

Chapter in:

Coward RT, Davis LA, Gold CH,
Smiciklas-Wright H, Thourdyke LE,
and Vondracek FW (eds). Rural
Women's Health: Mental, Behavioral,
and Physical Issues. New York:
Springer Publishing; 2006.

Chapter 5

Preterm Delivery and Low Birthweight Among Rural Women: The Importance of the Preconception Physical and Mental Health Status

Marianne M. Hillemeier, Carol S. Weisman, Gary A. Chase,
and Megan Romer

Preterm birth (delivery prior to 37 weeks of gestation) and low birthweight (less than 2500 grams or 5 pounds 8 ounces) are interrelated pregnancy outcomes that greatly increase the chances of infant death in the first year of life and predispose the infants who survive to chronic health problems and developmental disabilities (Goldenberg & Rouse, 1998; Paneth 1995). Reducing the occurrence

The authors are indebted to Chris Hollenbeak, PhD, who conducted the analyses of hospitalization data from the Pennsylvania Health Care Cost Containment Council. The authors are grateful to the Pennsylvania Department of Health for providing access to birth registration data for counties in the study region. The CePAWHS project is funded, in part, under a grant with the Pennsylvania Department of Health. The Department specifically disclaims responsibility for any analyses, interpretations, or conclusions drawn by the authors or researchers.

of these adverse pregnancy outcomes is a high-priority public health goal, highlighted by the Centers for Disease Control and Prevention in its *Healthy People 2010* initiative (U.S. Department of Health and Human Services [USDHHS], 2000), as well as in a related effort, *Rural Healthy People 2010* (Gamm, Hutchison, Dabney, & Dorsey, 2003). These outcomes also represent some of the most serious and persistent examples of health disparities associated with race/ethnicity, socioeconomic status, and geographic location. Nationally, about 20 percent of births occur among rural women, although less attention has been paid to births in rural areas compared with more urbanized areas.

This chapter provides an overview of the problem of preterm birth and low birthweight among rural women, discusses risk factors that are of particular concern among rural women, and describes an innovative new approach to prevention, the Central Pennsylvania Women's Health Study (CePAWHS) Project. This project, involving a large, population-based cohort of women in Central Pennsylvania, focuses on the importance of women's physical and mental health *prior to pregnancy* in determining their subsequent risks for preterm birth and low birthweight.

SCOPE OF THE PROBLEM

Despite considerable research effort and policy attention, preterm birth rates in the United States have increased in recent years, and currently over 12 percent of all deliveries are less than fullterm (Martin et al., 2003). Growth in the number of twin and higher-order multiple pregnancies, primarily due to assisted reproductive technology and increasing average age at pregnancy, is a contributing factor, since multiple pregnancies are more prone to early delivery (Blondel et al., 2002). However, the rate of preterm birth among single pregnancies is also on the rise (Alexander & Slay, 2002). As a consequence, the proportion of infants born with low birthweight has increased, and the current rate of 7.8 percent is the highest level reported in over three decades (Martin et al., 2003).

Over four million infants are born in the U.S. each year, and about 20 percent of those births are to rural mothers (Lishner, Larson, Rosenblatt, & Clark, 1999). Analyses of national data suggest

that, overall, crude rates of low birthweight in nonmetropolitan areas are slightly lower than rates in metropolitan areas, although they are not significantly different after socioeconomic and health care factors have been taken into account (Peck & Alexander, 2003). Rural-urban patterns of low birthweight have been found to vary importantly by race. White women, who account for the majority of births in both rural and urban settings, and those who live in nonmetropolitan counties have consistently higher rates of low birthweight compared with those living in metropolitan counties (Lishner et al., 1999; Larson, Hart, & Rosenblatt, 1997). Nonmetropolitan African American and American Indian women, in contrast, have lower rates of low birthweight than their urban counterparts (Lishner et al., 1999; Larson, Hart, & Rosenblatt, 1997).

Improvements in access to prenatal care since the 1980s, largely due to Medicaid expansions, have not been accompanied by a decline in indicators of adverse pregnancy outcomes, nor have disparities in these outcomes been reduced (Frick & Lantz, 1999; Lu & Halfon, 2003). A recent evidence review of the effectiveness of prenatal care for preventing low birthweight concluded that neither preterm birth nor intrauterine growth restriction (the two key determinants of low birthweight) could be prevented by prenatal care in its present form (Lu, Alexander, Kotelchuck, & Halfon, 2003). Skepticism is mounting about the efficacy of interventions targeted at women who are already pregnant (Grason, Hutchins, & Silver, 1999; Kotelchuck, 2003; Wise, 2003). Thus, although increasing access to early and adequate prenatal care remains an important goal, particularly among rural populations where access to health care is more limited than in urbanized areas, this alone is not expected to reduce disparities in preterm birth and low birthweight.

RISK FACTORS FOR PRETERM BIRTH AND LOW BIRTHWEIGHT AMONG RURAL WOMEN

The causal mechanisms underlying early delivery and low birthweight are not well understood (Slattery & Morrison, 2002; Goldenberg & Rouse, 1998). Epidemiological studies, however, have identified factors that tend to be associated with these outcomes (Alexander & Slay, 2002), many of which are common among rural

women and are likely to increase their risk. For example, socioeconomic disadvantage has been consistently associated with an increased likelihood of preterm birth and low birthweight (Parker, Schoendorf, & Kiely, 1994; Kogan, 1995; Kramer, Séguin, Lydon, & Goelet, 2000; Finch, 2003). Rural poverty rates are nearly 20 percent higher than urban rates, and currently 14.2 percent of those outside metropolitan areas live in poverty (DeNavas-Walt, Proctor, & Mills, 2004). The poverty rate is highest in completely rural counties, where 16.8 percent of the population is poor (Jolliffe, 2004). The median income of rural households was \$35,112 in 2003, as compared with \$46,060 in metropolitan areas (DeNavas-Walt, Proctor, & Mills, 2004), reflecting fewer employment opportunities and lower educational levels (Whitener & McGranahan, 2003). Although educational attainment among rural residents continues to rise, only about 15 percent of nonmetropolitan adults age 25 and over have graduated from a four-year college and only three-quarters of adults have a high school diploma or GED equivalent (Gibbs, 2004).

Rural women are also disproportionately likely to experience health risks that can increase their chances for poor pregnancy outcomes. Nationally, adults living in rural areas are the most likely to smoke, with current rates among rural women above one in four (Eberhardt et al., 2001). Obesity, which is linked to poor birth outcomes through its association with diabetes, heart disease, and other chronic illnesses, is most prevalent in rural counties, with a self-reported rate in the most rural counties approaching 25 percent (Eberhardt et al., 2001). Toxic exposures to herbicides and pesticides that can adversely impact pregnancy outcome are also more common in rural areas, where farm workers may inadvertently expose family members via pesticide residues on their skin and clothing (Goldman, Eskenazi, Bradman, & Jewell, 2004; Gaston, 2001). High levels of psychosocial stress may also be common among rural women, related in part to lack of material resources, geographic isolation, social pressure to conform with predominantly conservative lifestyle choices, and uncertainty associated with a livelihood tied to agriculture (Mulder et al., 1999; Bushy, 1998)

Health risks among rural women are further exacerbated by reduced access to appropriate medical care. Both health care providers—especially medical specialists—and high-quality medical facilities are less likely to be located in rural areas (Hart, Lishner, &

Rosenblatt, 2003; Larsen & Fleishman, 2003), and their lower income and employment levels make it more difficult for rural women to maintain health insurance coverage (Ziller, Coburn, Loux, Hoffman, & McBride, 2003). With regard to health care utilization, rural women receive fewer screening and preventive services (Casey, Call, & Klingner, 2001), receive less adequate prenatal care (Peck & Alexander, 2003), and make fewer ambulatory care visits than women in more urbanized areas (Larson, Machlin, Nixon, & Zodet, 2004). Fragmentation of women's health care may be exacerbated in rural areas, due in part to the relative scarcity of obstetrician-gynecologists and to fewer resources with which to establish comprehensive women's health care programs (Eberhardt et al., 2001). Problems in obtaining transportation to medical care facilities (Friedman, 2004; Agency for Healthcare Research and Quality [AHRQ], 1996), as well as lack of knowledge about the importance of preventive medical care contribute to rural women's suboptimal utilization of health services. It has also been suggested that rural cultural values including self-sufficiency, belief in traditional social roles for women, and reluctance to seek medical care unless seriously ill play a role in decreased utilization of health care services among rural women (Casey, Call, & Klingner, 2001; Hauenstein, 2003; Mulder et al., 1999; Larson & Fleishman, 2003).

CONCEPTUALIZING THE MECHANISMS UNDERLYING PRETERM BIRTH AND LOW BIRTHWEIGHT

Although a comprehensive theory of the determinants of preterm birth and low birthweight is not available, Misra, Guyer, and Allston (2003) have provided an "integrated perinatal health framework" that takes a lifespan perspective on reproductive health, rather than focusing only on pregnancy. This framework classifies risk factors for adverse pregnancy outcomes based on the Evans and Stoddart (1990) model of multiple health determinants. This classification distinguishes between *distal* and *proximal* determinants of health. Distal determinants affect susceptibility to proximal determinants and include genetic factors, the physical environment, and the social or community environment. Proximal determinants include the bio-

medical and behavioral responses of individuals that affect outcomes.

The lifespan perspective incorporated into Misra and colleagues' (2003) model affects how distal and proximal determinants are conceptualized and measured. For example, psychosocial stress is considered to be both acute and chronic, with effects on health that accumulate over time. This is consistent with the *weathering* process proposed by Geronimus (2001), whereby women's health reflects the cumulative impact of life experiences, including psychosocial stressors, from conception to the present. Health care (including public health programs, health information, and personal medical care) modifies relationships among variables in the model. Misra and colleagues (2003) argue that the proximal risks for adverse pregnancy outcomes are key targets for interventions in the preconceptional and interconceptional periods. A life-course perspective and greater investment in the health of women also have been proposed by scholars concerned about the persistence of racial/ethnic disparities in birth outcomes (Lu & Halfon, 2003).

For the CePAWHS project, which is described in detail in the next section, risk factors are classified as shown in Figure 5.1. This framework is adapted from Misra and colleagues (2003) to guide the project, which has preterm birth and low birthweight outcomes as endpoints. The focus is on women's preconceptional health, including chronic conditions, infections, and psychosocial stress and stress-related behavior as proximal risk factors. Pregnancy-specific factors such as preeclampsia and prior adverse pregnancy outcomes are also included. The risk factors in each preconceptional health category have been identified in previous studies of preterm birth and low birthweight as discussed below, although some have been subjected to less research than others.

Psychosocial Stress and Stress-Related Behavior

Psychosocial stress has long been considered as a risk factor in preterm birth and low birthweight (e.g., Nuckolls, Kaplan, & Cassell, 1972), although early methodologically limited studies yielded inconclusive findings (Hogue, Hoffman, & Hatch, 2001). More recently, associations have been reported between preterm birth and both acute and chronic stressors, including stressful life events, stressful

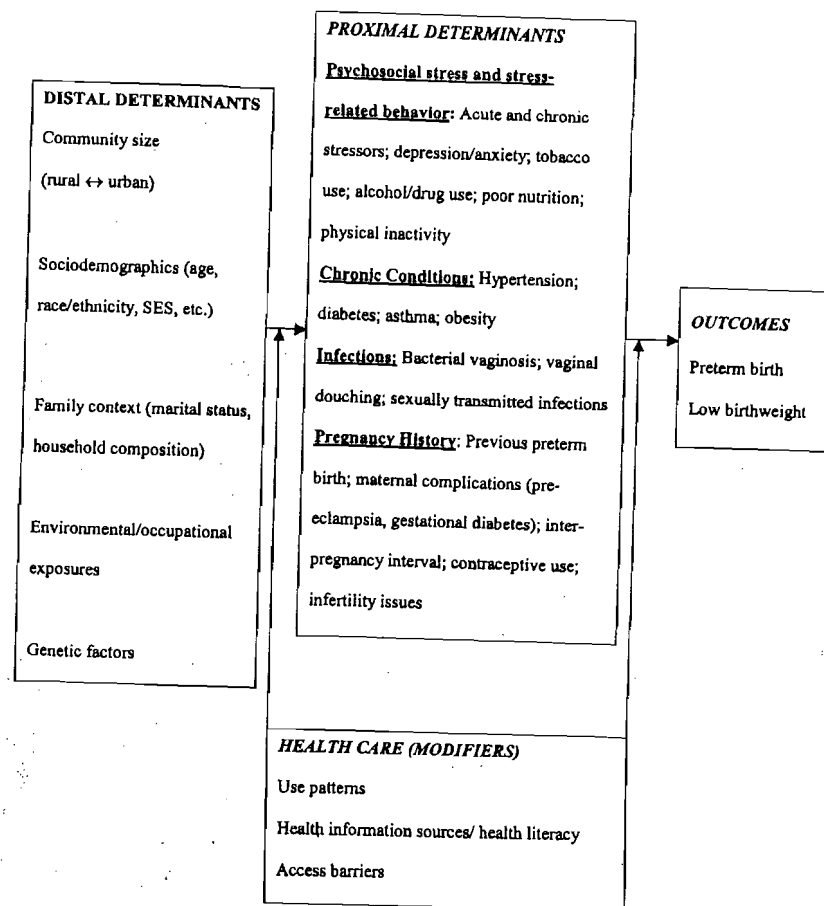


FIGURE 5.1 CePAWHS conceptual framework: Determinants of preterm birth and low birthweight.

work, physical abuse, racism, smoking, alcohol and drug use, poor nutrition, physical inactivity, low levels of social support during pregnancy, anxiety, and depression (Copper et al., 1996; Dole et al., 2003; Dunkel-Schetter, 1998; Hobel & Culhane, 2003; Leiferman & Evenson, 2003; Mamelle, Measson, Munoz, & Audreas de la Bastie, 1998; Misra, O'Campo, & Strobino, 2001; Misra, Guyer, & Alston, 2003; Mutale, Creed, Maresh, & Hunt, 1991; Nordentoft et al., 1996; Orr et al., 1996; Orr, James, & Blackmore Prince, 2002; Rich-Edwards

et al., 2001). The disproportionate risk for these stressors among poor, rural, and minority women, coupled with increasing evidence about the biological plausibility of stress-related mechanisms of preterm labor (Wadhwa et al., 2001), suggest that further exploration of stress-related interventions before pregnancy is needed.

Chronic Conditions

The prevalence of chronic disease is disproportionately greater among poor and minority women (Ephraim, Misra, Nguyen, & Vahra-tian, 2001; Geronimus, 2001) and many chronic conditions increase the risk of giving birth prematurely and of having a low-birthweight infant (Misra, Grason, & Weisman, 2000). Chronic hypertension is associated with both preterm birth and low birthweight (Sibai, 2002), with minority women at disproportionately greater risk (Barton, Barton, O'Brien, Berganer, & Sibai, 2002). Preexisting insulin dependent diabetes mellitus is associated with increased incidence of preterm delivery (Wylie et al., 2002), particularly among women whose diabetes is in poor control (Sibai et al., 2000). Women with asthma have a greater risk of both preterm birth and low birthweight, as well as adverse maternal outcomes, including preeclampsia, chorioamnionitis, and cesarean delivery (Liu, Wen, Demissie, Marcoux, & Kramer, 2001). Maternal obesity adversely impacts pregnancy outcomes, primarily through increased rates of hypertension, diabetes, and infection, which elevate preterm delivery risk (Castro & Avina, 2002).

Infections

Maternal urogenital tract infection is an important risk factor for preterm birth (Romero et al., 2001; Wadhwa et al., 2001). The presence of bacterial vaginosis (BV) at any time in pregnancy has been found to be associated with an approximately twofold increase in the risk of preterm labor and premature rupture of membranes, and the risk increases more than sevenfold when BV is detected early in pregnancy (Andrews, Hauth, & Goldenberg, 2000; Hillier et al., 1995; Leitich et al., 2003). Intrauterine infection is implicated as a key factor in up to 40 percent of preterm deliveries, with higher prevalence rates among disadvantaged and minority women as well

TABLE 5.1 Birth Outcomes and Maternal Risk Characteristics by Mother's County of Residence, 2002, in Comparison With Healthy People 2010 Goals

County	Pre-term Birth Rate ^a	Low Birth Weight Rate ^b	Very Low Birth Weight Rate ^c	1st Trimester Prenatal Care	Non-Smoking Mothers	Chronic High Blood Pressure	Pregnancy-Induced High Blood Pressure	Any Diabetes
Healthy People 2010 Goals	7.60	5.00	0.90	90.00	99.00	-	-	-
Adams	8.32	7.29	1.74	83.69	85.31	0.44	4.68	2.18
Bedford	7.79	5.88	0.95	86.15	81.59	0.57	4.55	6.07
Blair	8.48	7.21	1.30	91.90	75.63	0.55	3.09	5.77
Bradford	4.92	3.53	0.46	86.68	74.39	0.61	4.60	3.37
Cambria	9.22	8.44	1.38	89.71	77.95	0.83	4.70	5.18
Centre	7.11	5.84	1.44	87.92	87.79	0.88	4.15	6.70
Clinton	8.57	6.90	1.43	84.99	77.38	1.67	12.62	4.76
Columbia	10.72	7.96	2.14	82.06	80.40	2.76	7.04	5.82
Cumberland	9.52	8.31	1.38	90.41	86.70	1.19	5.51	4.18
Dauphin	10.20	10.75	1.79	90.58	87.98	1.24	3.52	2.64
Franklin	9.92	6.27	1.71	83.63	80.90	1.43	5.35	3.64
Fulton	8.40	6.72	0.00	80.51	78.15	4.20	3.36	4.20
Huntingdon	10.48	7.55	1.05	87.50	79.66	0.63	4.61	2.94
Juniata	7.03	5.81	1.53	76.32	84.40	1.22	4.59	4.59

(continued)

TABLE 5.1 (continued)

County	Pre-term Birth Rate ^a	Low Birth Weight Rate ^b	Very Low Birth Weight Rate ^c	1st Trimester Prenatal Care	Non-Smoking Mothers	Chronic High Blood Pressure	Pregnancy-Induced High Blood Pressure	Any Diabetes
Lancaster	7.75	6.18	1.01	78.59	87.75	0.94	4.19	4.37
Lebanon	8.67	6.93	1.64	81.84	83.85	0.52	2.75	2.09
Lycoming	9.88	7.09	1.54	80.89	75.73	0.85	4.70	4.62
Mifflin	7.36	5.51	1.17	72.77	81.64	1.17	2.84	2.84
Montour	9.59	6.82	1.36	85.85	80.91	2.73	6.82	5.45
Northumberland	9.95	7.54	1.15	86.13	75.71	1.78	5.65	6.28
Perry	9.55	7.31	1.73	84.58	81.54	1.92	5.00	3.08
Potter	6.29	4.00	0.57	94.26	68.57	2.86	8.00	4.57
Snyder	8.45	7.53	1.60	75.95	86.99	0.91	5.48	6.39
Somerset	9.10	6.42	0.80	87.72	79.95	0.80	2.54	2.54
Sullivan	7.84	11.54	1.92	80.00	78.85	1.92	1.92	3.85
Tioga	4.48	3.91	0.28	87.61	79.33	1.96	6.15	3.35
Union	9.07	6.68	0.95	74.24	87.35	2.15	4.06	8.11
York	9.99	8.15	1.63	86.36	80.06	0.98	4.6	4.6

^aPercentage of live births < 37 weeks of gestation

^bPercentage of live births < 2,500 grams

^cPercentage of live births < 1,500 grams

Note: n = 33,025 live births in 28 central Pennsylvania counties

as younger women generally (Goldenberg et al., 1996; Hillier et al., 1995; Meis et al., 1995). Both BV and sexually transmitted infections (STIs) are important components of women's health that have not been addressed adequately. The relationship among infection, immunity, and stress requires further investigation (Hobel & Culhane, 2003). The practice of vaginal douching, which is prevalent in some adolescent and African American populations, has been linked with genital tract infections and may increase the risk of preterm birth (Fiscella, Franks, Kendrick, Meldrum, & Kieke, 2002; Foch, McDaniel, & Chacko, 2001; Holzman, Leventhal, Qiu, Jones, & Wang, 2001; Ness et al., 2002).

The multiplicity of risks for preterm birth and low birthweight has two implications for research. First, data available from birth registry data, hospital discharge and managed care data sets, and ongoing surveys such as the Behavioral Risk Factor Surveillance System (BRFSS) and the National Health and Nutrition Examination Survey (NHANES) provide prevalence estimates for only a limited number of risks. A more comprehensive risk profile for rural women is needed. Second, the range of risk factors for preterm birth and low birthweight implies that a single-factor intervention is not likely to be effective. Interventions should address multiple risks, be tailored to the needs of high-risk groups, and address multiple levels (e.g., consumers, health care providers, communities). For example, an intervention focusing on preconceptional screening and treatment of bacterial vaginosis or other infections would have to address women's awareness of BV and access to health care providers in addition to the technical aspects of clinical treatment.

THE CEPAWHS PROJECT

The CePAWHS project was designed to address the need for both comprehensive information on the health status of rural women and a multilevel intervention approach to reduction of preterm birth and low birthweight. It includes 1) a population-based survey of reproductive-aged women; and 2) a multidimensional intervention designed to promote the health of high-risk women prior to pregnancy.

Target Population

The CePAWHS project focuses on a 28-county region in central Pennsylvania that includes a large rural population. According to the 2000 U.S. Census, 23 percent of Pennsylvania is designated as rural; the target region contains 15 counties whose populations are predominantly or entirely rural (Adams, Bedford, Bradford, Clinton, Fulton, Huntingdon, Juniata, Mifflin, Montour, Perry, Potter, Snyder, Somerset, Sullivan, and Tioga). This region accounted for 24 percent of all births in Pennsylvania in 2001. Birth record data for 2002 show that nearly all of the counties in this region have low birthweight rates that are considerably higher than the *Healthy People 2010* goal, and 23 of the 28 counties have preterm birth rates greater than the *Healthy People* target. All but four counties in the study region fail to meet the *Healthy People 2010* goal for first trimester initiation of prenatal care. Birth certificate data related to maternal health status indicate that chronic high blood pressure and diabetes are important health concerns among women in many of the target counties. Rates of smoking during pregnancy are also high, reaching 25–30 percent in a number of rural counties.

The costs associated with preterm birth and low birthweight in this region are considerable. Hospital charges alone are high and increasing. According to data from the Pennsylvania Health Care Cost Containment Council, of the 33,541 hospital-based births in this region in 2002, 8.4 percent were premature, 5.8 percent were low birthweight, and 1.6 percent were very low birthweight (under 1500 grams or 3.3 pounds). The average hospital charges in this region were \$1,212 for normal births; \$35,478 for premature births; \$19,291 for low birthweight births; and \$104,537 for very low birthweight births.

This region is relatively disadvantaged in terms of socioeconomic status indicators and health care resources, as shown in Table 5.2.

According to the 2000 U.S. Census, 19 of the counties had median household incomes below the state median (\$40,106), and 14 of the counties had higher percentages of persons in poverty than the state overall (11.0 percent). In the Pennsylvania population as a whole, 81.4 percent of those 25 years and older were high school graduates, while 22 of the 28 counties in the study region had lower

TABLE 5.2 Socioeconomic and Health Care Characteristics of 28 Central Pennsylvania Counties

County	% Rural Population ^a	Median Household Income, 1999	% Below Poverty Level, 1999 ^b	% High School Grads (age 25+), 1999	Number of Hospitals Providing Obstetric Care, 2001	Number of Hospitals With NICU, 2001	Primary Care, Office-Based MDs per 100,000 Population, 2001	Ob-Gyns per 100,000 Population, 2001
Adams	60	\$42,704	7.1	79.7	1	0	78.87	3.29
Bedford	84	\$32,731	10.3	78.3	1	0	50.02	6.00
Blair	26	\$32,861	12.6	83.8	4	0	186.61	16.26
Bradford	72	\$35,038	11.8	81.7	2	0	258.12	11.15
Cambria	32	\$30,179	12.5	80.0	2	2	184.80	9.17
Centre	36	\$36,165	18.8	88.2	1	0	158.37	9.58
Clinton	51	\$31,064	14.2	80.4	1	0	79.13	2.64
Columbia	44	\$34,094	13.1	80.6	2	0	113.79	10.91
Cumberland	25	\$46,707	6.6	86.1	2	1	207.79	14.51
Dauphin	15	\$41,507	9.7	83.4	2	2	253.38	17.47
Franklin	47	\$40,476	7.6	78.9	2	0	118.32	9.28
Fulton	100	\$34,882	10.8	73.2	0	0	35.06	7.01
Huntingdon	69	\$33,313	11.3	74.6	1	0	87.75	4.39
Juniata	85	\$34,698	9.5	74.5	0	0	17.53	0.00

(continued)

TABLE 5.2 (continued)

County	% Rural Population ^a	Median Household Income, 1999	% Below Poverty Level, 1999 ^b	% High School Grads (age 25+), 1999	Number of Hospitals Providing Obstetric Care, 2001	Number of Hospitals With NICU, 2001	Primary Care, Office-Based MDs per 100,000 Population, 2001	Ob-Gyns per 100,000 Population, 2001
Lancaster	25	\$45,507	7.8	77.4	3	1	128.33	6.37
Lebanon	36	\$40,838	7.5	78.6	1	0	140.45	11.63
Lycoming	36	\$34,016	11.5	80.6	1	0	144.95	6.66
Mifflin	56	\$32,175	12.5	77.2	1	0	133.37	6.45
Montour	54	\$38,075	8.7	82.3	1	1	1069.31	54.84
Northumberland	37	\$31,314	11.9	77.8	1	0	67.68	2.12
Perry	86	\$41,909	7.7	79.9	0	0	29.82	0.00
Potter	100	\$32,253	12.7	80.6	1	0	110.62	5.53
Snyder	71	\$35,981	9.9	73.2	0	0	61.26	5.33
Somerset	75	\$30,911	11.8	77.5	2	0	83.73	5.00
Sullivan	100	\$30,279	14.5	78.0	0	0	30.51	0.00
Tioga	84	\$32,020	13.5	80.5	1	0	99.10	0.00
Union	45	\$40,336	8.8	73.1	0	0	197.00	12.01
York	29	\$45,268	6.7	80.7	3	1	124.16	7.60

^aCensus classification of "rural"

^bPoverty rates are determined for residents in each county at the time of the 2000 Census, including students residing on college campuses.

educational attainment rates. While eight counties are home to hospitals that offer both obstetric and neonatal intensive care services, the majority lack one or the other type of hospital facilities, and 6 rural counties (Fulton, Juniata, Perry, Snyder, Sullivan, and Union) have no hospitals offering either type of service. Similarly, physician-to-population ratios indicate that relatively fewer physicians in both primary care and obstetrics-gynecology have practices located in these counties. According to the Pennsylvania Department of Health, the region also includes health professional shortage areas, defined as service areas with a critical shortage of primary care providers, and medically underserved areas, defined as areas or populations with a shortage of health care services in addition to selected health and population factors.

The target region contains ethnically diverse communities, with county populations ranging from 75.6 percent to 98.2 percent White, non-Hispanic. The region includes populations of African Americans primarily in the Harrisburg area, Latinas in the Lancaster area (traditional Mennonite and Amish communities), and various immigrant communities.

Community Survey

The first phase of the CePAWHS project is a population-based survey to determine the prevalence of risk factors for preterm birth and low birthweight and the relationships among risk factors and race/ethnicity, socioeconomic status, rural residence, and women's health care access and utilization patterns. This survey will consist of several components: (1) a telephone survey, using random-digit dialing (RDD), with a representative sample of 2,000 reproductive-age women (ages 18–45) residing in the target region; (2) household interviews of an additional 300 women (ages 18–45) residing in traditional Amish communities that do not have household telephones; and (3) interviews with 300 adolescents (ages 16–17) in family planning clinics. This survey is unique in studies of preterm birth and low birthweight outcomes because it is based on a representative community sample rather than a sample of clinically ascertained pregnant women.

Survey items address the following topic areas:

Pregnancy History

This includes measures of prior pregnancies and births; prior preterm or low birthweight births; maternal complications during pregnancy; and interpregnancy interval.

Health Status

This includes measures of chronic conditions and infections diagnosed by a doctor, using items from national surveys of women's health; a short-form depressive symptoms scale based on the CES-D instrument (Radloff, 1977) from the Commonwealth Fund Survey of Women's Health (Collins et al., 1999); overall health and disability status based on scales in the SF-12 instrument (Ware & Sherbourne, 1992); and height and weight for computing body mass index.

Psychosocial Stress

This includes measures of acute and chronic stressors from studies of preterm birth and low birthweight (Dole et al., 2003; Misra, O'Campo, & Strobino, 2001); survey measures of exposure to domestic or intimate partner violence adapted from the Commonwealth Fund Survey of Women's Health (Collins et al., 1999); and perceptions of discrimination based on race/ethnicity and gender.

Health Behaviors

This includes measures of smoking, alcohol/drug use, nutrition and physical activity, current contraceptive use, and vaginal douching, based on measures from the Behavioral Risk Factor Surveillance Survey, the National Health and Nutrition Examination Survey, and other behavioral research.

Health Care Access and Utilization

This includes measures from the Commonwealth Fund Survey of Women's Health (Collins et al., 1999) and the Kaiser Women's Health Survey (Kaiser Family Foundation, 2002) of type(s) of health insurance, usual source(s) of care, receipt of selected primary and preventive services in the past year, and access barriers such as transportation needs and lack of culturally sensitive care.

Sociodemographics

This includes measures of age, marital status, household composition, race/ethnicity, educational level, employment status, household income, and religiosity. Geocoding will permit linking individual data with community characteristics (such as race/ethnic composition, percent living in poverty, unemployment rates, and rurality) and area medical resources (such as presence of a hospital providing obstetrical services, ratio of obstetrician-gynecologists and other primary care providers to population).

Intervention

The conceptual framework guiding this project (see Figure 5.1) provides the rationale for a multidimensional intervention targeting prevalent risk factors in preconceptional women. The survey described above will document the prevalent risk factors and high-risk populations in the target region. The intervention will target key proximal risk factors and will be tested in diverse populations at risk, with particular attention to identifying opportunities for interventions in rural populations. The intervention is planned to incorporate the following attributes:

- It targets the *preconceptional* (and interconceptional) period.
- It is *population-based* (i.e., it is based on population-level data and will be implemented with women recruited in community as well as clinical settings, in order to ensure participation by women who do not have regular health care access or reside in rural areas).
- It is *multidimensional* (i.e., it addresses multiple biopsychosocial risks for preterm birth and low birthweight).
- It targets *multiple health outcomes* (i.e., health knowledge/literacy, self-efficacy, health behavior change, access to health care, and health status).
- It is offered in *group sessions* (rather than one on one).
- It is *multilevel* in that (1) the information and skills provided are relevant both to individual health behaviors and to interpersonal relationships and social factors affecting health; (2)

students in health care professions will be trained to facilitate the intervention sessions; and (3) information about the intervention content will be disseminated to primary care providers in the community.

- It is *evidence-based* in that the content of the intervention depends upon the findings of the population-based survey.

CONCLUSION

Preterm birth and low birthweight are high-priority pregnancy outcomes that greatly elevate the risk of mortality in the first year of life, increase the likelihood that infants who survive will experience morbidity and disability often persisting into adulthood, and account for an important share of current health-care costs. Although about one of every five infants is born to a rural mother, salient risk factors for preterm birth and low birthweight in this population are not well understood.

The CePAWHS project addresses the need for in-depth information on the health status of rural women and their risks for adverse pregnancy outcomes through a comprehensive, population-based survey that assesses both reproductive history and underlying physical and mental health status. Findings from the survey will form the basis of an innovative, multilevel intervention to reduce preterm birth and low birthweight among rural women through the reduction of health risks prior to pregnancy. This project offers the opportunity to advance our understanding of the mechanisms underlying these adverse pregnancy outcomes, as well as to promote improvements in the wellbeing of rural women and the health chances of their infants.

REFERENCES

- Agency for Healthcare Research and Quality (1996). Improving Health Care for Rural Populations. AHCPH Publication No. 96-P040. Retrieved October 4, 2004, from <http://www.ahrq.gov/research/rural.htm>
- Alexander, G. R., & Slay, M. (2002). Prematurity at birth: Trends, racial disparities, and epidemiology. *Mental Retardation and Developmental Disabilities Research Review*, 8(4), 215-220.

- Andrews, W. W., Hauth, J. C., & Goldenberg, R. L. (2000). Infection and preterm birth. *American Journal of Perinatology*, 17(7), 357-365.
- Barton, C. B., Barton, J. R., O'Brien, J. M., Berganer, N. K., & Sibai, B. M. (2002). Mild gestational hypertension: Differences in ethnicity are associated with altered outcomes in women who undergo outpatient treatment. *American Journal of Obstetrics and Gynecology*, 186(5), 896-898.
- Blondel, B., Kogan, M. D., Alexander, G. R., Dattani, N., Kramer, M. S., Macfarlane, A., et al. (2002). The impact of the increasing number of multiple births on the rates of preterm birth and low birthweight: An international study. *American Journal of Public Health*, 92(8), 1323-1330.
- Bushy, A. (1998). Health issues of women in rural environments: an overview. *Journal of the American Medical Women's Association*, 53(2), 53-56.
- Casey, M. M., Call, K. T., & Klingner, J. M. (2001). Are rural residents less likely to obtain recommended preventive healthcare services? *American Journal of Preventive Medicine*, 21(3), 182-188.
- Castro, L. C., & Avina, R. L. (2002). Maternal obesity and pregnancy outcomes. *Current Opinion in Obstetrics and Gynecology*, 14(6), 601-606.
- Collins, K. S., Schoen, C., Joseph, S., Duchon, L., Simantov, E., & Yellowitz, M. (1999). *Health concerns across a woman's lifespan: The Commonwealth Fund 1998 Survey of Women's Health*. New York: The Commonwealth Fund.
- Copper, R. L., Goldenberg, R. L., Das, A., Elder, N., Swain, M., Norman, G., et al. (1996). The preterm prediction study: Maternal stress is associated with spontaneous preterm birth at less than thirty-five weeks' gestation. *American Journal of Obstetrics and Gynecology*, 175(5), 1286-1292.
- DeNavas-Walt, C., Proctor, B. D., & Mills, R. J. (2004). Income, poverty, and health insurance coverage in the United States: 2003. Current Population Reports, P60-226. Washington, DC: U.S. Government Printing Office.
- Dole, N., Savitz, D. A., Hertz-Picciotto, I., Siega-Riz, A. M., McMahon, M. J., & Buekens, P. (2003). Maternal stress and preterm birth. *American Journal of Epidemiology*, 157(1), 14-24.
- Dunkel-Schetter, C. (1998). Maternal stress and preterm delivery. *Prenatal and Neonatal Medicine*, 3, 39-42.
- Eberhardt, M. S., Ingram, D. D., Makuc, D. M., Pamuk, E. R., Freid, V. M., Harper, S. B., et al. (2001). *Urban and Rural Health Chartbook: Health, United States*. Hyattsville, MD: National Center for Health Statistics.
- Ephraim, P., Misra, D., Nguyen, R., & Vahratian, A. (2001). Chronic conditions. In D. Misra (Ed.), *The women's health data book* (3rd ed.). Washington, DC: Jacobs Institute of Women's Health and Henry J. Kaiser Family Foundation.
- Evans, R. G., & Stoddart, G. L. (1990). Producing health, consuming health care. *Social Science and Medicine*, 31(12), 1347-1363.
- Finch, B. K. (2003). Socioeconomic gradients and low birth-weight: Empirical and policy considerations. *Health Services Research*, 38(6p1), 1819-1841.
- Fiscella, K., Franks, P., Kendrick, J. S., Meldrum, S., & Kieke, B. A. (2002). Risk of preterm birth that is associated with vaginal douching. *American Journal of Obstetrics and Gynecology*, 186(6), 1345-1350.

- Foch, B. J., McDaniel, N. D., & Chacko, M. R. (2001). Racial differences in vaginal douching knowledge, attitude, and practices among sexually active adolescents. *Journal of Pediatric and Adolescent Gynecology, 14*(1), 29-33.
- Frick, K. D., & Lantz, P. M. (1999). How well do we understand the relationship between prenatal care and birth weight? *Health Services Research, 34*(5p1), 1063-1073.
- Friedman, P. (2004). Transportation needs in rural communities. Rural Assistance Center Issue Note, 2(1). Retrieved October 4, 2004 from http://www.raconline.org/infor_guides/transportation/issuenote.html
- Gamm, L. D., Hutchison, L., Dabney, B. J., & Dorsey, A. M. (2003). *Rural Healthy People 2010: A Companion Document to Healthy People 2010*, Vol. 2. College Station, TX: Texas A&M University System Health Science Center.
- Gaston, M. H. (2001). 100% access and 0 health disparities: Changing the health paradigm for rural women in the 21st century. *Women's Health Issues, 11*(1), 7-16.
- Geronimus, A. T. (2001). Understanding and eliminating racial inequalities in women's health in the United States: The role of the weathering conceptual framework. *Journal of the American Medical Women's Association, 56*(4), 149-150.
- Gibbs, R. (2004). Rural Education at a Glance. Rural Development Research Report No. (RDRR98). Retrieved October 4, 2004 from <http://www.ers.usda.gov/publications/RDRR98/>
- Goldenberg, R. L., Thom, E., Moawad, A. H., Johnson, F., Roberts, J., & Caritis, S. N. (1996). The preterm prediction study: Fetal fibronectin, bacterial vaginosis, and peripartum infection. National Institute of Child Health and Human Development (NICHD) Maternal Fetal Medicine Units Network. *Obstetrics & Gynecology, 87*(5), 656-660.
- Goldenberg, R. L., & Rouse, D. J. (1998). Prevention of premature birth. *New England Journal of Medicine, 339*(5), 313-320.
- Goldman, L., Eskenazi, B., Bradman, A., & Jewell, N. P. (2004). Risk behaviors for pesticide exposure among pregnant women living in farmworker households in Salinas, California. *American Journal of Industrial Medicine, 45*(6), 491-499.
- Grason, H., Hutchins, J., & Silver, G. (Eds.). (1999). *Charting a course for the future of women's and perinatal health, Vol. II*. Baltimore, MD: Women's and Children's Health Policy Center, Johns Hopkins School of Public Health.
- Hart, L. G., Lishner, D. M., & Rosenblatt, R. A. (2003). Rural health workforce: Context, trends, and issues. In E. H. Larson, K. E. Johnson, T. E. Norris, D. M. Lishner, R. A. Rosenblatt, & L. G. Hart (Eds.), *State of the health workforce in rural America: Profiles and comparisons*. Seattle, WA: WWAMI Rural Health Research Center, University of Washington.
- Hauenstein, E. J. (2003). No comfort in the rural south: Women living depressed. *Archives of Psychiatric Nursing, 17*(1), 3-11.
- Hillier, S. L., Nugent, R. P., Eschenbach, D. A., Krohn, M. A., Gibbs, R. S., Martin, D. H., et al. (1995). Association between bacterial vaginosis and preterm delivery of a low-birthweight infant. *New England Journal of Medicine, 333*(26), 1737-1742.

- Hobel, C., & Culhane, J. (2003). Role of Psychosocial and Nutritional Stress on Poor Pregnancy Outcomes. *Journal of Nutrition, 133*(5), 1709S-1717S.
- Hogue, C. J. R., Hoffman, S., & Hatch, M. C. (2001). Stress and preterm delivery: A conceptual framework. *Paediatric and Perinatal Epidemiology, 15*(S2), 30-40.
- Holzman, C., Leventhal, J. M., Qiu, H., Jones, N. M., & Wang, J. (2001). Factors linked to bacterial vaginosis in nonpregnant women. *American Journal of Public Health, 91*(10), 1664-1670.
- Jolliffe, D. (2004). Rural Poverty at a Glance. Rural Development Research Report No. RDRR100. Retrieved October 4, 2004 from: http://www.ers.usda.gov/publications/rdr98/rdr98_lowres.pdf
- Kaiser Family Foundation (2002). *Women's health in the United States: Health coverage and access to care*. Menlo Park, CA: Henry J. Kaiser Family Foundation.
- Kogan, M. D. (1995). Social causes of low birth weight. *Journal of the Royal Society of Medicine, 88*(11), 611-615.
- Kotelchuck, M. (2003). Building on a life-course perspective in maternal and child health. *Maternal and Child Health Journal, 7*(1), 5-11.
- Kramer, M. S., Séguin, L., Lydon, J., & Goulet, L. (2000). Socio-economic disparities in pregnancy outcome: Why do the poor fare so poorly? *Paediatric and Perinatal Epidemiology, 14*(3), 194-210.
- Larson, E. H., Hart, L. G., & Rosenblatt, R. A. (1997). Is non-metropolitan residence a risk factor for poor birth outcome in the U.S. *Social Science and Medicine, 45*(2), 171-188.
- Larson, S. L., & Fleishman, J. A. (2003). Rural-urban differences in usual source of care and ambulatory service use. *Medical Care, 41*(S7), III-65-74.
- Larson, S. L., Machlin, S. R., Nixon, A., & Zodet, M. (2004). *Health Care in Urban and Rural Areas, Combined Years 1998-2000* (Publication No. 04-0001). Rockville, MD: Agency for Healthcare Research and Quality.
- Leiferman, J. A., & Evenson, K. R. (2003). The effect of regular leisure physical activity on birth outcomes. *Maternal and Child Health Journal, 7*(1), 59-64.
- Leitich, H., Bodner-Adler, B., Brunbauer, M., Kaider, A., Egarter, C., & Husslein, P. (2003). Bacterial vaginosis as a risk factor for preterm delivery: A meta-analysis. *American Journal of Obstetrics and Gynecology, 189*(1), 139-147.
- Lishner, D. M., Larson, E. H., Rosenblatt, R. A., & Clark, S. J. (1999). Rural maternal and perinatal health. In T. C. Ricketts (Ed.), *Rural health in the United States*. New York: Oxford University Press.
- Liu, S., Wen, S. W., Demissie, K., Marcoux, S., & Kramer, M. S. (2001). Maternal asthma and pregnancy outcomes: A retrospective cohort study. *American Journal of Obstetrics and Gynecology, 184*(2), 90-96.
- Lu, M. C., Alexander, T. V., Kotelchuck, M., & Halfon, N. (2003). Preventing low birth weight: Is prenatal care the answer? *Journal of Maternal-Fetal Medicine, 13*(6), 362-380.
- Lu, M. C., & Halfon, N. (2003). Racial and ethnic disparities in birth outcomes: A life-course perspective. *Maternal and Child Health Journal, 7*(1), 13-30.
- Mamelle, N., Measson, A., Munoz, F., & Audreas de la Bastie, M. (1998). Identification of psychosocial factors in preterm birth. *Prenatal and Neonatal Medicine, 3*(1), 35-38.

- Martin, J. A., Hamilton, B. E., Sutton, P. D., Ventura, S. J., Menacker, F., Munson, M. L. (2003). Births: Final data for 2002. *National Vital Statistics Report*, 52(10), 1-113.
- Meis, P. J., Goldenberg, R. L., Mercer, B., Moawad, A., Das, A., McNellis, D., et al. (1995). The preterm prediction study: Significance of vaginal infections. *American Journal of Obstetrics and Gynecology*, 173(4), 1231-1235.
- Misra, D. P., Grason, H., & Weisman, C. (2000). An intersection of women's and perinatal health: The role of chronic conditions. *Women's Health Issues*, 10(5), 256-267.
- Misra, D. P., O'Campo, P., & Strobino, D. (2001). Testing a sociomedical model for preterm delivery. *Paediatric and Perinatal Epidemiology*, 15(2), 110-122.
- Misra, D. P., Guyer, B., & Allston, A. (2003). Integrated perinatal health framework: A multiple determinants model with a life span approach. *American Journal of Preventive Medicine*, 25(1), 65-75.
- Mulder, P. L., Kenkel, M. B., Shellenberger, S., Constantine, M. G., Streiegel, R., Sears, S. F. Jr., et al. (1999). The Behavioral Health Care Needs of Rural Women. Report commissioned by the American Psychological Association. Retrieved October 4, 2004 from <http://www.apa.org/rural/ruralwomen.pdf>
- Mutale, T., Creed, F., Maresh, M., & Hunt, L. (1991). Life events and low birthweight—analysis by infants preterm and small for gestational age. *British Journal of Obstetrics and Gynaecology*, 98, 166-172.
- Ness, R. B., Hillier, S. L., Richter, H. E., Soper, D. E., Stamm, C., McGregory, J., et al. (2002). Douching in relation to bacterial vaginosis, lactobacilli, and facultative bacteria in the vagina. *Obstetrics and Gynecology*, 100(4), 765-772.
- Nordentoft, M., Lou, H. C., Hansen, D., Nim, J., Pryds, O., Rubin, P., et al. (1996). Intrauterine growth retardation and premature delivery: The influence of maternal smoking and psychosocial factors. *American Journal of Public Health*, 86(3), 347-354.
- Nuckolls, K. B., Kaplan, B. H., & Cassell, J. (1972). Psychosocial assets, life crisis and the prognosis of pregnancy. *American Journal of Epidemiology*, 95, 431-441.
- Orr, S. T., James, S. A., & Blackmore Prince, C. (2002). Maternal prenatal depressive symptoms and spontaneous preterm births among African American women in Baltimore, Maryland. *American Journal of Epidemiology*, 156(9), 797-802.
- Orr, S. T., James, S. A., Miller, C. A., Barakat, B., Daikoku, N., Pupkin, M., et al. (1996). Psychosocial stressors and low birthweight in an urban population. *American Journal of Preventive Medicine*, 12(6), 459-466.
- Paneth, N. S. (1995). The problem of low birthweight. *Future of Children*, 5(1), 19-34.
- Parker, J. D., Schoendorf, K. C., & Kiely, J. L. (1994). Associations between measures of socioeconomic status and low birth weight, small for gestational age, and premature delivery in the United States. *Annals of Epidemiology*, 4(4), 271-278.
- Peck, J., & Alexander, K. (2003). Maternal, infant, and child health in rural areas: A literature review. In L. D. Gamm, L. Hutchison, B. J. Dabney, & A. M. Dorsey (Eds.), *Rural Healthy People 2010: A Companion Document to Healthy People 2010* (Vol. 2). College Station, TX: Texas A&M University System Health Science Center.
- Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, 1, 385-401.
- Rich-Edwards, J., Kreiger, N., Majzoub, J., Zierler, S., Liberman, E., & Gillman, M. (2001). Maternal experiences of racism and violence as predictors of preterm birth: Rationale and Study Design. *Paediatric and Perinatal Epidemiology*, 15(S2), 124-135.
- Romero, R., Gomez, R., Chaiworapongsa, T., Conoscenti, G., Kim, J. C., & Kim, Y. M. (2001). The role of infection in preterm labour and delivery. *Paediatric and Perinatal Epidemiology*, 15(S2), 41-56.
- Sibai, B. M., Carittis, S., Hauth, J., Lindheimer, M., VanDorsten, J. P., MacPherson, C., et al. (2000). Risks of preeclampsia and adverse neonatal outcomes among women with pregestational diabetes mellitus. NICHD Network of Maternal-Fetal Medicine Units. *American Journal of Obstetrics and Gynecology*, 182(2), 364-369.
- Sibai, B. M. (2002). Chronic hypertension in pregnancy. *Obstetrics and Gynecology*, 100(2), 369-377.
- Slattery, M. M., & Morrison, J. J. (2002). Preterm delivery. *Lancet*, 360(9344), 1489-1497.
- U.S. Department of Health and Human Services (2000). *Healthy People 2010: Understanding and improving health* (2nd ed.). Washington, DC: U.S. Government Printing Office.
- Wadhwa, P. D., Culhane, J. F., Rauh, V., Barve, S. S., Hogan, V., Sandman, C. A., et al. (2001). Stress, infection and preterm birth: A biobehavioral perspective. *Paediatric and Perinatal Epidemiology*, 15(S2), 17-29.
- Ware, J. E., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36), I: Conceptual framework and item selection. *Medical Care*, 30(6), 473-483.
- Wise, P. H. (2003). The anatomy of a disparity in infant mortality. *Annual Review of Public Health*, 24, 1-22.
- Whitener, L. A., & McGranahan, D. A. (2003). Rural America: Opportunities and challenges. *Amber Waves*, 1(1), 14-21.
- Wylie, B. R., Kong, J., Kozak, S. E., Marshall, C. J., Tong, S. O., & Thompson, D. M. (2002). Normal perinatal mortality in Type 1 diabetes mellitus in a series of 300 consecutive pregnancy outcomes. *American Journal of Perinatology*, 19(4), 169-176.
- Ziller, E. C., Coburn, A. F., Loux, S. L., Hoffman, C., & McBride, T. D. (2003). Health Insurance Coverage in Rural America: Chartbook. Kaiser Commission on Medicaid and the Uninsured. Retrieved October 4, 2004 from <http://www.kff.org/uninsured/4093.cfm>