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Psychometric properties of the Prenatal Health Behavior Scale in mid- and late pregnancy

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Abstract

Introduction—Psychometrically sound self-report measures are important tools to advance research on health behaviors in pregnancy. The Prenatal Health Behavior Scale (PHBS) has been used in prior studies to quantify health behaviors and examine their associations with relevant variables, but its psychometric properties have not been carefully investigated.

Methods—In a sample of low-risk women, we examined the factor structure, reliability, and validity of the PHBS at mid- ($N=138$) and late ($N=102$) pregnancy.

Results—In confirmatory factor analysis, items on the PHBS loaded onto a single reliable factor, but separating health-promoting and health-impairing behavior into two factors had better model fit. The scales defined by these two factors had good internal consistency in mid- and late pregnancy, were only moderately correlated, and were predicted by somewhat different sets of sociodemographic and psychological variables. Pregnancy-specific stress was a robust predictor of health-promoting and health-impairing behavior across time.

Discussion—Results bolster confidence in the reliability and validity of the PHBS and its appropriateness as a self-report tool for investigation of health behaviors among pregnant women. This study is one of the first investigations to examine patterns and predictors of health behavior practices at two time periods of pregnancy.

Keywords

Birth outcomes; health behaviors; perceived control; pregnancy; prenatal stress

Introduction

Health-promoting behaviors during pregnancy, including adequate physical activity, sleep, and consuming a nutritious diet, contribute to better birth outcomes [1–4], whereas behaviors such as maternal smoking, other substance use, and poor nutrition are well-

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documented risk factors for adverse outcomes such as low birth weight [5]. There is also accumulating evidence that consuming caffeine during pregnancy is harmful [6,7]. Although pregnant women typically practice health-promoting behaviors [8,9] and reduce health-impairing behaviors such as caffeine consumption during pregnancy [8,10], approximately half of the women who smoke cigarettes continue to do so throughout their pregnancies [11], alcohol use among pregnant women in the USA ranges from 5% to 15% [12], and prevalence of prenatal exercise is generally low [1] despite evidence that for most pregnant women, exercise is associated with healthier birth outcomes [4]. Therefore, it is important to examine the uptake of health behaviors during pregnancy and to develop research tools that will enable such investigations.

Much existing research (e.g. [10,13,14]) has assessed prenatal health behaviors using generic instruments that are nonspecific to pregnancy. These often overlook pertinent behaviors such as adequate sleep and prenatal vitamin use. A variety of self-report measures with unknown reliability or validity (e.g. [13,15–17]) have been used, hampering efforts to document effects and to compare findings across studies. Also, because cross-sectional designs are common (e.g. [16]), the potential stability or change in health behavior across pregnancy has received little attention. A psychometrically sound, uniform measure administered more than once in pregnancy would help to advance research on prenatal health behaviors.

Self-report measures of health behaviors have demonstrated validity in a variety of populations [18,19]. The 20-item Prenatal Health Behavior Scale (PHBS) is a self-report measure first introduced 20 years ago [20] and used in numerous studies since [21–28] to assess health-relevant behaviors in pregnancy, including smoking, diet, prenatal vitamin use, sleep, and exercise. Initially, the PHBS was used as a unidimensional scale, scored by reversing unhealthful items and combining these with healthful items (e.g. [20,25–28]). Healthier behaviors in pregnancy as assessed by this single-factor scale were associated with adequate prenatal weight gain and better psychological and physical functioning [25,27,28]. However, more recent evidence suggests that healthful and harmful behaviors are sufficiently independent to be conceptualized and operationalized separately in pregnant women and in a variety of non-pregnant populations [22,29]. In a recent study [22], scores on the health-promoting and health-impairing behavior subscales of the PHBS were only moderately correlated ($r=-0.33$) in a socioeconomically diverse sample of pregnant women. Furthermore, the validity and independence of the subscales were bolstered by their distinct associations with other variables, including pregnancy-specific stress and perceived control over pregnancy [22]. Previous studies have not examined the reliability and validity of the PHBS across different time points in pregnancy, however.

The aim of the current study was to evaluate the psychometric properties of the PHBS in a differently constituted sample of women (e.g. lower risk) and at two time points in pregnancy. One goal was to examine via confirmatory factor analysis the adequacy of the measure's two putative factors, health-promoting and health-impairing behavior, and to examine the internal consistency of these. A second goal was to examine whether the PHBS factor structure and reliability were consistent from mid- to late pregnancy. Considerable change can occur over the course of pregnancy in a woman's medical and emotional status

[37], and these may influence her health behaviors. A third goal of this study was to examine the validity of the PHBS at these two time periods in pregnancy via hypothesized associations with psychological variables [21,22] and individual characteristics [17,22,30] that have been associated with health behaviors in prior research. For example, younger women and those with less education are more likely to smoke while pregnant than older and more educated women [31,32]. Pregnant women under high stress are more likely than other pregnant women to consume nutrient-poor foods and less protein [33], smoke cigarettes, consume caffeine, be sedentary, and fail to use prenatal vitamins [3,10,16,21,34]. Such health behaviors help to explain the well-documented association of prenatal maternal stress with adverse birth outcomes [35,36]. This study is one of the first investigations to examine patterns and predictors of health behavior practices at two time periods of pregnancy.

Methods

Participants and procedure

Participants were from a larger study conducted at a university-affiliated certified nurse-midwife practice for low-risk pregnancy. To be eligible for the larger study, women had to be English speaking, less than 20 weeks pregnant at recruitment, and at least 18 years old, with a singleton pregnancy. Participants provided written informed consent and completed a study questionnaire on four occasions during pregnancy. Participants were reassured during the consent process that their participation would not affect their health care and that their questionnaire responses would never be shared with their health care providers. Participants completed questionnaires in a private area. The research was carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki).

Data for the current investigation are from questionnaires completed during mid-pregnancy ($n=138$; average gestation 25.7 weeks; $SD=5.00$) and late pregnancy ($n=102$; average gestation 33.4 weeks; $SD=4.40$). Participants were approximately 30 years old ($SD=4.8$) and a majority (71%) were primiparous. Approximately half (51%) had an annual household income of \$75 001 or higher; 12% earned \$60 001–\$75 000; 13% earned \$30 001–\$60 000; and 16% earned \$30000 or less. The vast majority (97%) completed high school; 59% held college or advanced degrees. Most of the sample (77%) identified as White. Nearly all participants (96%) were married or living with a partner as if married. t -Tests were conducted to examine whether attrition was associated with any sociodemographic, behavioral, or psychological factor. No differences were found between participants who completed both mid- and late pregnancy questionnaires and those who completed only the mid-pregnancy questionnaire (all $ps>0.05$).

Measures

Measures described below were included at both time points.

PHBS—Participants were asked, “In the last two weeks, how often did you” engage in each of 20 behaviors [20,21,26] with responses on a 5-point scale, from 0 (Never) to 4 (Very Often). Additional descriptive information is reported in the Results section.

Pregnancy-specific stress—The Revised Prenatal Distress Questionnaire (NUPDQ) [21] assesses distress associated with pregnancy-specific concerns, including physical symptoms, bodily changes, labor and delivery, and fetal health. Women reported how “bothered, upset, or worried” they are about each of 17 items on a 3-point scale from 0 (Not at All) to 2 (Very Much). Responses were summed. The measure has excellent psychometric properties [38–40] and exhibited high internal consistency in this study ($\alpha=0.84$).

Prenatal control—Participants indicated on a 3-point scale from 0 (Not at All) to 2 (A Lot) the extent to which they felt there are things they can do to prevent medical problems from occurring during pregnancy, to keep their baby healthy, to improve their emotional adjustment during pregnancy, and to make their labor and delivery go more smoothly (4 items). Responses were summed. This instrument has exhibited excellent psychometric properties in previous work [22,41] and had acceptable internal consistency here ($\alpha=0.76$).

Statistical analyses

Each variable was examined for missing values. For variables with minimal missing data that appeared to be random, missing values were replaced using mean imputation. No outliers were detected.

Health behavior models were examined through confirmatory factor analysis (CFA) with maximum likelihood estimation using AMOS 22.0. This analysis requires a sample size to number of free parameters ratio of 5:1 for reliable results [42]. Thus, for the proposed models, a minimum of 100 participants is sufficient [43]. The hypothesized health-promoting and health-impairing behavior factors consisted of 10 items each. Based on well-accepted recommendations [44], the following indicators were used to signify good model fit: a non-significant χ^2 value; a normed χ^2 (CMIN/df) with a ratio smaller than 2.0; Tucker-Lewis index (TLI) value greater than 0.90; a comparative fit index (CFI) value greater than 0.95; and a root mean square error of approximation (RMSEA) value less than 0.06. The two-factor structure was compared to a one-factor structure at both time points. The Bayesian information criterion (BIC) was used to evaluate model parsimony, with smaller values indicating more parsimonious fit.

Following results from CFA, subscales were formed by summing appropriate items. Within-subjects Pearson's correlations were examined to assess stability of item and total scale scores from mid- to late pregnancy. Pairwise *t*-tests were performed to examine whether significant change occurred across the two time points. Hierarchical linear regression analyses were then conducted in SPSS 19.0 (IBM Corp., Armonk, NY, USA) to predict health behavior. Sociodemographic variables correlated ($p<0.05$) with health behavior were entered together in the first block of predictors; psychological predictors (pregnancy-specific stress and prenatal control) were entered together in the second block to determine whether they explained additional variance in health behavior. Separate regression analyses were conducted for mid- and late pregnancy.

Results

Confirmatory factor analyses (CFA) for mid- and late pregnancy

Two-factor solution—For mid-pregnancy, the initial hypothesized two-factor model of health behavior was a poor fit to the data, $\chi^2(170)=307.21$, $p < 0.01$; CMIN/df ratio=2.4; TLI=0.55, CFI=0.64; RMSEA=0.07. A number of covariances were above the cutoff value of 2.0 [40]. Data did not meet assumptions of multivariate normality. Univariate normality was examined. The item *alcohol consumption* had high kurtosis (critical value > 7.0); this is because 95% of the sample reported never drinking alcohol during pregnancy. This item was removed, and the resulting model met assumptions of multivariate normality (Mardia's coefficient critical ratio values < 1.96). In order to achieve the most parsimonious model, stepwise modifications were made, and fit indices were evaluated after each step. These modifications resulted in eliminating an additional 6 items (lifting heavy objects, eating more food than necessary, bending, taking naps, excessive standing, and eating fatty/oily foods) because they failed to load on their designated factor. The residuals of *exercising* and *stretching* were allowed to correlate, as modification indices indicated, suggesting shared measurement error. The final modified model included 9 health-promoting items loading on one factor and the remaining 4 items loading on a second, health-impairing factor. All factor loadings were significant, $p < 0.01$ (see Table 1). The normed χ^2 (CMIN/df ratio=1.39) and RMSEA (0.04) for the final modified model indicated good fit. The TLI (0.86) and CFI (0.90) were slightly lower than recommended, and the χ^2 was significant, $\chi^2(64)=90.66$, $p=0.02$, although this fit index tends to produce inflated results in samples of this size. The two factors were negatively correlated, $r=-0.34$, $p < 0.01$.

For late pregnancy, the initial hypothesized two-factor model was a poor fit, $\chi^2(170)=260.03$, $p < 0.01$; CMIN/df ratio=1.6; TLI=0.76, CFI=0.69; RMSEA=0.08. Stepwise modifications were performed, resulting in eliminating the same 7 items as described in the mid-pregnancy CFA model. The residuals of *exercising* and *stretching* were allowed to correlate, as modification indices indicated and as allowed in the mid-pregnancy model. The final modified model in late pregnancy included a factor on which the same 9 health-promoting items loaded as in the mid-pregnancy model; the same 4 items as in the mid-pregnancy model loaded on a second, health-impairing factor. All factor loadings were significant ($p < 0.01$) (see Table 1), and all fit indices in the final modified model for late pregnancy indicated excellent fit, $\chi^2(64)=64.22$, $p=0.47$; CMIN/df ratio=1.00; TLI=0.99; CFI=0.99; RMSEA=0.01. The two factors were negatively correlated, $r=-0.31$, $p < 0.01$.

One-factor solution—A one-factor model of health behavior was examined with the 20 PHBS items as indicators of a single factor. The initial one-factor model in mid-pregnancy was a poor fit, $\chi^2(165)=229.24$, $p < 0.05$; CMIN/df ratio=1.6; TLI=0.65; CFI=0.69; RMSEA=0.08. Stepwise modifications were performed, resulting in eliminating the same 7 items as described in the two-factor analyses. The 13-item model for mid-pregnancy did not fit well, $\chi^2(64)=112.45$, $p < 0.01$; CMIN/df ratio=1.46; TLI=0.84; CFI=0.86; RMSEA=0.07. The one-factor 13-item model also did not fit well at late pregnancy, $\chi^2(64)=76.03$, $p < 0.05$; CMIN/df ratio=1.18; TLI=0.84; CFI=0.86; RMSEA=0.05. At both time points, all factor

loadings were significant ($p < 0.01$), but fit indices for the one-factor model were poorer than fit indices for the two-factor model.

Comparing the one- and two-factor models in mid- and late pregnancy

For mid-pregnancy, BIC for the two-factor and one-factor models were 230.83 and 241.39, respectively; for late pregnancy, corresponding BIC values were 180.84 and 189.23, respectively. A BIC difference of 10 corresponds to odds of 150:1 that the model with the lower value is better fitting and is considered “very strong” evidence favoring the model with the lower BIC value over the model with the higher BIC value [45].

Constructing and evaluating PHBS subscales

The 9 health-promoting items identified through CFA were summed; the resulting subscale had high internal consistency in mid- and late pregnancy ($\alpha = 0.75$ for both time points). Responses on the health-promoting subscale corresponded to an average item rating between “sometimes” and “fairly often” at both mid- and late pregnancy (see Table 2). Health-promoting behavior was highly stable across time (within subjects $r = 0.74$, $p < 0.01$; pairwise $\kappa(101) = 1.68$, $p = 0.10$). Table 1 displays means and SDs for individual items and correlations from mid- to late pregnancy.

Similarly, a 4-item subscale was constructed from the health-impairing items identified through confirmatory factor analyses described above ($\alpha = 0.59$ for both time points). Average responses (see Table 2) on the health-impairing subscale correspond to an average item rating between “never” and “almost never” in mid- and late pregnancy. Health-impairing behaviors were stable across time (within subjects $r = 0.78$, $p < 0.01$; pairwise $\kappa(101) = 0.32$, $p = 0.75$). Health-impairing and health-promoting subscale scores were moderately inversely correlated at mid- and late pregnancy.

The internal consistency of the 13-item unidimensional scale was low ($\alpha = 0.48$ for both time points). Unidimensional health behaviors were stable across time ($r = 0.78$, $p < 0.01$; pairwise $\kappa(101) = 1.22$, $p = 0.23$).

Predicting health-promoting and health-impairing behaviors from psychological and sociodemographic variables in mid- and late pregnancy—

Age, income, and education were correlated with health-promoting and health-impairing behavior at both time points, as shown in Table 2. Therefore, they were included in the first block of predictors for both health behavior variables. There were no associations of study variables with other participant characteristics. As hypothesized, both pregnancy-specific stress and prenatal control were correlated with health-promoting and health-impairing behavior at both time points and were thus included in the second block of predictors for each health behavior variable.

In Model 1, the first block of predictors did not account for a significant portion of variance in health-promoting behaviors at mid-pregnancy (see Table 3). The second block of predictors accounted for 11% additional variance ($p < 0.01$). In the full model (Model 2), pregnancy-specific stress was the only significant predictor of health-promoting behavior. In late pregnancy, in Model 1, the first block of predictors significantly predicted health-

promoting behavior, accounting for 24% of its variance. The second block of predictors accounted for an additional 20% of variance in health-promoting behavior at late pregnancy. In the full model (Model 2), with all predictors included, education, pregnancy-specific stress, and prenatal control were significant predictors of health-promoting behavior at late pregnancy.

In mid-pregnancy, the combination of variables in Model 1 significantly predicted health-impairing behavior, accounting for 13% of variance (see Table 4). The second block of predictors accounted for an additional 6% of variance in health-impairing behavior. In the full model (Model 2), pregnancy-specific stress was a significant predictor of health-impairing behavior in mid-pregnancy. For late pregnancy, the predictors included in Model 1 did not predict health-impairing behavior. The second block of predictors accounted for a significant amount of additional variance (11%) in health-impairing behavior. In the full model (Model 2), pregnancy-specific stress was the only significant individual predictor of health-impairing behavior in late pregnancy. The full model accounted for 19% of variance in health-impairing behavior in late pregnancy.

Discussion

The present study offers evidence for the reliability and validity of the PHBS, a self-report measure of health behaviors in pregnancy, and is one of the first investigations to examine patterns and predictors of health behavior practices across two time periods of pregnancy. Results confirm the independence of health-promoting and health-impairing behaviors in pregnancy. The factors defined by these behaviors were only moderately inversely correlated, and were predicted by somewhat different sets of sociodemographic and psychological variables in mid- and late pregnancy. Additionally, we found that women's health behavior practices were quite consistent from mid- to late pregnancy. Although fatigue and accelerated physical demands may reduce a woman's motivation to maintain healthful practices as pregnancy progresses, we observed no decline in women's efforts to take care of themselves or to refrain from harmful practices.

Pregnancy-specific stress was a robust predictor of health-promoting and health-impairing behavior at both time points, even after controlling for variables that were also associated with health behaviors. The link between stress and health behavior has been reported in general population studies [46–48] and in pregnant samples as well, including two previous studies which found stronger associations of prenatal stress with unhealthy than with healthy behaviors [21,22]. Accumulating evidence indicates that health behaviors associated with prenatal stress account in part for its adverse impact on birth outcomes [35], underscoring the importance of health behavior assessment in studies of prenatal stress and its effects.

The variables other than stress were uniquely associated with health behavior type, further supporting the distinction between health-promoting and health-impairing behaviors. For example, perceived control over one's emotional state, health, and baby's health was positively associated with health-promoting behavior in late pregnancy after controlling for other predictors. A greater sense of control has been linked previously to better lifestyle and healthier behaviors in pregnancy [14,49,50], but investigators have not examined these

associations across the course of pregnancy. Education was also independently associated with more frequent health-promoting behavior in late pregnancy.

Some features of this study limit our ability to draw firm conclusions. First, similar to prior research [24], reliability of the health-impairing subscale was not particularly high, suggesting that the behaviors comprising this scale did not frequently co-occur, a plausible finding given that these behaviors were as disparate as cigarette smoking and skipping meals. Pregnant women may also under-report such behaviors. Presumably, this subscale's low reliability is also attributable to the small number of items comprising it. Low reliability may result in underestimating the true association of predictor variables with the health-impairing behavior scale. A second limitation is the study's correlational nature. It is possible, even likely, that health behaviors have bi-directional associations with variables such as stress, although we conceptualized and examined stress as a predictor rather than an outcome of health behaviors. Moreover, we used a conservative statistical approach, examining the simultaneous influence of sociodemographic factors and controlling for their associations with health behaviors before evaluating the additional contribution of psychological factors. Third, the sample was fairly homogeneous, which limits its generalizability. Participants in the study were socioeconomically advantaged women at low-risk who were receiving excellent prenatal care. These women may exhibit better health behaviors for reasons associated with their resources and advantaged status. Such sample characteristics may also help explain why some items (e.g. lifting, overeating, bending, standing, eating high fat food, and alcohol use) did not load as components of the health-impairing behavior factor, and were eliminated from further analysis because of low prevalence in this study. These items may be more common in different samples. For this reason, and because eliminating items can alter the content validity of an instrument, we recommend that all 20 items be administered in studies using the PHBS. The present study offers a foundation for further research using the PHBS to examine its applicability in other samples. As additional evidence is gathered about health behaviors in larger and more diverse samples of pregnant women, we can learn what is normative for particular groups and better evaluate the extent to which sociodemographic and psychological factors may independently and jointly influence their health behaviors. Sensitivity of the PHBS to change in health behaviors, such as in response to targeted health behavior interventions, remains unanswered by this study and warrants investigation in the future, as does the potential of the PHBS to predict birth outcomes.

Conclusions

Study results highlight the value and psychometric strengths of the PHBS, a health behavior instrument developed for pregnant women. Findings using this instrument confirm that health-promoting and health-impairing behaviors are distinguishable constructs and that pregnancy-specific stress is a potent and independent predictor of both types of health behavior in mid- and late pregnancy. Although the two-factor model of health behavior was quantitatively superior, the PHBS may also be used as a unidimensional scale when this is more appropriate for the research. Instruments tailored to the context of pregnancy and subjected to empirical testing are critical tools to advance research and inform the development of appropriate interventions for pregnant women. Understanding health

behaviors in pregnancy and what predicts them is vital because the consequences of these behaviors can be direct, relatively immediate, and affect the health and even survival of a developing fetus.

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Current knowledge on this subject

- Prenatal maternal stress is associated with poorer birth outcomes.
- Health-impairing behaviors during pregnancy such as smoking and poor nutrition are well-documented contributors to adverse birth outcomes.
- Psychometrically sound, self-report measures are important tools to advance research on health behaviors in pregnancy.

What this study adds

- The Prenatal Health Behavior Scale is a reliable and valid self-report tool for investigation of health behaviors in pregnancy.
- Health-promoting and health-impairing behaviors in pregnancy are distinguishable constructs.
- Pregnancy-specific stress is a potent predictor of health-promoting s mid-and late pregnancy even after controlling for sociodemographic factors that are also associated with health behavior practices.

PHBS factor loadings from the final two-factor model, item means, and correlations from mid- to late pregnancy

Table 1

Item number	Mid-pregnancy		Late pregnancy		Within subjects, <i>r</i>
	Factor loading	<i>M</i> (<i>SD</i>)	Factor loading	<i>M</i> (<i>SD</i>)	
<i>Health-promoting behavior subscale</i>					
1	0.49**	2.1 (1.1)	0.40**	2.1 (1.1)	0.66**
2	0.30**	2.7 (.86)	0.33**	2.6 (.88)	0.69**
4	0.45**	3.3 (.88)	0.35**	3.0 (.89)	0.57**
6	0.37**	3.7 (.77)	0.25**	3.6 (.74)	0.61**
10	0.83**	3.4 (.74)	0.68**	3.4 (.66)	0.47**
11	0.56**	2.2 (.95)	0.31**	2.4 (.98)	0.54**
13	0.78**	3.2 (1.0)	0.68**	3.1 (.85)	0.65**
15	0.68**	3.2 (.85)	0.69**	3.4 (.71)	0.62**
18	0.12	1.7 (1.2)	0.12	1.7 (1.2)	0.73**
20	0.86**	3.1 (.87)	0.71**	3.2 (.75)	0.53**
<i>Health-impairing behavior subscale</i>					
3	0.18	2.5(.96)	0.15	2.3 (1.0)	0.48**
5	0.17	1.9 (.71)	0.18	1.8 (.69)	0.48**
7	0.79***	1.6 (.98)	0.56**	1.6 (1.0)	0.51**
8	0.12	2.2 (1.1)	0.09	2.1 (1.1)	0.59**
9	0.26**	1.5 (1.0)	0.29**	1.5 (1.0)	0.62**
12	0.07	.15 (.48)	0.04	.15 (.45)	0.78**
14	0.11	1.1 (1.1)	0.10	1.3 (1.0)	0.53**
16	0.16	1.4 (.84)	0.15	1.5 (.80)	0.67**
17	0.54***	.13 (.62)	0.29**	.11 (.52)	0.97**
19	0.90***	.88 (1.0)	0.75**	.90 (1.0)	0.65**

** $p < 0.01$;

$P < 0.0001$

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Table 2
Correlations among major study variables at both time points

	1	2	3	4	5	6	7
1 Health-promoting behavior	–	–0.33**	0.19*	–0.25**	0.29**	0.18*	0.14*
2 Health-impairing behavior	–0.35**	–	–0.17*	0.38**	–0.35**	–0.25**	–0.33**
3 Prenatal control	0.41*	–0.23**	–	–0.17**	0.17*	0.23*	0.14*
4 Pregnancy-specific stress	–0.41**	0.34**	–0.34**	–	–0.17	–0.02	–0.11
5 Income	0.32**	–0.15*	0.29*	–0.23*	–	0.44**	0.46**
6 Education	0.37**	–0.23*	0.25**	–0.10	0.29**	–	0.37**
7 Age	0.22*	–0.30**	0.25*	–0.16*	0.40**	0.33**	–
Item <i>M</i> , mid-pregnancy	3.01	1.06	2.19	0.53			
Item <i>SD</i> , mid-pregnancy	0.51	0.63	0.63	0.33			
Item <i>M</i> , late pregnancy	2.96	1.01	2.26	0.48			
Item <i>SD</i> , late pregnancy	0.47	0.54	0.63	0.32			

*
 $p < 0.05$;

**
 $p < 0.01$;

bottom half of diagonal=mid-pregnancy; top half of diagonal=late pregnancy. The 9-item health-promoting subscale and the 4-item health-impairing subscale were used for all correlations, means, and SDs.

Table 3
The results of hierarchical multiple regression analysis predicting health-promoting behavior in mid- and late pregnancy

Pregnancy Time point	Variable	t	β	R^2	R^2 change	df	F	F change
Mid- ($n=138$)	<i>Model 1</i>			0.07		3, 134	2.80	
	Age	0.31	0.03					
	Income	2.08	0.21					
	Education	0.21	0.02					
	<i>Model 2</i>			0.19**	0.11**	5, 132	5.01	7.80
	Age	-0.02	-0.02					
	Income	2.08	0.21					
	Education	0.11	-0.02					
Late ($n=102$)	Pregnancy-specific stress	-3.36**	-0.28					
	Prenatal control	1.36	0.15					
	<i>Model 1</i>			0.24**		3, 98	5.60	
	Age	0.35	0.04					
	Income	2.07	0.21					
	Education	2.99**	0.33					
	<i>Model 2</i>			0.44**	0.20**	5, 96	9.09	12.39
	Age	-0.11	-0.03					
	Income	1.63	0.14					
	Education	2.50*	0.24					
	Pregnancy-specific stress	-2.83**	-0.28					
	Prenatal control	3.02**	0.31					

* $p<0.05$;

** $p<0.01$.

Table 4
The results of hierarchical multiple regression analysis predicting health-impairing behavior in mid- and late pregnancy

Pregnancy Time point	Variable	t	β	R^2	R^2 change	df	F	F change
Mid- ($n=138$)	<i>Model 1</i>			0.13 *		3, 134	5.49	
	Age	-1.61	-0.16					
	Income	-1.50	-0.15					
	Education	-1.33	-0.13					
	<i>Model 2</i>			0.19 *	0.06 *	5, 132	5.03	5.03
	Age	-1.44	-0.14					
	Income	-1.38	-0.14					
	Education	-1.40	-0.14					
	Pregnancy-specific stress	2.70 **	0.24					
	Prenatal control	-0.15	-0.01					
Late ($n=102$)	<i>Model 1</i>			0.08		3, 98	2.16	
	Age	-1.26	-0.16					
	Income	-0.27	-0.03					
	Education	-1.40	-0.17					
	<i>Model 2</i>			0.19 *	0.11 *	5, 96	3.70	5.58
	Age	-1.20	-0.14					
	Income	0.23	0.02					
	Education	-1.09	-0.13					
	Pregnancy-specific stress	2.64 **	0.31					
	Prenatal control	-0.67	-0.08					

* $p < 0.05$;

** $p < 0.01$.