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Pregnancy Intention and Health Behaviors: Results from the Central Pennsylvania Women's Health Study Cohort

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Abstract

Objective—Our objective was to determine whether intention for future pregnancy affects selected preconception health behaviors that may impact pregnancy outcomes.

Methods—Analyses are based on data from a population-based cohort study of women ages 18–45 residing in Central Pennsylvania. A subsample of 847 non-pregnant women with reproductive capacity comprise the analytic sample. We determined the associations between intention for future pregnancy and the pattern in the following health behaviors over a 2-year period: nutrition (fruit and vegetable consumption), folic acid supplementation, physical activity, binge drinking, smoking, and vaginal douching. Multivariable analyses controlled for pregnancy-related variables, health status, health care utilization, and sociodemographic variables.

Results—At baseline, 9% of women were considering pregnancy in the next year, 37% of women were considering pregnancy some other time in the future, and 53% of women were not considering future pregnancy. In multivariable analyses, there were no associations between intention for future pregnancy and maintaining healthy behavior or improving behavior for any of the seven longitudinal health behaviors studied.

Conclusions—The importance of nutrition, folic acid supplementation, physical activity, avoiding binge drinking, not smoking, and avoiding vaginal douching in the preconception period needs to be emphasized by health care providers and policy makers.

Keywords

Pregnancy intention; Preconception; Health behaviors; Pregnancy outcomes

Introduction

Health-related behaviors prior to conception impact pregnancy outcomes; this has been a major impetus behind the promotion of preconception care. The Centers for Disease Control (CDC) has defined preconception care as “a set of interventions that aim to identify and modify biomedical, behavioral, and social risks to a woman's health or pregnancy outcome through prevention and management” [1]. While women are likely to adopt healthier behaviors after pregnancy is recognized [2], waiting until a pregnancy is identified to improve health behaviors may be too late to reduce some adverse birth outcomes.

Research is limited on whether women who intend to become pregnant adopt healthier preconception behaviors. While some research shows high prevalence of unhealthy behaviors in the preconception period [2], there is also evidence that women with intended pregnancies are more likely to engage in health promoting behaviors prior to conception, such as smoking reduction, folic acid supplementation, and less binge drinking [3–5]. These were studies of women who were pregnant or post-partum; thus, report of both intent for pregnancy and preconception health behaviors was assessed retrospectively and is subject to recall bias. A study of non-pregnant women by Green-Raleigh et al. investigated the association between pregnancy planning status and health behaviors in a cross-sectional telephone survey of women enrolled in a staff-model HMO in California. Compared with women not planning pregnancy, women planning pregnancy within the next year were more likely to report some healthier behaviors (less smoking, more regular multivitamin use, more likely to have a health care visit in the past year), but there was no difference in alcohol use [6]. Their study was unique in that it collected intention and behavior data before conception, rather than retrospectively. However, it is unclear whether these findings truly reflect that women intending their pregnancies are actively improving their health prior to conception, or whether women who are more likely to have intended pregnancies are also more likely to have healthier behaviors to begin with. These uncertainties can be better clarified if intention status and health behaviors are measured prospectively and longitudinally.

Using a unique longitudinal data set, we examined whether pregnancy intention measured at baseline predicted maintenance of healthy behaviors or improved health behaviors during a 2-year follow-up period. Previous research using this data source found that baseline pregnancy intention was strongly associated with incident pregnancy during the follow-up period [7], suggesting that women intending future pregnancy at baseline might be motivated to engage in healthier behaviors in order to improve their pregnancy experiences and outcomes. We hypothesize that among non-pregnant women, intention for future pregnancy will be associated with healthier longitudinal behaviors, such as fruit and vegetable intake, physical activity, folic acid supplementation, reduced binge drinking, tobacco abstinence, and avoidance of vaginal douching.

Methods

Study Design and Sample

The Central Pennsylvania Women's Health Study (CePAWHS) includes a population-based cohort study of reproductive-age women residing in Central Pennsylvania, a region that includes urban as well as rural and semi-rural areas. The primary objective of the CePAWHS longitudinal survey was to provide estimates of the prevalence of risk factors for preterm birth and low birthweight in the region and to assess how these risks change over time and are related to pregnancy outcomes [8]. The current study uses these longitudinal data to evaluate prevalence and patterns of change in participants' health behaviors, and determine whether they are affected by pregnancy intention as measured at baseline. CePAWHS was approved by the Institutional Review Board of the Penn State College of Medicine and conducted in accordance with prevailing ethical principles.

The baseline CePAWHS survey was a random-digit dial telephone survey of 2002 women ages 18–45, residing in a 28-county region of Central Pennsylvania, who were either English or Spanish-speaking. The sample was highly representative of the target population with respect to age, race/ethnicity, educational level, and poverty status. Details of the sampling methodology, response rate, and representativeness have been previously published [8]. At the time of the baseline survey, 90% of participants consented to future follow-up interviews; of these, 1,420 women completed a 2-year follow-up telephone survey for a response rate of 79%. The main reason for loss to follow-up was failure to locate women who had changed residence; only 5% refused the interview. Women were more likely to respond to the follow-up survey if they were older (ages 35–45), college educated, married or partnered, not in poverty, and non-Hispanic white; there was no significant difference in response by location of residence along the rural–urban continuum.

The analytic sample for this paper includes a subset of the respondents to the follow-up survey: non-pregnant women who had reproductive capacity at both baseline and follow-up. Thus, women were excluded if they were pregnant at baseline ($n = 54$), reported hysterectomy or tubal sterilization either before or during the study ($n = 439$), or reported infertility at the baseline interview ($n = 75$). These exclusions were necessary because these women would not be planning for a future pregnancy. An additional five women were excluded because they were missing either pregnancy intention or follow-up pregnancy data. This resulted in 847 women for this analysis.

Hypotheses and Definition of Variables

The CePAWHS survey instrument was developed from previously validated surveys on women's health, modified to meet the objectives of the CePAWHS project. Data on pregnancy history and future pregnancy intention, health status, health care utilization, sociodemographics, and health behaviors were among the survey measures. The main hypothesis was that future pregnancy intention is associated with positive longitudinal health behaviors; more specifically, women considering pregnancy in the next year would be improving health behavior (or maintaining healthy behavior). Secondary hypotheses were that prior experience with pregnancy, better health status, more contact with the health care system, and higher socioeconomic status are associated with positive longitudinal health behaviors.

The outcome variables were measures of health behaviors that have been shown to impact pregnancy outcomes, such as nutrition (fruit and vegetable consumption), folic acid supplementation, physical activity, alcohol use, smoking, and vaginal douching. The rationale for inclusion of each of the seven health behaviors and how healthy levels of behavior were defined is described here. Proper nutrition prior to conception and during pregnancy has been

shown to improve pregnancy outcomes [9–14], and daily fruit and vegetable consumption is recommended by the American Dietetic Association for preconceptional and pregnant women [15]. Thus, we considered consumption of fruit and vegetables at least once daily as healthy preconception behaviors. Folic acid supplementation has been shown to reduce the risk of neural tube defects [16,17]. The March of Dimes [18], the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists (AAP/ACOG) [19], the Institute of Medicine [20], and the U.S. Public Health Service [21] recommend daily use of a multivitamin containing 400 mcg of folic acid in women capable of reproduction; we thus considered daily consumption of a multivitamin with folic acid as a healthy preconception behavior. Physical activity in the preconception period is important for achieving and maintaining a healthy weight, as maternal obesity is associated with numerous pregnancy-related complications [22]. Exercise has also been shown to decrease the risk of postpartum weight retention [23]. For healthy women before, during, and after pregnancy, ACOG recommends exercise at least 30 min a day on most, if not all, days of the week [23]; we thus used these guidelines as our definition of healthy preconception physical activity. Adverse effects of alcohol likely occur early in pregnancy (before a woman realizes she's pregnant) and no established safe level of alcohol consumption during pregnancy has been established. Alcohol is associated with preterm birth, miscarriage, growth retardation, and the fetal alcohol syndrome, making it the leading preventable cause of birth defects and developmental disabilities in the United States [24–27]. In view of the high prevalence of binge drinking (five or more drinks on an occasion) in the sample, we defined the absence of binge drinking in the past month as a healthy preconception behavior. Smoking has also been associated with numerous maternal and fetal complications, such as low birthweight, preterm birth, and intrauterine growth retardation [28–31]; we thus considered abstinence from smoking as a healthy preconception behavior. Vaginal douching was included since evidence suggests an association with preterm birth and adverse pregnancy outcomes [32,33]. No douching in the past 12 months was considered a healthy preconception behavior. For each of the seven behaviors, it was determined whether women were engaging in healthy levels of behavior at the baseline and follow-up time points.

For each of the seven health behaviors, we assessed whether the women were engaging in positive longitudinal behavior, defined as sustained healthy levels of behavior at both baseline and follow-up, or improved health behavior between baseline and follow-up (even if healthy levels were not met). For example, if a woman was not taking any folic acid supplements at baseline but was taking them twice a week at follow-up, that was considered positive longitudinal behavior for folic acid (even though she was not taking them daily, the recommended amount). Negative longitudinal behavior was behavior that remained unchanged at below healthy levels or declined from healthy to below healthy levels. Table 1 shows the longitudinal pattern for each of the seven health behaviors; overall, the most negative longitudinal behavior occurred for physical activity and folic acid supplementation, and the most positive longitudinal behavior occurred for binge drinking, vaginal douching, and smoking.

The main independent variable was pregnancy intention at the time of the baseline survey. Participants were asked, “Are you considering becoming pregnant within the next year, at some other time in the future, or not at all?” Future pregnancy intention was categorized as a three-level variable as per these responses.

Covariates included variables that were expected to influence the health behaviors of reproductive-age women. Pregnancy-related variables were *reproductive life stage* (preconceptional indicating never been pregnant and interconceptional indicating at least one previous pregnancy; women with a previous pregnancy were hypothesized to be more likely to engage in healthy behaviors); perceived severity of preterm birth/low birthweight for a baby's

health (very serious risk versus somewhat serious/somewhat small/very small risk; those perceiving higher risk were hypothesized to be more likely to engage in healthy behaviors); and *incident pregnancy* occurring during the 2-year study (pregnant women were hypothesized to engage in healthier behaviors).

We included several health status variables to test our hypothesis that better health status would be associated with better longitudinal health behaviors. Baseline health status variables included *overall self-rated health status* as measured using the first item from the SF-12v2 Health Survey [34], comparing those who report their overall health as excellent or very good versus good, fair, or poor. We included a measure for *obesity* (defined as a body mass index of 30 kg/m² or greater) and a *chronic condition* measure indicating whether the woman had received a diagnosis of diabetes, hypertension, or heart disease in the past 5 years. The Psychosocial Hassles Scale was used as a measure of *psychosocial stress*; this 12-item scale measures the degree to which common hassles (e.g., money worries, problems with friends) are perceived as stressful during the past 12 months. The scale was adapted from the Prenatal Psychosocial Profile Hassles Scale, which referred to stress during pregnancy, used by Misra et al. [35], which in turn was adapted from the stress subscale of the Prenatal Psychosocial Profile developed by Curry et al. [36]. For this analysis, the scale was dichotomized at the median value to indicate higher and lower measures of psychosocial stress. *Depressive symptoms* were measured using a 6-item scale assessing frequency of symptoms in the past week, based on the Center for Epidemiologic Studies Depression Scale [37]; the scale score was dichotomized to indicate high risk versus low risk for depression [38].

We hypothesized that greater access to the health care system would be related to improved healthy behaviors. Baseline health care utilization variables were whether the participant had seen an *obstetrician-gynecologist* in the 2 years preceding the baseline survey, and whether she had received *counseling* by a doctor or other health professional in the past 12 months for none, 1–2, or 3–6 of the following health topics: smoking, diet, weight, exercise, alcohol, or planning for pregnancy.

Finally, we included sociodemographic variables to test our hypothesis that higher socioeconomic status is associated with better health behaviors. Baseline sociodemographic measures were *age group* (18–24, 25–34, or 35–45), *race/ethnicity* (non-Hispanic White versus other race/ethnicity), *education* (high school graduate or less versus some college or more), *marital status* (married or living with partner versus not partnered) and *poverty status* (defined as in poverty, near poverty, or not in poverty using U.S. Census definitions based on household income and composition). A proportion of participants (12%) had missing income data, either because they did not know, were not sure, or refused to report their household income. Further examination of the women with missing income data revealed that they were similar to women in the poverty and near poverty groups in terms of educational attainment and type of health insurance. This group of women who did not report their household incomes was treated as a separate category in the poverty status variable.

Statistical Analysis

Frequencies of the study variables were determined. Bivariate tests of the association of intention for future pregnancy with positive longitudinal behaviors were determined using Chi-square tests and simple logistic regression analysis. Multivariable logistic regression models were fit to predict the likelihood of engaging in positive longitudinal behavior for each of the seven behaviors, with baseline pregnancy intention as the independent variable of interest. The pregnancy-related variables, health status, health care utilization, and sociodemographic variables described above were also included in the models. We checked for multicollinearity among the independent variables. Likelihood ratio test *P*-values testing for overall significance are reported for each of the regression models (*P*-values >0.05 suggest the model is predictive

of the outcome). All statistical analyses were performed on unweighted data using SAS software, Version 9.0 of the SAS System for Windows (SAS Institute Inc., Cary, NC, USA).

Results

Table 2 shows the frequencies for all independent variables. The main independent variable was pregnancy intention at baseline: 9% ($n = 79$) of women were considering a pregnancy in the next year, 37% ($n = 317$) were considering pregnancy some other time in the future, and 53% ($n = 451$) were not considering any future pregnancy.

Table 3 shows the bivariate relationships between baseline pregnancy intention and the seven behavioral outcomes. Women considering pregnancy within the next year were more likely to report positive longitudinal folic acid supplementation compared with women not considering future pregnancy. Other significant associations included vegetable consumption and binge drinking: in these cases, considering pregnancy some other time in the future reduced the odds of positive longitudinal behavior compared with women not considering future pregnancy. Table 4 shows multivariable logistic regression models for each of the behavioral outcomes, adjusting for all independent variables. Pregnancy intention fails to attain significance in any of these models. However, being interconceptional was associated with negative smoking and vaginal douching behavior. Having a pregnancy during the follow-up period significantly increased the odds of folic acid supplementation and avoiding binge drinking, whereas it reduced the odds of physical activity. Being in the youngest age group (18–24 years) was associated with negative binge drinking and smoking behaviors longitudinally, while higher education was associated with positive longitudinal physical activity.

Conclusions

In this study of non-pregnant women from a population-based cohort of reproductive-age women in Central Pennsylvania, we found no associations between intention for future pregnancy and seven longitudinal health behaviors that may impact pregnancy outcomes in adjusted analyses. These findings differ from data based on retrospective reports which have suggested that women with intended pregnancies report healthier preconception behaviors [3–5] and one cross-sectional study where non-pregnant women intending future pregnancy report healthier behaviors [6]. By using longitudinal data to measure health behaviors, the likelihood of recall bias encountered in retrospective studies is reduced.

Not surprisingly, incident pregnancy was associated with greater folic acid supplementation and reduced binge drinking. It is possible that these favorable changes in behavior did not occur until the pregnancy was recognized, which may be too late for greatest benefit. Of concern, incident pregnancy was not associated with positive longitudinal smoking behavior in our sample. Certainly young women should be a focus of preconception health messaging, since the youngest age group (18–24 years) was less likely to have positive longitudinal behaviors in terms of binge drinking and smoking. It is also of interest that receiving counseling on related health topics did not positively impact longitudinal health behaviors, providing additional evidence that brief counseling in the setting of a health care visit may not be adequate to effectively change the preconception health behaviors studied here.

The findings in this study are worth noting for several reasons. Since women in this sample who intend pregnancy were more likely to become pregnant than those not intending pregnancy [7], this is a relevant sample to study in terms of health behaviors that are related to future pregnancy. There are a number of unanswered questions, however. For example, what does a woman mean when she states she is considering a future pregnancy? Are there concomitant changes in behavior? There is likely some change in behavior (e.g., frequency of sexual

intercourse, birth control use) that results in increased likelihood of pregnancy, but does intent lead to other behavioral changes as well? From these results, intent does not seem to be correlated with a change in health behaviors that may impact pregnancy outcomes. These findings support the need for promotion of better preconception care, as has been recommended by the CDC [1]. Further work is needed to evaluate what women know about preconception health behaviors and what interventions may be effective in producing behavioral change in the preconception period.

Our study has several limitations. Report of health behaviors were collected at two time points: the baseline and 2-year follow-up surveys. We use the data from these two time points to represent health behaviors during the 2 year period, but we do not actually know if the behaviors reported were sustained throughout the study period, or if there was a change in behavior, when that change may have occurred. We use self-reported data which may result in women reporting more socially desirable behaviors, although the percentages reporting unhealthy behaviors in this sample are similar to or higher than other samples. Although our sample was highly representative of the target Central Pennsylvania population, this population is largely non-Hispanic white and does not include adolescents. Therefore, our findings may not be representative of more diverse populations.

In summary, our study confirms the need for improved preconception health promotion. We did not see evidence that women intending pregnancy were more likely to engage in positive longitudinal health behaviors. Policy makers, researchers, and health care providers should further investigate methods for effectively translating preconception health recommendations into clinical care and practice as this represents an area of great potential for improvement of pregnancy outcomes.

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Table 1

Distribution of positive and negative longitudinal behaviors^a (percentages, *n*)

Behavior	Positive longitudinal behavior		Negative longitudinal behavior		
	Sustained healthy levels	Improved from unhealthy to healthy levels	Remained unhealthy, but improved	Worsened from healthy to unhealthy levels	Remained unhealthy, without improvement
Fruit consumption	24% (204)	13% (111)	13% (109)	13% (110)	37% (313)
Vegetable consumption	29% (245)	16% (135)	10% (83)	15% (124)	31% (259)
Folic acid supplementation	29% (245)	16% (135)	10% (83)	15% (124)	31% (259)
Physical activity	12% (103)	9% (80)	15% (130)	14% (121)	49% (411)
Binge drinking Avoidance	80% (676)	7% (60)	2% (19)	6% (48)	5% (43)
Smoking avoidance	79% (669)	4% (34)	1% (5)	3% (29)	13% (109)
Vaginal douching avoidance	81% (683)	5% (38)	1% (12)	5% (40)	8% (71)

^aPositive longitudinal behavior was defined as sustained healthy levels of behavior at both baseline and follow-up, or improved health behavior between baseline and follow-up. Negative longitudinal behavior was behavior that remained unchanged at below healthy levels or declined from healthy to below healthy levels

Table 2Frequencies of independent variables ($n = 847$)

Variables	Percent (n)
<i>Pregnancy-related variables</i>	
Pregnancy intention at baseline	
Considering pregnancy in the next year	9 (79)
Considering pregnancy some other time in the future	37 (317)
Not considering future pregnancy	53 (451)
Reproductive life stage	
Preconceptional	30 (256)
Interconceptional	70 (591)
High perceived severity of preterm birth/low birthweight	46 (383)
Incident pregnancy during 2-year study	15 (127)
<i>Baseline health status variables</i>	
Overall self-rated health status	
Excellent/Very good	69 (587)
Good/Fair/Poor	31 (260)
Obesity (BMI 30+)	20 (169)
Diagnosis of diabetes, hypertension, or heart disease	12 (103)
Higher psychosocial stress (using Psychosocial Hassles Scale)	47 (399)
Depressive symptoms	16 (133)
<i>Baseline health care utilization variables</i>	
Obstetrician-gynecologist seen, past 2 years	71 (601)
Number of health topics discussed with a health care provider, past 12 months	
0	38 (326)
1–2	30 (250)
3–6	32 (271)
<i>Baseline sociodemographic variables</i>	
Age	
18–24 years	17 (145)
25–34 years	40 (340)
35–45 years	43 (360)
Race/Ethnicity	
White (not Hispanic)	93 (785)
Other	7 (59)
Education	
High school or less	30 (254)
Some college or more	70 (593)
Marital status	
Married or living with partner	76 (647)
Not partnered	24 (199)
Poverty status	
Poverty	7 (58)

Variables	Percent (n)
Near poverty	16 (137)
Not poverty	65 (551)
Income data not provided (missing)	12 (101)

Table 3Positive longitudinal health behaviors^a by pregnancy intention (*n* = 847)

Health behavior	Positive longitudinal behavior % (<i>N</i>)	Unadjusted odds of positive longitudinal behavior OR (95% CI)
<i>Fruit consumption</i>		
Considering pregnancy in next year	54% (43)	1.23 (0.76–1.99)
Considering pregnancy some other time	50% (159)	1.04 (0.78–1.38)
Not considering future pregnancy	49% (222)	Reference
<i>Vegetable consumption</i>		
Considering pregnancy in next year	62% (49)	1.23 (0.75–2.01)
Considering pregnancy some other time	50% (157)	0.74 (0.55–0.98)
Not considering future pregnancy	57% (257)	Reference
<i>Folic acid supplementation</i>		
Considering pregnancy in next year	52% (41)	1.73 (1.07–2.79)
Considering pregnancy some other time	41% (130)	1.11 (0.83–1.49)
Not considering future pregnancy	38% (173)	Reference
<i>Physical activity</i>		
Considering pregnancy in next year	33% (26)	0.80 (0.48–1.33)
Considering pregnancy some other time	37% (116)	0.95 (0.70–1.27)
Not considering future pregnancy	38% (171)	Reference
<i>Binge drinking avoidance</i>		
Considering pregnancy in next year	94% (74)	1.24 (0.47–3.29)
Considering pregnancy some other time	84% (266)	0.44 (0.28–0.70)
Not considering future pregnancy	92% (415)	Reference
<i>Smoking avoidance</i>		
Considering pregnancy in next year	87% (69)	1.34 (0.66–2.71)
Considering pregnancy some other time	83% (262)	0.92 (0.63–1.35)
Not considering future pregnancy	84% (377)	Reference
<i>Vaginal douching avoidance</i>		
Considering pregnancy in next year	91% (72)	1.50 (0.66–3.42)
Considering pregnancy some other time	85% (270)	0.84 (0.55–1.27)
Not considering future pregnancy	87% (391)	Reference

Bold entries indicate $P < 0.05$ ^aPositive longitudinal behavior defined as sustained healthy levels of behavior at both baseline and follow-up, or improved health behavior between baseline and follow-up

Table 4

Multivariable logistic regression models predicting positive longitudinal health behaviors: adjusted odds ratios and 95% confidence intervals

Positive longitudinal health behaviors ^a							
	Fruit consumption, <i>n</i> = 819	Vegetable consumption, <i>n</i> = 818	Folic acid supplementation, <i>n</i> = 818	Physical activity, <i>n</i> = 817	Binge drinking avoidance, <i>n</i> = 818	Smoking avoidance, <i>n</i> = 818	Vaginal douching avoidance, <i>n</i> = 816
<i>Pregnancy-related variables</i>							
Pregnancy intention at baseline							
Considering pregnancy next year	1.25 (0.70, 2.25)	1.10 (0.61, 1.98)	1.05 (0.58, 1.89)	1.05 (0.57, 1.95)	0.88 (0.29, 2.70)	1.27 (0.53, 3.05)	1.06 (0.41, 2.79)
Considering pregnancy some other time	1.39 (0.94, 2.07)	0.91 (0.61, 1.35)	1.12 (0.75, 1.67)	1.10 (0.73, 1.66)	0.70 (0.37, 1.33)	1.49 (0.86, 2.58)	0.92 (0.52, 1.63)
Not considering future pregnancy	Reference	Reference	Reference	Reference	Reference	Reference	Reference
<i>Reproductive life stage</i>							
Preconceptional	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Interconceptional	1.11 (0.76, 1.63)	1.14 (0.78, 1.68)	0.78 (0.53, 1.15)	1.44 (0.96, 2.16)	1.03 (0.55, 1.92)	0.51 (0.29, 0.89)	0.46 (0.24, 0.86)
High perceived severity of preterm birth/low birthweight	1.21 (0.91, 1.62)	1.22 (0.91, 1.63)	0.92 (0.68, 1.23)	0.80 (0.59, 1.08)	0.61 (0.37, 0.99)	0.87 (0.58, 1.30)	0.94 (0.60, 1.45)
Incident pregnancy during 2- year study	1.07 (0.68, 1.69)	1.46 (0.92, 2.30)	2.30 (1.46, 3.64)	0.54 (0.33, 0.88)	3.97 (1.46, 10.81)	1.36 (0.71, 2.58)	1.74 (0.84, 3.61)
<i>Baseline health status variables</i>							
Higher overall self-rated health status	1.01 (0.72, 1.40)	0.79 (0.56, 1.10)	0.93 (0.66, 1.31)	1.01 (0.72, 1.43)	1.03 (0.60, 1.77)	1.53 (0.99, 2.38)	1.12 (0.68, 1.82)
Obesity (BMI 30+)	0.81 (0.56, 1.19)	0.99 (0.68, 1.45)	1.01 (0.69, 1.48)	0.75 (0.51, 1.12)	0.93 (0.50, 1.75)	1.69 (0.98, 2.90)	0.65 (0.38, 1.09)
Diagnosis of diabetes, hypertension, or heart disease	0.84 (0.53, 1.33)	0.77 (0.48, 1.22)	0.94 (0.58, 1.52)	0.71 (0.43, 1.17)	0.68 (0.32, 1.42)	0.63 (0.35, 1.13)	0.75 (0.40, 1.40)
Higher psychosocial stress	0.73 (0.54, 0.99)	0.95 (0.71, 1.29)	0.91 (0.67, 1.24)	0.78 (0.57, 1.07)	0.70 (0.43, 1.15)	0.52 (0.34, 0.79)	0.66 (0.41, 1.04)
Depressive symptoms	0.95 (0.63, 1.43)	1.18 (0.78, 1.77)	0.83 (0.54, 1.27)	0.85 (0.55, 1.31)	0.78 (0.42, 1.45)	0.91 (0.54, 1.52)	0.83 (0.47, 1.47)
<i>Baseline health care utilization variables</i>							
Obstetrician gynecologist seen in past 2 years	1.31 (0.95, 1.81)	1.06 (0.77, 1.46)	0.84 (0.61, 1.17)	1.15 (0.82, 1.61)	1.31 (0.78, 2.18)	1.25 (0.80, 1.94)	1.13 (0.70, 1.81)
Number of health topics discussed, past 12 months							
0	Reference	Reference	Reference	Reference	Reference	Reference	Reference
1-2	0.80 (0.57, 1.14)	0.79 (0.56, 1.13)	0.94 (0.66, 1.35)	1.10 (0.76, 1.59)	1.56 (0.86, 2.82)	0.40 (0.24, 0.66)	0.80 (0.48, 1.33)
3-6	1.14 (0.80, 1.63)	0.95 (0.67, 1.36)	1.11 (0.77, 1.60)	1.42 (0.98, 2.04)	1.70 (0.95, 3.07)	0.53 (0.31, 0.89)	1.79 (1.00, 3.21)

Positive longitudinal health behaviors ^a							
	Fruit consumption, <i>n</i> = 819	Vegetable consumption, <i>n</i> = 818	Folic acid supplementation, <i>n</i> = 818	Physical activity, <i>n</i> = 817	Binge drinking avoidance, <i>n</i> = 818	Smoking avoidance, <i>n</i> = 818	Vaginal douching avoidance, <i>n</i> = 816
<i>Baseline sociodemographic variables</i>							
Age							
18–24	0.79 (0.46, 1.35)	0.66 (0.39, 1.13)	0.58 (0.33, 1.02)	0.82 (0.46, 1.44)	0.18 (0.08, 0.42)	0.32 (0.16, 0.65)	0.90 (0.41, 2.00)
25–34	0.89 (0.62, 1.28)	1.06 (0.73, 1.53)	1.01 (0.69, 1.46)	1.02 (0.70, 1.48)	0.54 (0.28, 1.06)	0.68 (0.41, 1.15)	0.71 (0.41, 1.22)
35–45	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Race/Ethnicity							
White (not Hispanic)	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Other	0.67 (0.37, 1.21)	0.92 (0.51, 1.65)	0.69 (0.37, 1.29)	1.30 (0.71, 2.37)	0.88 (0.35, 2.17)	1.06 (0.50, 2.28)	0.48 (0.23, 1.00)
Education							
High School or less	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Some college or more	1.07 (0.77, 1.49)	1.03 (0.74, 1.44)	1.21 (0.86, 1.71)	1.53 (1.08, 2.19)	0.61 (0.35, 1.09)	1.74 (1.12, 2.69)	1.77 (1.11, 2.84)
Marital status							
Married or living with partner	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Not partnered	0.76 (0.51, 1.13)	0.74 (0.50, 1.10)	1.03 (0.69, 1.54)	1.48 (0.98, 2.23)	1.10 (0.60, 2.03)	0.76 (0.45, 1.28)	0.63 (0.35, 1.10)
Poverty status							
Poverty	0.94 (0.52, 1.70)	1.50 (0.82, 2.74)	0.65 (0.34, 1.21)	0.77 (0.40, 1.48)	1.44 (0.51, 4.10)	0.44 (0.22, 0.88)	1.21 (0.50, 2.89)
Near poverty	0.72 (0.48, 1.08)	0.97 (0.65, 1.46)	0.88 (0.58, 1.34)	1.32 (0.87, 2.00)	0.81 (0.43, 1.52)	0.81 (0.47, 1.38)	0.71 (0.40, 1.24)
Not poverty	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Income data not provided (missing)	0.86 (0.53, 1.38)	1.27 (0.79, 2.06)	0.74 (0.45, 1.22)	1.00(0.60,1.65)	1.65 (0.73, 3.74)	1.15 (0.59, 2.21)	0.65 (0.34, 1.26)
Model likelihood ratio, <i>P</i> - value	0.07	0.10	0.02	0.01	<0.0001	<0.0001	0.0002

Bold entries indicate $P < 0.05$

^aPositive longitudinal behavior was defined as sustained healthy behavior at baseline and follow-up or any improvement in behavior between baseline and follow-up (further details in text)