those who were more conscientious in childhood had better health (Hampson et al., 2015). The scales derived from the new factors were expected to correlate with objectively assessed health indices in this sample, even after controlling for gender and the personality trait of conscientiousness.

Method

Participants

Hawaii sample. Ethical approval for this study was granted by the local Institutional Review Board. The participants in the Hawaii longitudinal study of personality and health have been described in detail elsewhere (e.g. Hampson et al., 2001, 2015). The Hawaii sample for the present report consisted of 1060 of the 1063 who completed the HBC (three participants with more than four missing HBC responses were excluded). The ethnic composition of the sample (499 women, 561 men) was 35.3 percent Japanese Americans, 21.9 percent Native Hawaiians or part Native Hawaiians, 18.4 percent European Americans, and 24.4 percent other ethnicities. A subset ($n = 636$) also participated in an in-person clinic visit, which included an assessment of cardiovascular and metabolic biomarkers. Those missing data on three or more biomarkers were excluded (40 did not agree to give blood for the lipid profile, and 2 were not measured for blood pressure, height, weight, and waist/hip ratio reducing the clinic sample size to 594).

The Eugene-Springfield Community Sample. Participants were recruited in 1993 from lists of home owners who volunteered to complete questionnaires for at least 5–10 years (for further details, see Goldberg and Saucier, 2016). The Eugene-Springfield Community Sample (ESCS) sample (403 women, 303 men, 97 percent Caucasian) consisted of 706 of the 735 who completed the HBC, which was included in a larger survey. The 29 excluded participants all had missing data on the same 21 items, likely due to the placement of this section in the survey.

Measures

Health behaviors (Hawaii sample and ESCS). We administered a 39-item version of the original 40-item HBC (excluding "I pray or live by principles of religion"), with minor wording changes to 9 items for purposes of clarification or simplification. As in the original version, all the items were in the first person, and participants responded by rating how typical each item was for them on a 5-point scale where 1 = not at all like me and 5 = very much like me.

Physiological dysregulation (Hawaii sample). Biomarkers of cardiovascular and metabolic health were assessed at a clinic examination that included a blood draw and a urine sample. Previously, a summary measure was developed and evaluated, which was constructed from 11 of these biomarkers (Hampson et al., 2009): systolic and diastolic blood pressure (mean of two measurements for each), high-density lipoprotein (HDL) cholesterol (reversed), total cholesterol/HDL, triglycerides, fasting blood glucose,

body mass index (BMI; kg/m^2), waist/hip ratio, urine protein, and whether or not the participant was taking medications for cholesterol or blood pressure. Each biomarker was standardized, and these standard scores were summed across the measures. Higher scores indicated greater dysregulation (i.e. poorer health). Scores on combined correlated biomarkers were also used: blood pressure (systolic and diastolic blood pressure); blood glucose (fasting blood glucose and urine protein; both are indicators of diabetes risk); lipids (HDL cholesterol, total cholesterol/HDL, triglycerides); and BMI (BMI and waist/hip ratio).

Conscientiousness (Hawaii sample). Hawaii participants completed the Big Five Inventory (BFI; John et al., 1991), which was included in the same survey as the HBC.

Procedure. Hawaii participants completed the HBC as part of a larger survey in 1999 at mean age 44.6 years, (standard deviation (*SD*) = 1.97, range = 40.4–49.5). The ESCS completed the HBC as part of a larger survey in 1995 at mean age 53.9 years (*SD* = 12.9, range = 20–87). Objective health measures were obtained for the Hawaii participants at clinic examinations held between 2003 and 2011 as close as possible to Hawaii participants' 50th birthday.

Analytic strategy. Missing data on the HBC were imputed using the sample mean. For the Hawaii sample, 77 participants were missing 1–4 items: 1 (n = 60), 2 (n = 11), 3 (n = 3), and 4 (n = 3). For the ESCS, 37 participants were missing 1–3 items: 1 (n = 31), 2 (n = 5), and 3 (n = 1). In each sample, the dimensional structure of the HBC was examined separately for men and women, and for men and women combined, using exploratory factor analyses (principal components followed by varimax rotation). The similarity between the factors for each sample and across men and women was assessed by the Tucker–Lewis index of factor congruence (Tucker, 1951). Congruence values range from −1 to +1; values greater than .95 indicate essentially identical factors, and values between .85 and .95 indicate fair congruence. For the Hawaii sample, new scales for the HBC were developed based on these analyses, and the validity of these new scales and the original HBC scales was examined by correlating them with biomarkers of dysregulation, controlling for the effects of gender and adult conscientiousness. These analyses were conducted using SPSS (Unix version 6.1). The data may be obtained from the authors upon request.

Results

Factor structure of the HBC

Hawaii sample. Two-, three-, and four-factor solutions were compared. The three-factor solution produced clearly interpretable factors distinguishing preventive health behaviors from risk avoidance (including substance use) and other kinds of health concerns (see Supplemental Table s1). The factors were labeled: Good Health Practices (eigenvalue = 6.49), Risk Avoidance (eigenvalue = 3.05), and Other Health Concerns (eigenvalue = 1.95). Congruence between these factors analyzed separately for men and women was good: Good Health Practices (.92), Risk Avoidance (.95), and Other Health Concerns (.85), (see Supplemental Tables s2 and s3).

ESCS sample. The three-factor solution appeared to be highly similar to that obtained for the Hawaii sample, although the factors emerged in a different order: Risk Avoidance (eigenvalue = 6.19), Other Health Concerns (eigenvalue = 3.05), and Good Health Practices (eigenvalue = 1.98), (see Supplemental Table s4). Congruence between these factors analyzed separately for men and women was as follows: Good Health Practices (.85), Risk Avoidance (.92), and Other Health Concerns (.87), (see Supplemental Tables s5 and s6).

The congruence between the factors across the Hawaii and ESCS samples was examined. Good Health Practices (.88) and Risk Avoidance (.96) were congruent across samples, whereas Other Health Concerns (.81) was less so. In

Table 1. Items in the new Good Health Practices scale and their correlations with physiological dysregulation ($N = 594$).

	Dysreg	DysregG	DysregC
I exercise to stay healthy[a]	−.23**	−.28**	−.21**
I eat a balanced diet[b]	−.23**	−.23**	−.21**
I take vitamins[a]	−.14**	−.13**	−.13**
I see a dentist for regular checkups[a]	−.24**	−.21**	−.23**
I watch my weight[a]	−.33**	−.34**	−.32**
I limit my intake of foods like coffee, sugar, and fats[a]	−.17**	−.15**	−.15**
I gather information on things that affect my health[a]	−.13**	−.05	−.12**
I watch for possible signs of major health problems[b]	−.19**	−.12**	−.17**
I take health food supplements[a]	−.09*	−.10*	−.09*
I see a doctor for regular checkups[a]	−.18**	−.07	−.17**
I use dental floss regularly[a]	−.20**	−.15**	−.18**
I discuss health with friends, neighbors, and relatives[a]	−.12**	−.03	−.12**
I don't smoke[c]	−.14**	−.11**	−.13**
I brush my teeth regularly[b]	−.12**	−.06*	−.11**
I get shots to prevent illness[b]	.02	.05	.03
I get enough sleep[b]	−.11**	−.11**	−.10*

Dysreg = physiological dysregulation (composite of 11 biomarkers, higher = poorer health); DysregG = Dysreg controlling for gender; DysregC = Dysreg controlling for conscientiousness.
[a]Items included in the original Wellness Maintenance scale (Vickers et al., 1990).
[b]Items included in the list of additional items but not assigned to a scale by Vickers et al. (1990).
[c]Item on the original Substance Use scale (Vickers et al., 1990).
*$p < .05$; **$p < .01$.

contrast, congruence values for pairs of non-matched factors ranged from .17 to .69.

HBC scales

Original scales. The scales recommended by Vickers et al. (1990) were as follows: Wellness Maintenance (10 items, for example, "I exercise to stay healthy"), Accident Control (6 items, for example, "I keep emergency numbers near the phone"), Traffic Risk (7 items, for example, "I cross busy streets in the middle of the block"), and Substance Risk (4 items, for example, "I do not drink alcohol," reverse scored). In the study by Vickers et al. (1990), the remaining 13 items (i.e. one-third of all the items including ones such as "I eat a balanced diet," "I get enough sleep," and "I drive after drinking") did not load highly on any one factor according to their criteria, so were not included in the original scales they recommended. They referred to these as additional items.

New scales. Three new scales were developed based on the three-factor solutions obtained in this study. The similarity in factor structures between men and women indicated that the same scales would be applicable to both genders. The internal reliabilities (coefficient alpha) of the final scales for the Hawaii sample were as follows: Good Health Practices = .83, 16 items; Risk Avoidance = .78, 14 items; and Other Health Concerns = .63, 9 items. The Other Health Concerns scale had relatively low internal reliability, reflecting the diversity of its content. When the Vickers et al. (1990) original scales were applied to the Hawaii sample, the internal reliabilities were as follows: Wellness Maintenance = .79 (10 items), Accident Control = .62 (6 items), Traffic Risk = .75 (7 items), and Substance Risk = .47 (4 items).

The three new scales developed here reflect the simplified factor structure, and they incorporate all the 39 HBC items, which include the 13 additional items not included in the original

scales by Vickers et al. (1990). The original Wellness Maintenance scale corresponded to the new Good Health Practices scale; all 10 of the Wellness Maintenance items were included in the Good Health Practices scale (see Table 1), along with five of the additional items and one ("I don't smoke") from the original substance risk scale. All the items from the original Traffic Risk scale and two from the original Substance Risk scale were included in the new Risk Avoidance scale. All the items on the original Accident Control scale were included in the new Other Health Concerns scale.

Gender differences. Women had significantly more favorable scores (i.e. higher levels of health-enhancing behaviors and lower levels of risk-taking) than men on all the scales (see Supplemental Table s7).

Predictive validity of the HBC scales in the Hawaii sample

For the new HBC scales, Good Health Practices was significantly correlated with all the criterion health variables, even when controlling for gender and conscientiousness (dysregulation $r=-.25, p<.01$ and its components of blood glucose $r=-.21$, $p<.01$; blood pressure $r=-.10$, $p<.05$; lipids $r=-.12$, $p<.01$; medications $r=-.09$, $p<.05$; and BMI $r=-.23$, $p<.01$), whereas Risk Avoidance was correlated with none, and Other Health Concerns correlated positively with BMI. For the original scales, Wellness Maintenance was significantly correlated with all the health criteria except medications. Accident control was correlated positively with several health variables (i.e. better Accident Control was associated with poorer health). Traffic Risk and Substance Risk were not correlated with the health criteria. The complete correlation table is provided in Supplemental Table s8.

Table 1 shows the correlations between each of the items of the new Good Health Practices scale and dysregulation. Only one item was unrelated to dysregulation. For the majority of items, controlling for the effects of gender or conscientiousness had no marked effect on these correlations, indicating that the scale was not a surrogate measure of the effects of these influences.

Discussion

As expected, we found a different factor structure to the one reported by Vickers et al. (1990), and we derived scales that included all 39 HBC items. The healthy young men in the Vickers et al.'s (1990) Navy samples probably had less discretion than a civilian population over many of their health behaviors and were less concerned with their health than our older community samples. Although different factor structures for men and women were not justified by the analyses, we did observe substantial gender differences on the resulting scales, which of course were not apparent from the early reports based on exclusively male samples (Booth-Kewley and Vickers, 1994; Vickers et al., 1990). Both the 16-item Good Health Practices scale and the comparable but shorter 10-item original Wellness Maintenance scale measured internally coherent combinations of health behaviors and were related to important risk factors for chronic diseases. These results provide support for the predictive validity of this portion of the HBC.

In contrast to the new Good Health Practices scale, the new Risk Avoidance scale and the original scales of Traffic Risk and Substance Risk were mostly unrelated to the health outcomes. These outcomes may not have been ideal variables for validating these HBC scales. Ones that reflected more immediate consequences of risk-taking, such as traffic violations or accidental injury, would provide a better test of the validity of these scales, and this limitation of this study could be corrected in future. The new Other Health Concerns scale, which was comparable to the original Accident Control scale, was the least internally coherent and cannot be recommended without further development.

This study was limited to investigating the original HBC items, which reflected a four-dimensional theory of health behaviors, and the data were collected 17–21 years ago. Future

research into self-report measures would benefit from developing items assessing a wider range of health behaviors of relevance today and evaluating them on contemporary samples. However, based on the present results, a subset of the HBC items appears to offer an economical measure of health behaviors that are related to reduced risk of cardiovascular and metabolic diseases. The new 16-item Good Health Practices scale provides users with a somewhat broader coverage of health behaviors than the original 10-item Wellness Maintenance scale by adding such key behaviors as "I eat a balanced diet" and "I get enough sleep." The Good Health Practices scale could be used as a brief self-report measure of health behaviors for research where longer or more objective health behavior assessments are not possible.

Declaration of Conflicting Interests

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Supplemental Material

Supplemental Material is available for this article online.

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