

## PRECONCEPTIONAL HEALTH: RISKS OF ADVERSE PREGNANCY OUTCOMES BY REPRODUCTIVE LIFE STAGE IN THE CENTRAL PENNSYLVANIA WOMEN'S HEALTH STUDY (CePAWHS)

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This study used population-based data to examine how health status and risks vary by reproductive life stage, with particular focus on the proximal risks for preterm birth and low birthweight (LBW) infants in preconceptional and interconceptional women. Data are from the Central Pennsylvania Women's Health Study (CePAWHS), which included a telephone survey of a representative sample of 2,002 women ages 18–45 years residing in largely rural central Pennsylvania. Women were classified according to reproductive stage—preconceptional, interconceptional, and postconceptional—on the basis of pregnancy history and reproductive capacity. Multiple indicators of health status and health risks were examined by reproductive stage, stratified by age group (ages 18–34 and ages 35–45). Results show that many risk factors varied significantly by reproductive stage and by age group within reproductive stage. Preconceptional and interconceptional women exhibited several unhealthy behaviors (e.g., binge drinking, nutritional deficits, physical inactivity). Younger pre- and interconceptional women (ages 18–34) had more gynecologic infections, some less favorable health behaviors, and more psychosocial stress than older women (ages 35–45) in the same reproductive stages. Older preconceptional women were more likely to have chronic conditions (hypertension, high cholesterol) than younger preconceptional women. Results suggest how interventions could be tailored to women's reproductive stages.

Researchers, clinicians, and policymakers have called for reallocating efforts to improve maternal health and pregnancy outcomes from the prenatal period to the preconceptional and interconceptional periods (Moos, 2004). The prenatal period is a narrow timeframe in which to intervene to improve health and pregnancy outcomes, such as preterm birth and

low birthweight (LBW) infants or birth defects related to insufficient folate levels, even with early and adequate prenatal care. Many risk factors, such as infections and chronic stressors, likely predate pregnancy, and other risk factors, such as chronic conditions like hypertension and diabetes, cannot be optimally treated during pregnancy. Further, there is little evidence that improved access to prenatal care in the U.S. population, owing largely to the expansions of Medicaid since the mid-1980s, has improved maternal health or reduced the rates of adverse pregnancy outcomes. In fact, the proportions of live births that

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are premature (<37 weeks of gestation) and LBW (infants weighing <2,500 g) have been increasing (Martin et al., 2005).

Given the limitations of intervening during pregnancy alone, perspectives that place pregnancy in the context of women's overall health and reproductive lifespan are needed. Various conceptual frameworks have been advanced, including a life course perspective that locates determinants of reproductive potential in early life experiences and cumulative allostatic load (Lu & Halfon, 2003) and a lifespan perspective based on understanding the multiple determinants of perinatal health during women's reproductive stages (Misra, Guyer, & Allston, 2003). Differentiation of the preconceptional period (before pregnancy) and interconceptional period (between pregnancies, including postpartum) is important both for understanding the timing of risks and their impact and for determining optimal intervention points (Kotelchuck, 2003).

Although numerous risk factors for adverse pregnancy outcomes have been identified, the research to date linking prepregnancy health with pregnancy outcomes is scant (Haas et al., 2005; Lu & Halfon, 2003; Misra et al., 2003). This research, furthermore, is limited by retrospective designs using samples of women who are already pregnant or have recently given birth. Reliance on such research to understand prepregnancy health is problematic because of recall bias. Prospective research linking prepregnancy health with pregnancy outcomes is not available in part because operationalization of the *pregnancy* period is difficult. Because approximately half of all pregnancies in the U.S. are unintended (Henshaw, 1998), researchers cannot know with certainty, based on women's stated intentions at a point in time, which women will or will not become pregnant in the future. In addition, comprehensive data sources on the health of women in the population, including measures of both reproductive health and nonreproductive health for women at various reproductive life stages, are not available. Yet efforts to develop programs for "preconception care" or policies to ensure the health of preconceptional and interconceptional women require information about the health of women at these reproductive stages.

This study sought to operationalize the concept of *preconceptional health* by describing the health status and health risks of a representative sample of women of reproductive age in a defined geographic area. The data are from the Central Pennsylvania Women's Health Study (CePAWHS), an ongoing multiphase study designed to identify and intervene on multiple risks for preterm birth and LBW in a largely rural population. In this paper, pregnancy history and reproductive capacity, rather than pregnancy intentions, were used to classify women according to reproductive stages: preconceptional, interconceptional, and

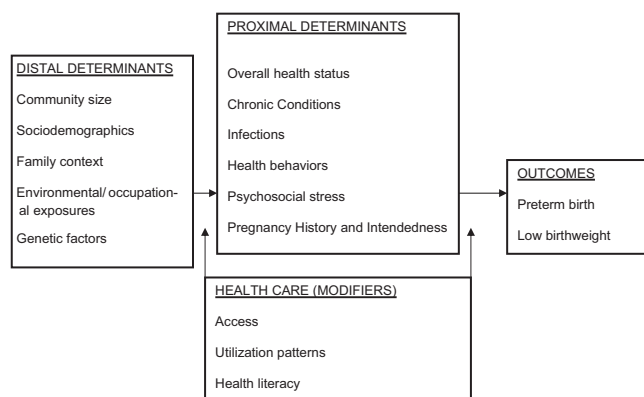


Figure 1. Conceptual framework.

postconceptional. An integrated perinatal health framework adapted from work by Misra and colleagues (2003) was used to conceptualize the key proximal risks for preterm birth and LBW during women's preconceptional and interconceptional periods (Figure 1). Proximal risks were categorized as overall health status, chronic conditions, infections (gynecologic and periodontal), health behaviors, psychosocial stress, and pregnancy history and intendedness. All but the latter category are addressed in this analysis, which shows how proximal risks vary by reproductive life stage. We were particularly interested in the health risks of preconceptional and interconceptional women, because these are groups who can be targeted for prepregnancy interventions to reduce adverse pregnancy outcomes.

## Methods

Phase I of CePAWHS consisted of a population-based survey of women of reproductive age residing in a largely rural 28-county region in central Pennsylvania. The purpose of the survey was to estimate the prevalence of multiple risk factors for preterm birth and LBW, identify subpopulations at greatest risk, and provide a baseline for a prospective cohort study to link prepregnancy health with pregnancy outcomes. The study was reviewed and approved by the Institutional Review Board of the Penn State College of Medicine and a Certificate of Confidentiality from NIH (CC-HD-04024) was obtained.

### Survey sample and data collection

A random-digit dialing (RDD) telephone survey was conducted between September 2004 and March 2005. Inclusion criteria were female gender, age 18–45 years, residence in the 28-county target region, and English or Spanish speaking. Exclusions included participants needing a proxy or translator to respond to the survey. (A simultaneous survey was conducted of a representative sample of Old Order Amish women,

whose households do not have telephones, but the data were not available as of this writing.)

The telephone sample was obtained using a disproportionately stratified RDD design. The population consisted of all telephone central office codes (3-digit exchanges) in the target region. Telephone numbers were oversampled in rural counties and in areas estimated to include  $\geq 30\%$  minority populations. The sample was designed to yield completed interviews with 2,000 women; this sample size yields estimates of sample characteristics that are accurate to within  $\pm 2.2\%$  at the 95% confidence level.

Field preparation included publicizing the study in the media (local newspapers and radio interviews) and through community organizations. The Penn State Survey Research Center conducted the survey in English and Spanish, using computer-assisted telephone interviewing. The interviews took an average of 30 minutes.

Sampled households for which an address was available (32%) received a prenotification letter including a small (\$2) incentive. Interviewers contacted the sampled households to screen for an eligible respondent and obtain consent to be interviewed. If the household contained more than 1 eligible woman, 1 woman was randomly selected to be the respondent. Interviewers made up to 25 calls per household before considering the household a noncontact.

#### Response rate

The American Association for Public Opinion Research (AAPOR, 2004) defines *response rate* as the number of complete interviews with reporting units divided by the number of eligible reporting units in the sample, and *cooperation rate* as the proportion of all cases interviewed of all eligible units ever contacted. The RDD sample yielded 2,002 complete interviews (an additional 29 partially completed interviews are excluded from analysis). An eligible household was defined as one in which there was at least 1 resident woman aged 18–45 who spoke English or Spanish. A response rate calculated using an estimated proportion eligible among households of unknown eligibility (AAPOR Response Rate 4) yields a response rate of 52%. This rate is consistent with RDD survey trends reported by Curtin, Presser, & Singer (2005). The cooperation rate was 63%. Comparisons of sample demographics with U.S. Census data show that the sample is highly representative of the target population (see Results).

#### Measures

Reproductive life stage was defined based on pregnancy history and reproductive capacity. *Preconceptional* women were defined as those who have never been pregnant but are capable of reproduction (19% of the sample,  $n = 385$ ); *interconceptional* women as those

who have had at least 1 pregnancy and are capable of reproduction (47%,  $n = 950$ ); and *postconceptional* women as those who are not capable of reproduction, defined as having had a hysterectomy or tubal ligation, or who believe themselves to be infertile owing to menopause or other factor (33%,  $n = 666$ ). These category labels are not intended to imply that all women will become pregnant; however, only women in the first 2 categories (preconceptional and interconceptional) are at risk of a future pregnancy. These category definitions are consistent with the conceptualization of women's reproductive stages in Misra et al. (2003).

Several indicators of health status and health risks are presented. Overall health status was measured using the SF-12v2TM Health Survey (Ware et al., 2002). A set of 12 questions about health and functioning during the past 4 weeks were scored, using norm-based scoring, as 8 scales and 2 summary measures, representing physical and mental health. (Scores have a mean of 50 and a standard deviation of 10 in the 1998 general U.S. population; higher scores indicate better health status.) The norm-based summary measures are presented herein. In addition, women were asked, "In the past 5 years, has a doctor or other health care professional told you that you have any of the following health conditions. . . [list of 28 chronic and acute conditions]?" The presence of selected major chronic conditions, periodontal disease (an infectious condition that has been implicated in preterm delivery), and a summary score of gynecologic infections (including urinary tract infection, chlamydia, herpes, gonorrhea, syphilis, pelvic inflammatory disease, bacterial vaginosis, vaginal yeast infection, HIV/AIDS, and hepatitis B) are presented. Depressive symptoms were measured using a 6-item scale assessing the frequency of symptoms in the past week, based on the Center for Epidemiologic Studies Depression Scale (Radloff, 1977); we used a dichotomous indicator of high risk for psychological distress, particularly depression (Sherbourne, Dwight-Johnson, & Klap, 2001). Finally, body mass index (BMI) was computed based on self-reports of height and weight.

A number of health behaviors related to adverse pregnancy outcomes were measured, and those reported here reflect high-prevalence risks to health in this sample. They include current cigarette smoking, binge drinking (defined as  $\geq 5$  drinks of alcoholic beverages on 1 occasion among those who reported alcohol consumption) during the past month, number of servings of vegetables (excluding carrots, potatoes, and salad) in a typical week, use of a multivitamin with folic acid in the past month, number of days per week getting  $\geq 30$  minutes of moderate or strenuous exercise (defined as physical activities or exercises such as "working out, running, brisk walking, tennis, swimming, or golf"), and frequency of vaginal douch-

ing in the past 12 months. These measures were based on standard items used in the Behavioral Risk Factor Surveillance System and on current recommendations with regard to physical activity (American College of Sports Medicine, 2000).

Several measures of stressors are presented. The Prenatal Psychosocial Profile Hassles Scale (Curry, Campbell, & Christian, 1994), a 12-item scale measuring the degree to which common hassles (e.g., money worries, problems with friends) are perceived as stressful (on a 4-point scale from no stress to severe stress), was modified for hassles during the past 12 months, rather than for during pregnancy. The scale score is a sum, with a higher score indicating greater stress (Cronbach  $\alpha = .69$ ). Intimate partner violence was measured using an 8-item scale adapted from the Conflict Tactics Scale (Straus, 1979) and used in the 1998 Commonwealth Fund Survey of Women's Health (Collins et al., 1999), assessing types of violence perpetrated by a "spouse, partner, or boyfriend"; the scale score is a count of the number of types violence occurring during the past 12 months (Cronbach  $\alpha = .83$ ). Experiencing unfair treatment based on race, ethnicity, or cultural background and based on gender was measured using items adapted from Krieger (1999); these measures assess unfair treatment in 7 areas (getting a job, at work, at school, getting housing, getting medical care, on the street or in a public setting, and by police or in the courts). We present the percentage of women reporting unfair treatment within the past 12 months.

### Analyses

The analyses reported here examined differences in levels of risk factors by reproductive life stage, within age groups, and differences by age within reproductive stages. Analyses are stratified by age group because reproductive life stage is strongly associated with age: for preconceptional women, mean age was 27.1 (standard deviation = 7.5); for interconceptional women, mean age was 33.5 (SD = 6.9); and for postconceptional women, mean age was 37.4 (SD = 5.9). Two age groups are defined: ages 18–34, the peak reproductive years, and ages 35–45, the later reproductive years.

Analyses used cross-tabulations and the  $\chi^2$  statistic, *t*-test, or ANOVA and the *F*-test, depending on the form of the variables. Analyses were conducted using SAS software, Version 9.1 (SAS Institute Inc., Cary, NC).

### Results

Table 1 shows selected sociodemographic characteristics for women ages 18–44 in the CePAWHS RDD sample compared with U.S. Census data for women

**Table 1.** Representativeness of the CePAWHS RDD sample: Demographic characteristics of RDD sample and 28-county central Pennsylvania region, women ages 18–44<sup>a</sup>

	CePAWHS RDD sample <sup>b</sup> (weighted <i>n</i> = 1,878) (%)	Central Pennsylvania <sup>c</sup> ( <i>n</i> = 549,166) (%)
Age (years)		
18–19	8.8	8.1
20–24	17.4	17.2
25–29	16.0	15.6
30–34	16.7	17.3
35–39	20.7	20.6
40–44	20.3	21.3
Race		
White	93.1	92.4
African American	4.1	3.6
Other	2.9	4.0
Hispanic ethnicity	2.3	2.9
Education		
Less than high school	11.8	12.3
High school graduate	39.3	39.1
Some college	30.7	30.2
College graduate	13.7	13.7
Postgraduate	4.5	4.7
Poverty status (poverty)	11.9	12.7

<sup>a</sup>Comparisons are for women ages 18–44 because the U.S. Census provides data in 5-year intervals among women aged  $\geq 20$  (i.e., women aged 45 in the RDD sample are deleted from this table for purposes of these demographic comparisons).

<sup>b</sup>Data are weighted to account for oversampling of rural and minority populations.

<sup>c</sup>Data are from the 2000 U.S. Census.

ages 18–44 in the 28-county Central Pennsylvania region. Although the CePAWHS includes women ages 18–45, only women ages 18–44 are shown to allow comparison with the U.S. Census age categories. The RDD sample is highly representative of the target population with respect to all variables shown.

Table 2 shows how selected sociodemographic characteristics of women in the CePAWHS RDD sample are associated with reproductive stages and age group. Among women in both the younger and older age groups, preconceptional status was associated with relative socioeconomic advantage compared with inter- and postconceptional women, including generally higher educational attainment, greater likelihood of being employed full time, and lower likelihood of being poor or near poor. Older interconceptional women, compared with younger interconceptional women, were more likely to be white, college graduates, married, and employed, and they tended to have higher household incomes and to be nonpoor. As might be expected, preconceptional women in both age groups were the least likely to be married or living with a partner.

Table 3 displays various health indicators for the full sample and stratified by reproductive stage and age group. In the full sample, the most prevalent

**Table 2.** Sociodemographic characteristics by reproductive stage, women ages 18–45

	Ages 18–34			Ages 35–45		
	Preconceptional (n = 319)	Interconceptional (n = 519)	Postconceptional (n = 194)	Preconceptional (n = 66)	Interconceptional (n = 431)	Postconceptional (n = 472)
Race/ethnicity (%)						
White, non-Hispanic	94	83	83	86	95	91
Black, non-Hispanic	3	9	9	6	2	5
Hispanic	2	6	5	4	1	3
Other	1	2	3*	3	1 <sup>†</sup>	2 <sup>†</sup>
Education (%)						
Less than high school	8	8	16	3	3	9
High school graduate	19	32	41	23	29	43
Some college	33	32	32	27	30	29
College graduate	40	28	11*	47	38 <sup>†</sup>	18* <sup>†</sup>
Married or living with partner (%)						
	43	83	80*	62 <sup>†</sup>	90 <sup>†</sup>	84*
Employment status (%)						
Employed full time	56	45	47	77	49	59
Employed part time	29	22	19	15	30	20
Not employed	15	33	34*	8 <sup>†</sup>	22 <sup>†</sup>	21* <sup>†</sup>
Household income (%)						
<\$20,000	11	15	18	6	5	8
\$20–29,999	8	12	16	8	8	9
\$30–44,999	17	20	25	20	15	19
\$45–64,999	17	20	23	23	20	24
≥\$65,000	25	22	10	30	41	29
Don't know/refused	22	11	7*	14	12 <sup>†</sup>	12 <sup>†</sup>
Poverty status (%)						
Poverty	8	15	19	4	7	7
Near poverty	12	29	38	2	16	22
Not poverty	80	55	43*	95 <sup>†</sup>	78 <sup>†</sup>	71* <sup>†</sup>

\* $P < .05$ , based on  $\chi^2$  tests of associations between reproductive stage and sociodemographic characteristics, by age group.

<sup>†</sup> $P < .05$  for age group comparisons within reproductive stage.

health conditions were gynecologic infection (38%), anxiety or depression (28%), obesity (22% by diagnosis and 25% by BMI), and depressive symptoms (21%). A sizable minority was diagnosed with hypertension or high cholesterol. (Diabetes was not included in this table because only 2.4% of women in the sample reported having diabetes.) With regard to health behaviors, 25% were current cigarette smokers, and among women who drink alcohol (about half the sample), 29% reported having  $\geq 5$  drinks on 1 occasion in the past month. Intake of vegetables and vitamin supplements with folic acid were far below recommended levels, as were levels of physical activity, with only 25% of women reporting moderate or strenuous exercise on 4–7 days per week. Vaginal douching, which has been associated with heightened risk of gynecologic infection, was reported by 23% of women.

Among women ages 18–34, postconceptional women tended to have significantly worse physical health status, more anxiety or depression, more depressive symptoms, more obesity, lower folic acid use, and more use of douching compared with pre- and interconceptional women. Preconceptional women had the lowest percentages reporting hypertension and high cholesterol, periodontal disease, gynecologic

infection, obesity, smoking, douching, and the highest percentage reporting physical activity on  $\geq 4$  days per week. Preconceptional women also had the highest percentage reporting binge drinking and consumption of vegetables less often than daily, and they were less likely than interconceptional women to use folic acid. Interconceptional women fared worse than preconceptional women with respect to gynecologic infections, obesity, cigarette smoking, physical inactivity, and douching.

Among the older age group (ages 35–45), preconceptional women had physical health status and obesity (by BMI) similar to postconceptional women. Interconceptional women had the healthiest characteristics with regard to overall physical health and obesity, but they were less likely than preconceptional women to use folic acid. Postconceptional women had the worst mental health status (by the SF-12), including more depression.

For age comparisons within reproductive stages, it is apparent that for most health conditions, with the exception of gynecologic infections, older women exhibited poorer health than their younger counterparts. For example, whereas only 5% of younger preconceptional women reported having hypertension or high

**Table 3.** Health status, selected health conditions, and health behaviors by reproductive stage, women ages 18–45

	Total Sample ( <i>n</i> = 2,002)	Ages 18–34			Ages 35–45		
		Preconceptional ( <i>n</i> = 319)	Interconceptional ( <i>n</i> = 519)	Postconceptional ( <i>n</i> = 194)	Preconceptional ( <i>n</i> = 66)	Interconceptional ( <i>n</i> = 431)	Postconceptional ( <i>n</i> = 472)
Health status (SF-12) <sup>a</sup>							
Physical health (mean)	52.0	54.1	53.0	51.0*	50.6 <sup>†</sup>	52.2	50.0*
Mental health (mean)	48.8	48.2	49.2	47.3	50.5 <sup>†</sup>	50.2 <sup>†</sup>	48.2*
Health conditions							
Diagnosed, past 5 years (%)							
Hypertension	11	5	10	10*	14 <sup>†</sup>	12	16 <sup>†</sup>
High cholesterol	10	5	5	6	23 <sup>†</sup>	12 <sup>†</sup>	16 <sup>†</sup>
Anxiety or depression	28	24	26	38*	24	23	36*
Obesity	22	15	17	22	27 <sup>†</sup>	23 <sup>†</sup>	31 <sup>†*</sup>
Periodontal disease	8	2	5	7*	4	9 <sup>†</sup>	14 <sup>†*</sup>
Any gynecologic infection <sup>b</sup>	38	32	48	46*	29	37 <sup>†</sup>	34 <sup>†</sup>
Depressive symptoms (%) <sup>c</sup>	21	18	19	32*	14	15	27*
BMI (%)							
Underweight (<18.5)	2	4	2	5	2	<1	1
Normal (18.5–24.99)	46	58	44	36	38	51	38
Overweight (25–29.99)	27	22	30	29	27	27	26
Obese (≥30)	25	17	23	30*	33 <sup>†</sup>	22 <sup>†</sup>	34 <sup>†*</sup>
Health behaviors							
Cigarette smoking (%)	25	19	26	42*	17	14 <sup>†</sup>	34 <sup>†*</sup>
Binge drinking (%) <sup>d</sup>	29	29	10	12*	15 <sup>†</sup>	10	12
Servings of vegetables (%)							
Twice/week or less	17	21	18	25	9	12	16
3–6 times/week	39	44	34	32	38	45	39
Once a day	30	22	35	31	32	26	31
More than once a day	14	12	13	12*	21 <sup>†</sup>	17 <sup>†</sup>	13 <sup>†</sup>
Uses vitamin with folic acid (%)	42	41	48	23*	53	46	37 <sup>†*</sup>
Physical activity/week (%) <sup>e</sup>							
Never	35	18	40	44	23	32	41
1–3 days/week	40	51	37	34	45	43	37
4–7 days/week	25	30	22	22*	32	26 <sup>†</sup>	22*
Douching, past 12 months (%)	23	11	21	41*	20	18	30 <sup>†*</sup>

\**P* < .05, based on  $\chi^2$  tests of associations or on *F*-tests for one-way ANOVA (for SF-12 scores), for reproductive stage comparisons within age groups.

<sup>†</sup>*P* < .05 for age group comparisons within reproductive stage.

<sup>a</sup>These are SF-12v2 norm-based summary measures for physical health and mental health (Ware et al., 2002).

<sup>b</sup>Includes urinary tract infection, chlamydia, herpes, gonorrhea, syphilis, pelvic inflammatory disease, bacterial vaginosis, vaginal yeast infection, HIV/AIDS, and hepatitis B.

<sup>c</sup>Defined as scoring high on 6-item depressive symptom scale (Sherbourne et al., 2001).

<sup>d</sup>Defined as ≥5 drinks on 1 occasion in past month, among those who use alcohol (48% of sample).

<sup>e</sup>Defined as moderate or strenuous exercise.

cholesterol, among older preconceptional women the corresponding percentages were 14% and 23%. Age group had a mixed effect on mental health: younger pre- and interconceptional women had lower overall mental health status (by the SF-12) than their older counterparts, but age group had no effect on having anxiety or depression or on depressive symptoms. For health behaviors, the significant differences by age group were all in the direction of older women having healthier behaviors than younger women in the corresponding reproductive stages.

Table 4 shows that reproductive age women experienced a number of different stressors. Scores on the Psychosocial Hassles Scale ranged from 12 (no stress) to 41 (highest stress), and the mean for the total sample was 17.1. Among the items in this scale, those eliciting the highest stress responses overall were money worries (26% of women reported moderate or severe stress), feeling “overloaded” (25%), illness of a family member or friend (19%), and work or job problems (16%). Intimate partner violence in the previous year was reported by 6% of women in the sample. Twelve percent of women reported experiencing unfair treatment owing to race, ethnicity, or cultural background in the past year, and 1 in 5 women reported unfair treatment owing to gender. The most common domain reported for both types of unfair treatment was the workplace.

According to mean scores on the Psychosocial Hassles Scale by reproductive stage, preconceptional women ages 18–34 perceived the most stress. Among the younger women, particularly salient stressors for preconceptional women, compared with inter- and postconceptional women, included feeling “overloaded” and work or job problems. Among the younger women, preconceptional women also were most likely to report experiencing unfair treatment owing to gender in the past 12 months, particularly on the street or in a public setting. Among the older women, pre- and postconceptional women had higher mean Psychosocial Hassles scores than interconceptional women; preconceptional women were most likely to report stress owing to work or job problems, whereas postconceptional women were most likely to report stress owing to money worries. Reports of intimate partner violence and unfair treatment because of race, ethnicity, or cultural background did not differ significantly by reproductive stage in either group. In sum, there is some evidence that preconceptional women perceive greater stress than women in other reproductive stages, and for some indicators, that interconceptional women perceive less stress than other women.

For age comparisons within reproductive stages, significant differences generally were in the direction of older women reporting less stress than younger women at the same reproductive stage. The exceptions

**Table 4.** Stressors by reproductive stage, women ages 18–45

	Total Sample ( <i>n</i> = 2,002)	Ages 18–34			Ages 35–45		
		Preconceptional ( <i>n</i> = 319)	Interconceptional ( <i>n</i> = 519)	Postconceptional ( <i>n</i> = 194)	Preconceptional ( <i>n</i> = 66)	Interconceptional ( <i>n</i> = 431)	Postconceptional ( <i>n</i> = 472)
Psychosocial Hassles Scale (mean) <sup>a</sup>	17.1	18.3	17.0	17.3*	17.1 <sup>†</sup>	16.3 <sup>†</sup>	17.2*
Intimate partner violence, past 12 months (%) <sup>a</sup>	6%	6%	10%	9%	4%	2%	4% <sup>†</sup>
Unfair treatment due to race, ethnicity, culture, past 12 months (%)	12%	11%	16%	15%	11%	7% <sup>†</sup>	12%
Unfair treatment due to gender, past 12 months (%)	20%	29%	19%	24%*	18%	14% <sup>†</sup>	18%

\**p* < .05, based on  $\chi^2$  tests or *t*-tests for reproductive stage comparisons within age groups.

<sup>†</sup>*p* < .05 for age group comparisons within reproductive stage.

<sup>a</sup>See text for description of scale.

are that older interconceptional women reported more stress associated with illness of a family member than younger interconceptional women; older preconceptional women reported more unfair treatment owing to race, ethnicity, or cultural background at work than younger preconceptional women; and older interconceptional women reported more unfair treatment because of gender at work than younger interconceptional women.

## Discussion

This population-based study demonstrates that women of reproductive age in Central Pennsylvania have numerous health risks for adverse pregnancy outcomes, including chronic physical and mental conditions, gynecologic infections, overweight and obesity, smoking, binge drinking, nutritional deficits, lack of folic acid use, physical inactivity, and psychosocial stress. Furthermore, when women were classified according to reproductive life stages, many risk factors for adverse pregnancy outcomes varied by reproductive stage, controlling for age group, and by age within reproductive stage. These results show the potential value of using reproductive life stage as a means of identifying women at risk for adverse pregnancy outcomes.

Differences by reproductive life stage revealed that although women at risk of a future pregnancy (preconceptional and interconceptional women) tended to be healthier on average than postconceptional women according to many of the health status and health behavior indicators, they also exhibited some key risks for adverse pregnancy outcomes. Specifically, preconceptional women had some unhealthy behaviors (notably binge drinking and nutritional deficits) and more perceived stress compared with women at other reproductive stages. The nutritional deficit risk is compounded by suboptimal use of folic acid supplementation in younger preconceptional women. Older preconceptional women (ages 35–45) also had chronic disease profiles that placed them at higher risk. Younger interconceptional women, compared with younger preconceptional women, reported more gynecologic infections, more obesity, more smoking, less physical activity, and more douching. Younger pre- and interconceptional women had lower mental health status scores than their older counterparts.

These data suggest how interventions could be tailored to target the specific needs of women based on their reproductive stage, age, and risk profile. Interventions targeted at younger pre- and interconceptional women in this population should address unhealthy behaviors (including sexual behaviors), mental health, and psychosocial stress. Interventions targeted at older pre- and interconceptional women in this population should focus on chronic disease detection and management, in addition to unhealthy behaviors and stress.

When there has been discussion about preconceptional health promotion, the focus has been on clinical care (Korenbrodt et al., 2002; Moos, 2004) and consequently on populations that are able to access health services. Although clinical care approaches are essential, they are not the only available strategies for improving women's pre- and interconceptional health status. Many of the risk factors examined here—including unhealthy behaviors and psychosocial stress—could be addressed through community-level interventions or health and social welfare policy interventions. Furthermore, in analyses not presented here, we found that most risk factors for adverse pregnancy outcomes varied by socioeconomic status (educational level and household income), race/ethnicity, and place of residence along the urban–rural continuum, such that those women with lower educations, lower household incomes, minority race/ethnic status, and residence in medically underserved areas (both urban and rural) were at greater risk. This suggests the need for targeting populations with fewer resources for accessing traditional health services.

For example, community-wide health education campaigns to improve women's health by focusing on such factors as tobacco avoidance, nutrition and folic acid, physical activity, and stress management could reduce key risks for adverse pregnancy outcomes and also be beneficial to the health of women generally. With regard to folic acid, health promotion efforts are needed to increase awareness that folic acid has many health benefits for women across their life spans; these efforts are particularly important in light of poor nutritional habits. Or again, policy interventions could be designed to reduce chronic stresses affecting women of reproductive age, including reducing unfair treatment in the workplace, providing important social supports such as child-care, and ensuring continuous health insurance coverage for women and their families.

The main limitations of this survey are that it relies solely on self-report data and is cross-sectional. A follow-up survey of the women in this sample is planned and will provide the basis for analyses of how prepregnancy health changes over time and affects pregnancy outcomes, and for linking baseline pregnancy intent (which is not included in these analyses because of lack of evidence of predictive validity) with subsequent pregnancy, in a prospective cohort study. The follow-up study also will obtain vital record information on live births that occur between the surveys to measure pregnancy outcomes for both the mother and infant and to supplement self-report data. In addition, this survey is limited to 1 region of 1 state, although we have no reason to believe that women in other largely rural areas would be substantially different with respect to overall health status and health risks.

The CePAWHS survey provides a unique regional dataset that combines multidimensional health information with fertility history, allowing classification by re-

productive life stage with health correlates. The range of variables measured in the CePAWHS survey is not generally available in ongoing state or national surveys and is not captured in health system databases. The data presented herein provide a profile of the health status and health risks of women of reproductive age in a defined population. In addition, the data provide insights to guide interventions and policies to improve the health of women, and to potentially reduce adverse pregnancy outcomes, in the preconceptional and inter-conceptional reproductive stages.

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