

OBSTETRICS

Perceived risk of preterm and low-birthweight birth in the Central Pennsylvania Women's Health Study

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OBJECTIVE: Engaging women in preconception prevention may be challenging if at-risk women do not perceive increased risk. This study examined predictors of perceiving increased risk for preterm/low birthweight birth.

STUDY DESIGN: Using the Central Pennsylvania Women's Health Study, a population-based sample of reproductive-age women, we analyzed whether sociodemographics, health and pregnancy history, health behaviors, attitudes, or health care utilization predicted risk perception of preterm/low-birthweight birth.

RESULTS: Of the 645 women analyzed, 157 (24%) estimated their risk of preterm/low-birthweight birth to be very or somewhat likely. Higher

perceived risk was associated with being underweight, previous preterm/low-birthweight birth, having a mother with previous preterm/low-birthweight birth, lower perceived severity of preterm/low birthweight, and smoking.

CONCLUSIONS: Several factors known to predict preterm/low birthweight did influence risk perception in this study, whereas others did not. Further research on how these factors have an impact on participation in preconception care programs is warranted.

Key words: adverse pregnancy outcome, low birthweight, preterm birth, risk perception

Cite this article as: Chuang CH, Green MJ, Chase GA, et al. Perceived risk of preterm and low-birthweight birth in the Central Pennsylvania Women's Health Study. *Am J Obstet Gynecol* 2008;199:64.e1-64.e7.

Preterm and low-birthweight births continue to be significant causes of perinatal mortality and morbidity in the United States. Although prenatal care became more accessible after the mid-1980s with expansion of Medicaid coverage, rates of adverse pregnancy outcomes have not improved, and there is even evidence that these adverse pregnancy outcomes are on the rise.¹ Perhaps this is not surprising because the prenatal period is a narrow one in which to intervene in hopes of improving pregnancy outcomes. Optimizing

health in the preconception stage may prove to be more effective than prenatal care alone in reducing the incidence of adverse pregnancy outcomes and perhaps maternal health in general.² In response to these issues, the Centers for Disease Control and Prevention (CDC) has made improving preconception health delivery a priority as detailed in their recent recommendations on preconception health.³

Meeting the recommendations set out by the CDC will require engagement of both the health care delivery system and

active participation of women in the preconception period. The Health Belief Model suggests that perceived susceptibility to a condition and perceived severity of a condition contribute to likelihood of engaging in health-promoting behavioral change.⁴ Adopting this theory, we hypothesized that women who perceive increased susceptibility (or risk) of an adverse pregnancy outcome (as well as perceive increased severity of these outcomes) are more inclined to participate in preconception health optimization programs. The main purpose of this research was to better understand how women perceive their risk of preterm and low-birthweight birth. However, whether risk perception of adverse pregnancy outcome directly affects preconception health promotion has yet to be investigated.

We used the commonly applied Psychometric Model of risk perception to model our study design. The Psychometric Model suggests that people perceive risk across 2 principal factors: how well the risk is understood and how much of a feeling of dread it evokes.^{5,6} Applying the first factor of the Psychometric Model,

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Presented in part at the Society of General Internal Medicine Mid-Atlantic Regional Meeting, Hershey, PA, March 10, 2006.

Received July 20, 2007; revised Sept. 25, 2007; accepted Dec. 18, 2007.

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The Central Pennsylvania Women's Health Study is funded in part by Grant 4100020719 from the Pennsylvania Department of Health. C.H.C. is supported by Grant K23HD051634 from the National Institute of Child Health and Human Development.

The Pennsylvania Department of Health specifically disclaims responsibility for any analyses, interpretations, or conclusions presented herein.

0002-9378/\$34.00 • © 2008 Mosby, Inc. All rights reserved. • doi: 10.1016/j.ajog.2007.12.018

we considered groups of women who have higher understanding of preterm/low-birthweight birth. This may be women who have had previous experience (either direct or indirect) with preterm or low-birthweight birth or women with known risks for preterm birth or low-birthweight birth (such as advancing age, nonwhite race, underweight, hypertension, smokers) who have been counseled by health care providers about those risk factors and therefore perceive an increased risk.

The second factor in risk perception as described by the Psychometric Model is defined by the amount of a feeling of dread is evoked by thoughts of the hazard. We hypothesized that a greater feeling of dread may be seen in women who feel less control or self-efficacy toward achieving a healthy pregnancy. This may be the case in women with higher levels of psychosocial stress or lower overall health status.

In this study, we use the Central Pennsylvania Women's Health Study (CePAWHS), a population-based cohort of reproductive-age women, to determine how women perceive their risk of preterm or low-birthweight birth. Based on the Psychometric Model of risk perception, we also analyzed whether sociodemographics, pertinent health variables, pregnancy history, health status, health behaviors, attitudes, or health care utilization are associated with risk perception of preterm or low-birthweight birth.

MATERIALS AND METHODS

Study design

The CePAWHS includes a population-based survey of reproductive-age women residing in a largely rural 28-county region in Central Pennsylvania. The primary objective of the CePAWHS baseline survey was to provide estimates of the prevalence of risk factors for preterm birth and low birthweight in the region and determine the distribution of these risk factors by race/ethnicity, socioeconomic status, rurality, and health care access and utilization patterns.⁷

The current study uses these cross-sectional data collected in the CePAWHS baseline survey to evaluate how repro-

ductive-age women perceive their risk of preterm birth and low birthweight. The CePAWHS survey was approved by the Institutional Review Board of Penn State College of Medicine.

The baseline CePAWHS survey consisted of a random-digit dialing telephone survey of 2002 women, which was conducted between September 2004 and March 2005. Women 18–45 years old, residing in the 28-county Central Pennsylvania region, and English or Spanish speaking were eligible. Minority and rural populations were oversampled to ensure adequate representation of these groups.

Informed consent was obtained from all participants. Further details regarding the sampling methodology have been previously published.⁷

Women who were incapable of reproduction (because of hysterectomy, tubal sterilization, or other infertility) or were not considering a future pregnancy were not asked the question regarding perceived risk of preterm/low-birthweight birth and were therefore not included in the present analysis. Of the 2002 women participating in the random-digit dialing CePAWHS survey, 645 women were asked the question about perceived risk and are included in this analysis.

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 sociodemographics, medical history, pregnancy history, health status, health behaviors, and health care utilization were among the measures collected in the survey.

The outcome variable in this analysis was perceived risk of having a preterm birth or low-birthweight baby. This variable was derived from the survey question, "How likely do you think it is that you might have a preterm or low-birthweight baby: very likely, somewhat likely, somewhat unlikely, or very unlikely?" Of the 645 respondents, 5% replied that their risk was very likely, 19% replied somewhat likely, 35% replied somewhat unlikely, and 41% replied their risk of having a preterm or low-

birthweight baby was very unlikely. The responses to this question were then dichotomized to represent the outcome variable used in this analysis (women reporting being very/somewhat likely vs very/somewhat unlikely to have a preterm or low-birthweight baby).

We chose independent variables that fit our theoretical model on risk perception of preterm/low-birthweight birth based on the Psychometric Model and/or expected to be associated with preterm/low-birthweight birth based on current literature. These included pertinent health variables (weight category, diabetes, and hypertension), pregnancy history, health status, health behaviors, attitudes, health care utilization, and sociodemographic variables. Weight category was classified as underweight for body mass index (BMI) below 18.5 kg/m², normal weight for BMI 18.5 to 24.9 kg/m², overweight for BMI 25.0 to 29.9 kg/m², and obese for BMI 30 kg/m² and above. The BMI was calculated from self-reported weight and height data.

We hypothesized that being underweight would increase risk perception because of the association of low maternal weight with preterm birth and low birthweight.^{8,9} Survey participants reported diabetes and hypertension based on self-reported confirmation of the condition by a doctor or other health care provider within the past 5 years.

Because hypertension has been strongly associated with preterm birth and low birthweight,^{10–12} we hypothesized that hypertensive women would have been counseled of these pregnancy risks by their health care providers, and thus, they would perceive an increased risk. Although pregnancies complicated by pregestational diabetes are at an increased risk for hypertension and preterm birth,¹² we suspected that women with diabetes would be more aware of the risk of macrosomia and therefore not perceive increased risk.

Pregnancy history variables were previous preterm birth or low-birthweight birth, previous birth defect/birth disorder, and participant's mother with history of a low-birthweight/preterm birth. Not only are previous low birthweight and fetal malformation associated with

these outcomes,¹³ but also these experiences may increase familiarity with these outcomes. We therefore hypothesized that these pregnancy variables would be associated with increased perceived risk of preterm birth and low birthweight.

Overall health status was measured using the first item from the SF-12v2 Health Survey,¹⁴ comparing those who report their overall health as excellent or very good vs good, fair, or poor. We hypothesized that women reporting lower health status may be more pessimistic about their health and thus perceive higher risk of adverse pregnancy outcomes. Health behaviors known to increase the risk of adverse pregnancy outcomes, current cigarette smoking,¹⁵⁻¹⁷ and any illicit drug use^{15,18} in the past month were included and expected to be associated with increased perceived risk.

A variable representing perceived severity of preterm birth/low-birthweight baby for a baby's health (dichotomous variable representing perceiving preterm birth or low birthweight as very serious health risk vs somewhat serious/somewhat small/very small health risk) was included. The rationale for including this measure comes from the Health Belief Model, which suggests that perceived severity of a condition (as well as perceived susceptibility) contributes to the likelihood of health-promoting behavioral change⁴; thus, we wanted to evaluate the relationship of perceived severity and perceived risk of preterm and low-birthweight birth.

The Psychosocial Hassles Scale was used as a measure for psychosocial stress. This 12-item scale measures the degree to which common hassles (eg, money worries, problems with friends) are perceived as stressful (on a 4-point scale ranging from "no stress" to "severe stress") 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,¹⁹ which in turn was adapted from the stress subscale of the Prenatal Psychosocial Profile developed by Curry et al.²⁰

Studies differ on whether stress is linked to preterm birth or low birthweight,^{21,22} but we hypothesize psycho-

social stress may be associated with increased worry and perhaps feeling of dread regarding health risks and were therefore interested in evaluating its relationship with risk perception. A health care utilization variable was also included to indicate whether the participant had 5 or more health care visits in the past year. We hypothesized that greater health care utilization would be associated with greater perceived risk because this subgroup would have had more opportunities for pregnancy risk counseling.

Additionally, higher utilization could also be a marker for a greater burden of medical conditions, which could also increase risk perception. Sociodemographic measures were age group (18-34 vs 35-45 years), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, or other), education (high school graduate or less vs at least some college), and annual household income (less than \$30,000; \$30,000-44,999; \$45,000-64,999; \$65,000 or more, refused/do not know/missing). Because older age, non-white race, and lower socioeconomic status have been associated with preterm birth and low birthweight,¹³ we expected these variables to be associated with increased perceived risk.

Statistical analysis

Frequencies of the study variables were determined. Bivariate tests of the associations of the independent variables with perceived risk of preterm/low birthweight were performed using χ^2 tests, Fisher's exact tests, simple logistic regressions, and *t* tests. A multivariable logistic regression model was fit to predict higher perceived likelihood of preterm/low-birthweight birth, using the independent variables as predictors. All statistical analyses were performed using SAS software, version 9.0 of the SAS System for Windows (SAS Institute Inc, Cary, NC).

RESULTS

Characteristics of the 645 women included in this analysis are shown in Table 1. Overall, 24% of the women perceived themselves to be very likely (5%) or somewhat likely (19%) to have a preterm

birth or low-birthweight baby. The remaining women with lower perceived risk described their risk as somewhat unlikely (35%) or very unlikely (41%). The proportion of women perceiving higher risk of preterm birth or low birthweight with respect to the independent variables is also shown in Table 1.

In these bivariate analyses, none of the sociodemographic variables (age category, race/ethnicity, education, and income) predicted risk perception. Similarly neither of the chronic medical conditions (diabetes, hypertension) was individually associated with higher perceived risk of adverse pregnancy outcome; however, there was a significant association between being underweight and perceiving higher risk of preterm/low-birthweight birth ($P = .01$), compared with normal-weight women.

Of the pregnancy history variables, previous preterm or low-birthweight birth, previous preterm birth defect/birth disorder, and participant's mother with history of preterm or low-birthweight birth were all associated with higher perceived risk of the adverse pregnancy outcomes of preterm and low-birthweight birth. Other significant bivariate predictors were lower health status, higher levels of psychosocial stress, smoking, and greater health care utilization.

The results of the multivariable model are shown in Table 2. None of the sociodemographic variables were associated with risk perception of preterm/low birthweight in the multivariable model. Being underweight (adjusted odds ratio 3.61, 95% confidence interval (CI) 1.09 to 12.03) was the only health history variable associated with increased risk perception. Of the pregnancy history variables, previous preterm or low-birthweight birth and having a mother with history of previous preterm/low-birthweight birth remained significantly associated with the outcome in adjusted analysis. Other predictors of increased perceived risk were smoking, lower perceived severity of preterm/low-birthweight birth, and greater health care utilization (5 or more health care visits in the past year). Health status and psychosocial stress variables were not significant in the model.

TABLE 1

Sample characteristics and higher perceived risk of preterm birth/low birthweight by study characteristics (n = 645)

Characteristic	n (%)	Perceive preterm birth/low birthweight as very/somewhat likely, n (%)	P value ^a
Sociodemographic variables			
Age category, y			.91
18-34	570 (89)	140 (25)	
35-45	71 (11)	17 (24)	
Race/ethnicity			.38
Non-Hispanic white	561 (87)	131 (23)	
Non-Hispanic black	39 (6)	11 (28)	
Hispanic	30 (5)	11 (37)	
Other	12 (2)	3 (25)	
Education			.36
High school graduate or less	215 (33)	57 (27)	
Some college or more	430 (67)	100 (23)	
Annual household income			.06
Less than \$30,000	155 (24)	50 (32)	
\$30,000-\$44,999	116 (18)	26 (22)	
\$45,000-\$64,999	124 (19)	31 (25)	
\$65,000 and above	153 (24)	34 (22)	
Refused/do not know/missing	97 (15)	16 (16)	
Health variables			
Weight category			.03
Underweight	15 (2)	8 (53)	
Normal weight	335 (53)	77 (23)	
Overweight	153 (24)	42 (27)	
Obese	134 (21)	28 (21)	
Diabetes	15 (2)	3 (20)	.69
Hypertension	48 (7)	15 (31)	.25
Pregnancy history			
Previous preterm/low birthweight	52 (8)	35 (67)	<.0001
Previous birth defect/birth disorder	20 (3)	11 (55)	.003
Mother with history of preterm birth/low birthweight	105 (16)	44 (42)	<.0001
Health status variables			
Higher health status	421 (65)	91 (22)	.03
Psychosocial stress (mean, SD)	17.5 (4.2)	18.4 (4.9)	.006
Health behaviors			
Current smoker	150 (23)	53 (35)	.0003
Current drug use	27 (4)	9 (33)	.27

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TABLE 1

Sample characteristics and higher perceived risk of preterm birth/low birthweight by study characteristics (n = 645)

Continued from page 64.e4.

Characteristic	n (%)	Perceive preterm birth/low birthweight as very/somewhat likely, n (%)	P value ^a
Higher perceived severity of preterm/low birthweight	241 (38)	50 (21)	.12
Health care utilization	264 (42)	79 (30)	.002
5 or more health care visits/past year			

Participants of the (CePAWHS) without hysterectomy, tubal sterilization, infertility, or not considering future pregnancy.

^a χ^2 analysis (or Fisher's exact test when appropriate) for categorical variables and *t* tests for continuous variables comparing participants perceiving higher risk to those perceiving lower risk of preterm birth or low birthweight.Chuang. Preterm and low-birthweight birth in the CePWHS. *Am J Obstet Gynecol* 2008.**COMMENT**

In this analysis of the CePAWHS cohort, perceiving increased risk for a preterm or low-birthweight birth was predicted by being underweight, previous preterm or low-birthweight birth, having a mother with history of previous preterm or low-birthweight birth, smoking, and lower perceived severity of preterm or low-birthweight birth, and greater health care utilization.

In accordance with the Psychometric Model,⁶ we hypothesized that women with increased familiarity with preterm/low-birthweight birth would correlate with greater perceived risk. This can explain why experience with the outcome (personal or mother's history of preterm/low-birthweight birth) or known predictors (smoking, being underweight) were found to be associated with increased risk. It also suggests that other known predictors (older age, nonwhite race, lower socioeconomic status, and hypertension) are not well known to be associated with preterm/low-birthweight birth by our study participants because these variables did not contribute to risk perception in our analysis.

The second factor of the Psychometric Model suggests an increased feeling of dread about the outcome drives risk perception. In our study, we tested "dread" with psychosocial stress or lower health status variables, but these variables were not significant in our analysis. We were surprised to find that lower perceived severity of preterm/low-birthweight birth was associated with higher perceived risk of these outcomes. Perception of severity may be attributable to other personal experiences that we did not measure in our

study. The role of perceived severity and its role in risk perception will need further study.

The strength of this study is the use of a population-based sample that is representative of women residing in central Pennsylvania. This largely rural region is similar to many nonurban areas in the United States and therefore generalizes well to many populations. The large sample size and rigorous survey methodology also strengthen the study.

There are limitations to consider in our survey methodology. The survey items used to determine risk perception and perceived severity of preterm or low-birthweight birth did not specify a degree of preterm or low birthweight. Some babies that just meet definitions for preterm or low birthweight may have relatively few complications, whereas babies that are more preterm or of lower birthweight may be expected to have more severe complications. Participants could have considered the degree of preterm and low birthweight birth quite differently, which may affect the reliability of survey responses.

Previous research on perceived risk of adverse pregnancy outcomes has been very limited; therefore, a valid and reliable method of measuring this construct has not been established. The question used in the CePAWHS study aims at assessing one's perceived absolute risk, in terms of likelihood of having a preterm or low-birthweight birth. This may be problematic; 1 woman may consider a 5% risk to be "very unlikely," whereas another woman may consider the same 5% risk to be "likely."

Use of these subjectively calibrated responses has been a recurring obstacle in risk perception literature.²³ Additionally, this measure cannot be used to determine whether women perceive their absolute risk of adverse pregnancy outcomes accurately but can be used only to compare their perceived absolute risk to others in the study. Perceived absolute risk could also have been assessed quantitatively using numeric percentages, but this methodology is also problematic because numeracy skills among even literate persons can be poor.²⁴ Alternatively, risk perception can be assessed as a relative risk measure, in which a woman is asked how her risk compares with the risk of an average woman of her same age. Further understanding of how to measure and interpret a woman's perceived risk of adverse pregnancy outcome will require further study, perhaps qualitatively, as well as quantitatively.

Some known predictors of preterm and low-birthweight birth were associated with greater perceived risk in our analysis (underweight, previous preterm/low birthweight birth, smoking); however, other known predictors (such as older age, nonwhite race, lower socioeconomic status, and hypertension) did not. Because the Health Belief Model suggests that perceived susceptibility is a key contributor to the likelihood of engaging in health-promoting behavioral change,⁴ these findings have implications for efforts to improve preconception care. Research is needed to investigate whether women perceiving higher risk of adverse pregnancy outcomes are more likely to engage in health-changing behaviors. Furthermore, if women at

TABLE 2

Logistic regression modeling higher perceived risk of preterm birth or low birthweight (n = 614)

Characteristic	Adjusted odds of perceiving higher risk of preterm birth/low birthweight (95% CI)
Sociodemographic variables	
Age category, y	
18–34	Reference
35–45	1.40 (0.74 to 2.67)
Race/ethnicity	
Non-Hispanic white	Reference
Non-Hispanic black	1.51 (0.64 to 3.55)
Hispanic	1.31 (0.48 to 3.58)
Other	0.58 (0.12 to 2.73)
Education	
High school graduate or less	Reference
Some college or more	1.01 (0.62 to 1.63)
Annual household income	
Less than \$30,000	1.24 (0.66 to 2.31)
\$30,000–44,999	0.97 (0.50 to 1.89)
\$45,000–64,999	1.29 (0.69 to 2.41)
\$65,000 and above	Reference
Refused/do not know/missing	0.67 (0.31 to 1.44)
Health variables	
Weight category	
Underweight	3.61 (1.09 to 12.03)
Normal weight	Reference
Overweight	1.02 (0.61 to 1.69)
Obese	0.77 (0.43 to 1.37)
Diabetes	0.38 (0.09 to 1.67)
Hypertension	0.56 (0.21 to 1.47)
Pregnancy history	
Previous preterm/low-birthweight baby	8.15 (3.94 to 16.88)
Previous birth defect/birth disorder	1.32 (0.34 to 5.08)
Mother with history of preterm/low-birthweight baby	2.28 (1.36 to 3.82)
Health status variables	
Higher health status	0.75 (0.47 to 1.19)
Stress and exposures	1.03 (0.98 to 1.08)
Health behaviors	
Current smoker	1.65 (1.01 to 2.69)
Current drug use	1.18 (0.45 to 3.11)
Higher perceived severity of preterm/low birthweight	0.52 (0.33 to 0.82)
Health care utilization	1.98 (1.29 to 3.06)
5 or more health care visits/past year	

Participants of the CePAWHS without hysterectomy, tubal sterilization, infertility, or not considering future pregnancy. Logistic regression analysis was limited to 614 participants because of listwise deletion.

Chuang. Preterm and low-birthweight birth in the CePAWHS. *Am J Obstet Gynecol* 2008.

greater risk for adverse pregnancy outcomes do not perceive increased risk, effectively engaging women in preconception health promotion may be challenging.

Research in preconception health modification has previously focused on intervening with specific health behaviors or medical conditions, such as smoking cessation for smokers or glycaemic control for diabetics. However, it is now being recognized that all women in the preconception period may benefit from efforts to improve preconceptional health.³ Because current efforts focus more broadly on general preconception health promotion applicable to all preconception women, better understanding of risk perception (or lack thereof) of adverse pregnancy outcomes in this broader group of women is needed. This will better guide our efforts in designing preconception health promotion programs that effectively engage all preconception women. ■

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