Changes in the Relationship Between Marriage and Preterm Birth, 1989–2006

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ABSTRACT

Objective. Maternal marriage has historically been protective against preterm birth (PTB); however, social norms and behaviors surrounding marriage have changed over time in the United States. We analyzed secular trends in the relationship between marriage and PTB.

Methods. We collected data about all births in Michigan between 1989 and 2006 to assess (1) the relationship between marital status and PTB and moderately PTB risk by year, and (2) the relationship between married and unmarried status and PTB and moderately PTB by year relative to similar marital status in 1989.

Results. Among nearly 2.4 million births between 1989 and 2006, PTB risk among married mothers increased while risk among unmarried mothers decreased. In adjusted models, married status became less protective against PTB relative to unmarried status over time by year, and was associated with higher risk of PTB over time. Moderately PTB risk increased among both married and unmarried groups, but more so among married mothers.

Conclusion. Our findings suggest that marriage is becoming less protective against PTB over time. The influence of social factors on risk for adverse birth outcomes is likely dynamic, suggesting that ongoing revisions to our understanding are in order.

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Defined by the World Health Organization as birth before 37 completed weeks of gestation, preterm birth (PTB) is a major contributor to perinatal and neonatal mortality, serious neonatal morbidity, and moderate to severe childhood disability.¹ In wealthy countries such as the United States, 6%–10% of all births are preterm, and deaths to preterm infants comprise more than two-thirds of all neonatal deaths.²

Married status has long been associated with a lower risk of PTB,^{1,3,4} as well as other adverse perinatal outcomes including low birthweight,^{3,5,6} small-for-gestational-age infants,^{3,5,7,8} and fetal and neonatal mortality.⁹ Several factors may explain the relationship between marital status and risk for adverse birth outcomes, including differences between married and unmarried mothers in financial security,^{10–12} health-care access,^{4,13} social support, and mental health.^{14–18}

The presumed health-promoting effect of marriage has led to its promotion as a positive social construct that may improve the health of populations.^{19–22} However, in the past two decades, the role of marriage has changed in North America. Bumpass and Cherlin independently contended that marriage has undergone a “decline in significance” and a deinstitutionalization as a result of a deterioration of the marital norms that shape partners’ social behaviors and a trend toward individuation, personal choice, and self-development.^{23,24} It is plausible, therefore, that as norms governing partners’ marital behaviors have deteriorated over time, mechanisms mediating the relationship between marriage and PTB risk may have weakened, thereby altering the relationship between marital status and the risk of PTB. For example, as partners involved in marital relationships become more independent and self-oriented, and therefore invest fewer of their resources (e.g., money, time, and attention) in one another, it follows that the financial and social support afforded married mothers via their marriages may diminish, with plausible downstream effects on maternal mental health and access to health-care services.

In addition, the increasing incidence of PTB in wealthy countries in the past two decades has been shown to be partially attributable to the increasing rate of obstetric interventions,²⁵ such as cesarean section and induced labor.²⁶ Compared with unmarried mothers, married mothers have been shown to have more ready access to health services.^{4,13} It is possible that a higher rate of later-term obstetric interventions among married vs. unmarried mothers could change the relationship between marital status and PTB over time by increasing the incidence of obstetrically induced PTB among married vs. unmarried mothers.

We hypothesized that the apparent protective effect of marriage on risk of PTB has decreased with time as a result of the aforementioned mechanisms. We analyzed secular trends in PTB, very PTB, and moderately PTB risk among married and unmarried mothers over time using data from one U.S. state between 1989 and 2006.

METHODS

Data

We obtained birth certificate data for live singleton births in Michigan from January 1, 1989, to December 31, 2006 ($n=2,377,661$). Data were compiled from the birth records of the state of Michigan by the Michigan Department of Community Health.

The primary health indicator of interest was PTB; we also considered very PTB and moderately PTB in explanatory analyses. Infants with clinical gestational age estimates <37 weeks were considered PTB, those with estimates between 34 and 36 completed weeks were considered moderately PTB, and those with estimates <32 completed weeks were considered very PTB.²⁷ No gestational age estimates were missing.

Explanatory covariates collected included maternal marital status at birth (collected and analyzed as a binary variable: married vs. unmarried), maternal race/ethnicity (analyzed as a categorical variable: white, black, Hispanic, or other), maternal education (analyzed as a categorical variable: <12 years of education, ≥12 years of education, college graduate, or unknown), maternal age at birth (analyzed as a categorical variable: <20, 20–35, or >35 years of age), and previous live birth(s) (analyzed as a categorical variable for analysis: none, one, or ≥2 previous births, or unknown). No marital status data were missing; missing data in other covariates were classified as “unknown.”

The Health Science Institutional Review Board of the University of Michigan and the Institutional Review Board of the Michigan Department of Community Health approved this study.

Analysis

All analyses were stratified by year. First, we calculated univariate statistics to describe our sample and used bivariate Chi-square tests to assess differences in each outcome and explanatory covariate by marital status. Second, we assessed PTB incidence by year, stratified by marital status, and calculated Cochran-Armitage tests for trend. Third, we used multivariable log-binomial regression models of PTB independently by year, adjusted for race/ethnicity, education, age, and previous live birth(s) to assess risk of PTB among

unmarried vs. married mothers. Fourth, we calculated incidence of very PTB and moderately PTB by year. Fifth, we used multivariable log-binomial regression models adjusted for race/ethnicity, education, age, and previous live birth(s) to assess PTB and moderately PTB risk among married mothers by year relative to married mothers in 1989. We also used similarly adjusted multivariable models to assess PTB and moderately PTB risk among unmarried mothers by year relative to unmarried mothers in 1989.

We used SAS® version 9.2 for all statistical analyses.²⁸

RESULTS

The Table shows univariate statistics and bivariate Chi-square tests between each covariate and marital status. Married mothers had a lower risk ($p<0.01$) of PTB, moderately PTB, and very PTB compared with unmarried mothers. Marital status was also significantly associated with race/ethnicity ($p<0.01$), education

($p<0.01$), and previous live births ($p<0.01$); married mothers were generally better educated, older, and more likely to have had previous births.

Figure 1 shows the incidence of PTB by year, stratified by maternal marital status as well as Cochran-Armitage tests for trend. The incidence of PTB increased with time among married mothers and decreased with time among unmarried mothers. The incidence of PTB among married mothers increased by 31% from 1989 to 2006 ($p<0.001$), while incidence of PTB among unmarried mothers decreased by 9% ($p<0.001$) during the same time period.

Figure 2 shows the relative risk of PTB among unmarried vs. married mothers by year, adjusted for race/ethnicity, education, age, and previous live birth(s). The adjusted relative risk (ARR) of PTB among unmarried mothers vs. married mothers decreased with time. In 1989, the ARR of PTB among unmarried vs. married mothers was 1.49. By 2006, the ARR of PTB among unmarried vs. married mothers was 1.21.

Figure 3 shows the risk of PTB among married and

Table. Bivariate relationships between marital status and outcome and predictor variables in a study of live singleton births ($n=2,377,661$) in Michigan, 1989–2006

Variable	Overall	Marital status		P-value
	N (percent)	Unmarried (percent)	Married (percent)	
Birth				
PTB	186,575 (7.9)	10.6	6.5	<0.01
Moderately PTB	131,549 (5.5)	6.9	4.8	<0.01
Very PTB	33,958 (1.4)	2.4	1.0	<0.01
Marital status				
Married	1,598,633 (67.2)			
Unmarried	779,028 (32.8)			
Race/ethnicity				<0.01
White	1,753,743 (73.8)	22.3	77.7	
Black	443,680 (18.7)	74.6	25.4	
Hispanic	103,593 (4.4)	41.4	58.6	
Other/unknown	76,645 (3.2)	18.1	82.0	
Education				<0.01
<12th grade	428,817 (18.0)	67.7	32.3	
≥High school	1,311,756 (55.2)	33.0	67.0	
≥College degree	516,210 (21.7)	4.9	95.1	
Unknown	120,878 (5.1)	25.3	74.7	
Age (in years)				<0.01
<20	277,865 (11.7)	81.7	18.4	
20–35	1,839,771 (77.4)	28.0	72.0	
>35	260,025 (10.9)	14.3	85.7	
Previous live birth(s)				<0.01
0	752,496 (31.7)	40.2	59.8	
1	677,898 (28.5)	27.7	72.4	
≥2	484,450 (20.4)	33.3	66.7	
Unknown	462,817 (19.5)	27.6	72.4	

PTB = preterm birth

Figure 1. Incidence of preterm birth^a stratified by marital status among 2,377,661 live singleton births in Michigan, 1989–2006

^aPreterm birth is defined as birth at <37 completed weeks of gestation.

^bCochrane-Armitage test of trend, $p < 0.001$

unmarried mothers by year relative to mothers of the same marital status in 1989, adjusted for race/ethnicity, education, age, and previous live birth(s). Among

married mothers, the risk of PTB increased relative to 1989. The risk of PTB among married mothers in 2006 relative to their counterparts in 1989 was 1.46. However,

Figure 2. Adjusted^a relative risk of preterm birth^b among unmarried relative to married mothers among 2,377,661 live singleton births in Michigan, 1989–2006

^aAdjusted for race/ethnicity, previous live birth(s), age, and education

^bPreterm birth is defined as birth at <37 completed weeks of gestation.

the risk among unmarried mothers by year relative to unmarried mothers in 1989 did not change appreciably. The risk of PTB among unmarried mothers in 2006 relative to their counterparts in 1989 was 0.99.

Figure 4 shows the incidence of very PTB (<32 weeks gestation) and moderately PTB (34–36 weeks gestation) by year. Incidence of moderately PTB increased by 42.8% from 4.4% of live singleton births in 1989 to 6.3% of live singleton births in 2006. However, the incidence of very PTB (about 1.4%) did not change appreciably between 1989 and 2006.

Figure 5 shows the risk of moderately PTB among married and unmarried mothers by year relative to mothers of the same marital status in 1989, adjusted for race/ethnicity, education, age, and previous live birth(s). Among married mothers, the risk of moderately PTB increased relative to 1989. The risk of moderately PTB among married mothers in 2006 relative to their counterparts in 1989 was 1.58. The risk of moderately PTB among unmarried mothers by year relative to unmarried mothers in 1989 also increased, but not as appreciably as among married mothers. The risk of moderately PTB among unmarried mothers in 2006 relative to their counterparts in 1989 was 1.12.

DISCUSSION

In a study of nearly 2.4 million births in one U.S. state between 1989 and 2006, we found that PTB risk

increased over time among married mothers and decreased over time among unmarried mothers. In models adjusted for potential confounders, we found that married status became less protective against PTB relative to unmarried status over time. We also found that married mothers in 2006 had a higher risk of PTB than married mothers in 1989. With regard to moderately PTB, we found a greater increase in risk among married mothers than among unmarried mothers. Overall, our findings suggest that the role of marriage as a protective factor against PTB has changed over time.

Extant research about the changing role of marital status as a determinant of health has focused primarily on the changing role of marital status as a determinant of mortality. This literature, in contrast with our study, has suggested that marital status has become more protective against mortality over time.^{29–31} Moreover, we know of two studies concerned with secular trends in the relationship between marital status and self-reported health. Waite et al. assessed the relationship between marital status and self-reported health using data from the General Social Survey, a population-representative sample of Americans, from 1972 to 1996. She found no difference in self-reported health among unmarried individuals relative to married individuals over time.³² By contrast, Liu and Umberson assessed secular trends in the relationship between marital status and self-reported health from the National

Figure 3. Adjusted^a relative risk of preterm birth^b among married and unmarried mothers by year relative to mothers of the same marital status in 1989 among 2,377,661 live singleton births in Michigan, 1989–2006

^aAdjusted for race/ethnicity, previous live birth(s), age, and education

^bPreterm birth is defined as birth at <37 completed weeks of gestation.

Figure 4. Incidence of moderately preterm birth and very preterm birth^a among 2,377,661 live singleton births in Michigan, 1989–2006

^aModerately preterm birth is defined as birth between 34 and 36 completed weeks of gestation; very preterm birth refers to birth prior to 32 completed weeks of gestation.

Health Interview Survey, a population-representative sample of Americans, between 1972 and 2003. They found that self-reported health of the never-married population improved steadily, and that the difference in self-reported health between married and unmarried people converged during the study period.³³

We know of one study that assessed temporal differences in marital status and the risk of PTB. Vagero and colleagues assessed the relationship between unmarried status and the risk of PTB among two Swedish birth cohorts: one consisting of all births in a regional hospital between 1920 and 1924, and the other consisting of all births in Sweden in 1985. In the 1920–1924 cohort, the odds of PTB among unmarried mothers compared with married mothers, adjusted for age, parity, and child gender, were 1.63; however, in the 1985 cohort, unmarried status was not a significant predictor of PTB risk.³⁴ Our findings build on those of Vagero et al., demonstrating similar effects of time on the relationship between marital status and PTB in a continuous cohort of mothers.

We observed that the gap in PTB risk between married and unmarried mothers decreased with time. There are likely several explanations at play. The increasing trend toward cohabitation among unmar-

ried couples is one such explanation. It is clear that cohabitation has grown in social acceptability and preference among young adults in the U.S. In 1995, 47% of women aged 25–29 years had reported cohabiting during their lifetime, as compared with 7% of women in that age group who had reported cohabiting in 1975.^{35,36} By the mid-1990s, more than half of American high school seniors thought that cohabitation was “a good idea.”³³ In fact, a substantial proportion of the increase in out-of-wedlock births during the past several decades has been due to the increase in births to cohabiting couples.^{36,37} Importantly, cohabitation has been accompanied by the formation of joint households³⁸ and, thus, can be seen as a social competitor to marriage.

It is plausible, therefore, that cohabiting mothers may experience levels of financial and emotional support, documented mediators of the relationship between marital status and PTB risk,^{10–12,16–18} that are greater than their non-cohabiting unmarried counterparts, but lower than their married counterparts. This finding is supported by Bumpass and colleagues, who showed that a sizable proportion of women in cohabiting relationships reported that their economic and emotional security would be better if they were

married.³⁹ Moreover, Zeitlin and colleagues showed that cohabiting unmarried mothers had a lower risk of PTB than non-cohabiting unmarried mothers.⁴ If cohabitation is associated with higher financial and social support and lower PTB risk than unmarried single status, but lower financial and social support and higher risk of PTB than married status, then as the proportion of births to cohabiting vs. unmarried single mothers has increased with time,^{36,37,39} it is plausible that the relative advantage of married status should have decreased with time. This assertion may explain our observation that the risk of PTB among unmarried relative to married mothers has decreased with time.

The increasing risk of PTB among married mothers may also be explained by changes in the social norms surrounding partners' behaviors in marriage. As we noted previously, Bumpass and Cherlin independently described a trend toward individuation, personal choice, and self-development in married partners.^{23,24} It is plausible, therefore, that as social norms governing partners' marital behaviors have deteriorated over time, behavioral mechanisms mediating the relationship between marriage and PTB risk (e.g., financial or emotional support) may also have weakened, thus leading to an increased risk of PTB among married mothers over time.

Our findings regarding changes in moderately PTB risk over time also have implications with regard to potential explanations. A recent study found that

38% of moderately PTB was obstetrically induced³⁸ as compared with 18% among earlier term neonates in another study.⁴⁰ Because obstetrical intervention is most likely to cause moderately PTB, moderately PTB may be considered a proxy for obstetrically induced PTB. Our findings (1) that moderately PTB increased by 42.8% while very PTB remained stagnant during our study period and (2) that there was a greater increase in moderately PTB among married relative to unmarried mothers during our study period suggest that increases in obstetric intervention during our study period may also partly explain our findings. Because married mothers have been shown to have better health-care access than unmarried mothers,^{4,13} more ready access to obstetrical intervention among married relative to unmarried mothers may explain the increasing risk for overall PTB that we observed among married mothers.

Our findings have implications for understanding the role that social factors play as determinants of health over time. While it has long been shown that social factors (e.g., marital status) contribute to health indicators such as PTB,^{1,3,4} the roles of social determinants and the meanings of health metrics have generally been considered as static over time, and certain factors (e.g., marriage) have routinely been considered health protective.^{19–22} Our conception of social determinants of health metrics may need to change to include a more dynamic picture in which the contribution of social factors to health indicators may change as the

Figure 5. Adjusted^a relative risk of moderately preterm birth^b among married and unmarried mothers by year relative to mothers of the same marital status in 1989 among 2,377,661 live singleton births in Michigan, 1989–2006

^aAdjusted for race/ethnicity, previous live birth(s), age, and education

^bModerately preterm birth is defined as birth between 34 and 36 completed weeks of gestation.

natures of both social factors and health indicators change with time. This concept is particularly relevant when considering secular trends in social inequalities in health, as the strata upon which we measure health differences may change in meaning, and in relation to health outcomes through time.

Our findings suggest several avenues for future research. First, investigations about secular trends in the relationship between marital status and other health metrics (e.g., infant mortality, child mortality, and chronic disease risk) may clarify the changing role of marriage as a health determinant over time. Second, study of the relationship between cohabitation and/or changing marital norms and adverse birth outcomes over time may help us to understand the changing dynamic of marriage as a determinant of adverse birth outcomes. Third, investigators might explicitly consider the role of obstetric intervention in explaining the changing relationship between marital status and PTB. Fourth, and more broadly, studies concerned with the social determinants of health may consider secular trends in the health-determining roles of other social factors, such as education, socioeconomic position, race/ethnicity, and/or neighborhood-level characteristics.

Limitations

It is important to consider the following limitations when interpreting our findings. First, our data come from only one U.S. state. Therefore, our findings may not be generalizable to other contexts both within the U.S. or abroad. Second, we used a limited covariate set; of particular note, we did not include maternal anthropometric data or previous health complaints. Thus, it is possible that unmeasured factors associated with both marital status and PTB (e.g., maternal obesity), which have changed in prevalence among mothers with time, could explain our findings. Third, our work was limited by the accuracy of birth certificate data recorded in vital registry files, which can be unreliable.^{41–43}

CONCLUSION

We found that PTB risk increased over time among married mothers and decreased over time among unmarried mothers. In adjusted models, we found that married status became less protective against PTB relative to unmarried status over time by year. We also found a greater increase in risk for moderately PTB among married mothers than among unmarried mothers. Our findings suggest that the role of marriage as a protective factor against PTB has decreased over time. This occurrence may be explained, in part, by a

deterioration of the behavioral mechanisms mediating the relationship between marriage and PTB risk and/or better access to late-term obstetric interventions among married relative to unmarried mothers, as obstetrically induced PTB has increased with time.

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