Social Science & Medicine 74 (2012) 1961–1967

Contents lists available at SciVerse ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Maternal religious attendance and low birth weight

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ARTICLE INFO

Article history:
Available online 19 March 2012

Keywords:
Birth outcomes
Infant health
Health behaviors
Religion
USA

ABSTRACT

We use data from the U.S. Fragile Families and Child Wellbeing study to test whether maternal religious attendance is protective against low birth weight. Building on previous research, we also consider the mediating influence of mental health, cigarette use, alcohol use, illicit drug use, poor nutrition, and prenatal care. Our results indicate that maternal religious attendance is protective against low birth weight. In fact, each unit increase in the frequency of religious attendance reduces the odds of low birth weight by 15%. Religious attendance is also associated with lower odds of cigarette use and poor nutrition, but is unrelated to mental health, alcohol use, illicit drug use, and prenatal care. Although lower rates of cigarette use help to mediate or explain 11% of the association between maternal religious attendance and low birth weight, we find no evidence to substantiate the mediating influence of mental health, alcohol use, illicit drug use, poor nutrition, or prenatal care. Our results suggest that the health benefits of religious involvement may extend across generations (from mother to child); however, additional research is needed to fully explain the association between maternal religious attendance and low birth weight. It is also important for future research to consider the extent to which the apparent health advantages of religious adults might be attributed to health advantages in early life, especially those related to healthy birth weight.

Introduction

Low birth weight (or infants born weighing less than 2500 g or 5 pounds, 8 ounces) is a major public health concern in the United States. In 2008, approximately 8% of all singleton births were classified as low birth weight (Martin et al., 2010). Low birth weight can have devastating consequences throughout the life course. For example, research suggests that low birth weight is associated with higher rates of infant mortality, poor health, and lower levels of educational attainment (Conley, Strully, & Bennett, 2003; Goldenberg & Culhane, 2007; Valero de Bernabé et al., 2004). Lewit, Baker, Corman, and Shiono (1995) estimate that the annual direct costs associated with low birth weight account for approximately 10% of all health care costs for children.

Although low birth weight is an important issue for society as a whole, studies consistently show that rates of low birth weight are higher among mothers who are African American, of lower socioeconomic status, and single than among mothers who are non-Hispanic White, of higher socioeconomic status, and married (Conley et al., 2003; Goldenberg & Culhane, 2007; Valero de Bernabé et al., 2004). For example, in 2008, the rate of low birth weight for singleton births was approximately 5% for non-Hispanic Whites and nearly 12% for African Americans (Martin et al., 2010). In light of these inequalities, it is extremely important for researchers to identify factors that might protect against low birth weight in socially disadvantaged and underserved populations.

In this paper, we explore the protective effects of maternal religious attendance. A large and ever expanding body of research indicates that religious attendance tends to favor health and longevity within individuals (Hill, Burdette, & Idler, 2011; Idler, 2011; Koenig, McCullough, & Larson, 2001). However, only a few studies consider whether the apparent health benefits of religious involvement might extend across generations (from mother to child). In a study of non-Hispanic White singleton births in Utah, Woolley, Schuman, and Lyon (1982) found that high activity members of the Church of Jesus Christ of Latter Day Saints (LDS or Mormons) (defined as christenings performed by the baby's father) tend to exhibit a lower risk of neonatal mortality than low activity LDS members (defined by christenings performed by a non-relative), but not non-LDS respondents. Using data from the Mater-University of Queensland Study of Pregnancy, Najman, Williams, Keeping, Morrison, and Anderson (1988) show that regularly attending (weekly or monthly) affiliates of Christian sects (e.g., Jehovah's Witnesses, Mormons, and Seventh Day Adventists)

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doi:10.1016/j.socscimed.2012.02.021

and mainstream Christian groups (Protestants and Catholics) tend to exhibit lower rates of low birth weight than so-called "lukewarm Christians" who affiliate with mainstream Christian groups and attend religious services less than monthly. Although religion is not the focus of their work, Reichman, Hamilton, Hummer, and Padilla's (2008) analysis of data from the U.S. Fragile Families and Child Wellbeing study also indicates that unmarried urban mothers who attend religious services at least once per week tend to exhibit lower odds of low birth weight than unmarried urban mothers who never attend religious services.

Following the work of Reichman et al. (2008), we use data from the Fragile Families study to examine the link between maternal religious attendance and low birth weight among women who are predominantly African American, of lower socioeconomic status, and single. Building on previous research, we identify and test several possible explanations as to why religious attendance might protect against low birth weight.

Background

Why might religious attendance protect against low birth weight? Previous research has identified several explanations that are at least theoretically viable (Elsenbruch et al., 2007; Jesse, Graham, & Swanson, 2006; Jesse & Reed, 2004; Magaña & Clark, 1995; Mann, McKeown, Bacon, Vesselinov, & Bush, 2007; Najman et al., 1988; Page, 2004; Page, Ellison, & Lee, 2009). Drawing on this body of research, we explore the potential mediating influence of mental health and various health behaviors.

Mental health

Religious attendance could protect against low birth weight by enhancing the mental health of expectant mothers (Jesse et al., 2006; Magaña & Clark, 1995; Page, 2004). Studies show that religious attendance is associated with better mental health across a range of indicators, including anger, depression, anxiety, and non-specific psychological distress (Hill et al., 2011; Koenig et al., 2001). Koenig et al. (2001) explain that religious involvement benefits mental health by promoting social (e.g., social support) and psychological (e.g., optimism and a sense of meaning and purpose) resources. Research also suggests that poor mental health is a significant risk factor for several negative birth outcomes, including, for example, preterm birth, intrauterine growth retardation, and low birth weight (Dole et al., 2003; Rondó, 2007; Rondo et al., 2003).

Health behaviors

Religious attendance might also protect against low birth weight by encouraging positive health behaviors and discouraging unhealthy lifestyle choices (Jesse et al., 2006; Jesse & Reed, 2004; Magaña & Clark, 1995; Najman et al., 1988; Page, 2004; Page et al., 2009). Studies show that religious attendance is associated with a wide range of healthy behaviors, including, for example, lower levels of smoking and drinking, higher levels of exercise, greater use of preventive health care services, and more rigid adherence to medication regimens (Hill, Burdette, Ellison, & Musick, 2006; Hill et al., 2011; Koenig et al., 2001). Research concerning the health behaviors of pregnant and postpartum women confirms that regular religious attendance is associated with lower rates of alcohol use, cigarette use, and illicit drug use (Mann et al., 2007; Page et al., 2009).

There are several compelling explanations for why religious individuals might engage in so many healthy behaviors, including exposure to religious messages that discourage specific behaviors (e.g., specific biblical proscriptions against intoxication) and reinforce the sanctification (i.e., attaching religious significance) of (a) the body (e.g., the idea that the body is a temple of God), (b) parent–child relationships (e.g., the idea that children are a gift from God), and (c) authority (e.g., the idea that existing authorities are appointed by God) (Hill et al., 2011; Mahoney, Pargament, Aaron, & Murray-Swank, 2003; Page et al., 2009; Regnerus & Burdette, 2006). Specific religious doctrines and general sanctification processes are so important for health behaviors because they add religious and spiritual consequences to the regular pressures that mothers face to take care of their bodies and to follow the recommendations of health professionals or medical authorities. Religious attendance might also contribute to healthy behaviors by reducing motivations to behave in risky ways (e.g., by satisfying the need for social ties and support, and reducing negative emotions and the likelihood of self-medication) (Page et al., 2009). Negative maternal health behaviors (e.g., cigarette smoking, poor diet, heavy alcohol use, and illicit drug use) are important because they are associated with fetal growth restriction and low birth weight (Bailey & Byrom, 2007; McCormick et al., 1990; Peacock, Bland, & Anderson, 1995; Valero de Bernabé et al., 2004). There is also some evidence to suggest that prenatal care is associated with positive infant health outcomes (Alexander & Kotelchuck, 2001; Gortmaker, 1979). Cigarette smoking may be an especially important mechanism because it is one of the most common negative health practices (approximately 21% of our sample report smoking during pregnancy) and one of the most consistent predictors of low birth weight (Valero de Bernabé et al., 2004).

Hypotheses

Drawing on this background, we developed the following hypotheses to guide our analyses. Hypothesis 1: Higher levels of religious attendance will be associated with lower odds of low birth weight. Hypothesis 2: The association between religious attendance and low birth weight will be at least partially mediated or explained by lower rates of mental health problems, cigarette use, alcohol use, illicit drug use, poor nutrition, and increased use of prenatal care.

Methods

Data

The current study uses data from the Fragile Families and Child Wellbeing Study (FFCWB), an American longitudinal birth cohort study of 4898 children. Children were sampled at birth from 75 randomly selected hospitals in 20 U.S. cities (in 15 states) with populations over 200,000 between 1998 and 2000. Within each hospital, researchers took random samples of both married and unmarried births until they reached preset quotas that were based on the percentage of non-marital births in the city that occurred at that hospital in 1996 or 1997 (Reichman, Teitler, Garfinkel, & McLanahan, 2001). Roughly three quarters of the sample include births to unmarried parents. Parents were interviewed in the hospital shortly after the birth of their child. As part of an "add on" study to the core survey, additional information was collected from the medical records of both the mother and focal child. Medical records were missing on certain cases for one of three reasons: (1) The hospital did not permit researchers to abstract records or there were too few cases for it to be financially feasible to collect data at that hospital (38% of missing cases), (2) the mother refused consent (33%), or (3) the records could not be located within the hospital (29%) (http://www.fragilefamilies.princeton.edu/medrecs.asp). All standard errors are adjusted for the clustering of births within

hospitals. Medical records data are available for 3684 births in the FFCWB sample. Being missing on the medical record data (for any reason) is uncorrelated with church attendance. However, having missing values for the medical record data is positively associated with being older, married, non-Hispanic White, and having higher levels of education and income, suggesting that this subsample is even more disadvantaged than the full FFCWB sample. We also exclude mothers who had multiple births ($n = 65$) or missing information on their child's birth weight ($n = 36$). Our final sample includes 3583 respondents. Missing values for all other variables are estimated using a regression-based imputation procedure (Impute) in Stata (StataCorp, 2009). The study was reviewed by the institutional review board at Florida State University.

Measures

Low birth weight (LBW) is our focal outcome measure. Birth weight information was obtained from medical records and coded as a dichotomous variable indicating whether the child was less than 2500 g at birth (1 = LBW, 0 = not LBW).

Religious service attendance, our focal predictor variable, was measured via responses to the question, "About how often do you attend religious services?" Responses ranged from (1) "not at all" to (5) "once a week or more."

Mental health problems, our first mediating variable, were assessed using information from the respondent's medical records indicating whether the respondent had any history of depression or other mental health problems (1 = mental health problems, 0 = no mental health problems).

We also examined the mediating influence of a number of deleterious health behaviors during pregnancy: *cigarette smoking* (1 = smoked during pregnancy, 0 = did not smoke during pregnancy), *alcohol use* (1 = used alcohol during pregnancy, 0 = did not use alcohol during pregnancy), *illicit drug use* (1 = used drugs during pregnancy, 0 = did not use drugs during pregnancy) and any indication of *nutrition inadequacy* (1 = poor nutrition, 0 = no nutritional deficits) were assessed using information from the respondent's hospital medical records as well as self-reported behavior. Any indication of a health risk behavior during pregnancy resulted in the respondent being coded as positive for that specific indicator. So, for example, if a mother reported that she did not use illicit drugs during pregnancy, but she tested positive for drug use, she was then coded as using drugs during pregnancy. The medical records data contain information from laboratory tests of the mother or the baby, as well as notes by physicians or social workers. Tests for substance abuse could have taken place at any time during the pregnancy or postpartum hospital stay. In some instances, substance use was noted on the basis of case notes during the course of prenatal care or International Classification of Diseases – Ninth Revision (ICD-9) codes for drug addiction during pregnancy (Reichman, Corman, Noonan, & Dave, 2009).

We also examined the mediating influence of prenatal care. Respondents were first asked if during their pregnancy they visited a doctor or other health care professional to check on the pregnancy. Those who answered "yes" to the first question were then asked during which month of pregnancy they first visited the doctor or other health care provider. This item was then recoded to indicate the start of prenatal care in the *1st trimester* (the reference category), *2nd trimester*, *3rd trimester*, or receiving *no prenatal care*.

Numerous socio-demographic characteristics have been identified as significant correlates of low birth weight (Blumenshine, Egerter, Barclay, Cubbin, & Braveman, 2010; Goldenberg & Culhane, 2007; Kleinman & Kessel, 1987; Valero de Bernabé et al., 2004). Therefore, our analyses included controls for the following variables: *infant's sex* (1 = male infant, 0 = female infant), *mother's race/ethnicity* (1 = non-Hispanic White, 1 = Hispanic, 1 = Other Race, 0 = African American), *mother's age* (in years), *mother's level of education* (1 = less than high school, 1 = some college, 1 = college, 0 = high school), *household income-to-needs ratio* (the household's total income divided by the poverty threshold determined by household size), *respondent's relationship status* (1 = married, 1 = cohabitating, 0 = other status), *immigrant status* (1 = immigrant, 0 = born in the U.S.), *health insurance* (1 = Medicaid, 1 = uninsured, 0 = private insurance), *parity* (1 = low parity, 1 = high parity, 0 = first birth), and *gestational age* (in weeks). We also included a measure of *mother's self-reported health status*, which originally ranged from (1) "excellent" to (5) "poor." This item was recoded to indicate fair or poor health (1 = poor health, 0 = other health status).

Because religious traditions differ in their level of church attendance, as well as some health behaviors (Koenig et al., 2001; Smith, Denton, Faris, & Regnerus, 2002), we also accounted for religious affiliation. Using a modified version of the coding scheme developed by Steensland et al. (2000), religious affiliation was measured with seven dummy variables. These variables captured *conservative Protestants* (e.g., Baptists, Pentecostals), *other Protestants* (e.g., Methodists, Presbyterians, Episcopalians), *Catholics*, *Muslims*, *other religious faiths* (e.g., Jews), *other Christian* affiliations (e.g., those who identify as "just Christian"), and *no affiliation* (the reference category).

Results

Descriptive analyses

Table 1 provides descriptive statistics for all selected variables. According to these results, approximately 10% of respondents gave birth to a low birth weight infant. The average respondent reported attending religious services "several times a year." The most common religious affiliations included conservative Protestantism (30%), Catholicism (30%), and other Christian faiths (17%). With respect to potential mediating variables, we observed moderate levels of smoking (21%) and low levels of alcohol consumption (8%), illicit drug use (10%), mental health issues (13%), poor nutrition (5%), and no prenatal care (2%).

The overall demographic profile of the sample was socially disadvantaged across several key indicators. The average respondent was quite young (approximately 25 years of age). In terms of race and ethnic composition, the sample included African Americans (48%), Hispanics (29%), non-Hispanic Whites (19%), and respondents of other races and ethnicities (4%). Very few respondents reported having a college degree (10%). Most respondents were unmarried (77%).

Table 1 also provides key bivariate associations. The attendance column presents unstandardized coefficients obtained from a series of bivariate ordered logistic regressions of religious attendance. The low birth weight column presents unstandardized coefficients obtained from a series of bivariate binary logistic regressions of low birth weight. With no adjustments for background variables, we observed that women who exhibited a history of mental health issues, poor nutrition, substance use during pregnancy (smoking, alcohol, and illicit drug use), and delayed prenatal care attended religious services less often than other women. A history of mental health issues, poor nutrition, substance use during pregnancy, and delayed prenatal care also increased the odds of low birth weight. In the next section, our formal mediation analyses consider whether these patterns help to explain why religious attendance appears to reduce the odds of low birth weight.

Table 1
Descriptive statistics.

	Range	Mean/ proportion	SD	Attendance	Low birth weight
Dependent variable					
Low birth weight	0–1	0.099	–	–	–
Focal variable					
Religious attendance	1–5	3.025	1.370	–	−0.13***
Potential mediators					
Mental health problems	0–1	0.131	–	−0.23**	0.91***
Poor nutrition	0–1	0.045	–	−0.66***	0.58*
Cigarette use	0–1	0.208	–	−0.63***	0.92***
Alcohol use	0–1	0.078	–	−0.38**	0.89***
Illicit drug use	0–1	0.102	–	−0.40***	1.05***
1st Trimester prenatal care	0–1	0.781	–	–	–
2nd Trimester prenatal care	0–1	0.175	–	−0.17*	0.38**
3rd Trimester prenatal care	0–1	0.020	–	−0.54**	0.27
No prenatal care	0–1	0.024	–	−0.29	0.91**
Socio-demographic controls					
Religious affiliation					
Conservative Protestant	0–1	0.296	–	2.00***	0.18
Other Protestant	0–1	0.055	–	2.09***	−0.07
Catholic	0–1	0.297	–	2.01***	−0.66**
Muslim	0–1	0.013	–	2.28***	−0.10
Other religion	0–1	0.055	–	2.55***	−0.25
Other Christian	0–1	0.171	–	2.33***	−0.19
No affiliation	0–1	0.113		–	–
Male infant	0–1	0.522	–	0.03	−0.21
Race/ethnicity					
African American	0–1	0.478	–	–	–
Non-Hispanic White	0–1	0.194	–	−0.22*	−0.45**
Hispanic	0–1	0.289	–	0.05	−0.80***
Other race	0–1	0.039	–	0.03	−0.78*
Mother's age	15–43	25.071	6.004	0.04***	0.01
Education					
Less than high school	0–1	0.368	–	−0.24*	−0.03
High school	0–1	0.301	–	–	–
Some college	0–1	0.236	–	0.37***	−0.40*
College	0–1	0.095	–	0.57***	−0.46*
Income-to-needs ratio	0–14	2.133	2.328	0.06***	−0.03
Relationship status					
Married	0–1	0.229	–	0.76***	−0.73***
Cohabitating	0–1	0.372	–	−0.18*	−0.28*
Other status	0–1	0.393	–	–	–
Immigrant	0–1	0.172	–	0.62***	−0.83***
Health insurance					
Medicaid	0–1	0.636	–	−0.43***	0.60***
Uninsured	0–1	0.067	–	−0.41**	0.72**
Private insurance	0–1	0.303	–	–	–
Obesity	0–1	0.216	–	0.11	−0.43**
Poor health	0–1	0.078	–	−0.11	0.46**
Parity					
First birth	0–1	0.366	–	–	–
Low parity	0–1	0.484	–	0.08	−0.26*
High parity	0–1	0.150	–	−0.12	0.22
Gestational age	23–43	38.599	2.319	0.01	−0.98***

Notes: $n = 3583$. Shown are variable ranges, means/proportions, and standard deviations. The attendance column presents unstandardized coefficients obtained from a series of bivariate ordered logistic regressions of religious attendance. The low birth weight column presents unstandardized coefficients obtained from a series of bivariate binary logistic regressions of low birth weight. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Mediation analyses

Our mediation analyses proceeded in four steps. In Step 1, we tested whether religious attendance was associated with low birth weight. In Step 2, we tested whether each potential mediator was associated with low birth weight. In Step 3, we tested whether religious attendance was associated with each potential mediator. Finally, in Step 4, we formally tested the indirect effect of religious attendance on low birth weight through each viable mediator (i.e., those mediator variables associated with religious attendance and low birth weight).

Tables 2a and 2b present the results of our primary multivariate logistic regression analyses. According to Model 1 of Table 2a, religious attendance was associated with a reduction in the odds of low birth weight (Step 1). In other words, women who attended religious services more frequently tended to exhibit lower odds of low birth weight than women who attended less frequently. The odds ratio for church attendance (0.836) implied that each unit increase in the frequency of religious service attendance reduced the odds of low birth weight by approximately 16% ($[e^b - 1]100$). This means that respondents who report attending religious services "once a week or more" (the maximum score of 5) exhibited an 80% reduction in the odds of low birth weight in comparison to those who never attended religious services. The general association between religious attendance and low birth weight was consistent across models, even with adjustments for a range of potential mediators and background factors. In the full model (Model 8 of Table 2b), the odds ratio for religious attendance

Table 2a
Odds ratios for logistic regression of low birth weight on religious attendance and background factors.

	Model 1	Model 2	Model 3	Model 4
Religious attendance	0.836**	0.835**	0.852*	0.838**
Mental health problems		1.723*		
Cigarette use			2.057***	
Alcohol use				1.240
Illicit drug use				
Poor nutrition				
2nd Trimester				
3rd Trimester				
No prenatal care				
Conservative Protestant	1.594	1.618	1.581	1.594
Other Protestant	1.149	1.149	1.111	1.140
Catholic	0.915	0.966	0.941	0.925
Muslim	2.069	2.098	2.098	2.088
Other religion	1.862	1.823	1.886	1.873
Other Christian	1.284	1.300	1.279	1.275
Male infant	0.752	0.747	0.765	0.758
Non-Hispanic White	0.680	0.646	0.585*	0.677
Hispanic	0.732	0.714	0.774	0.729
Other race	0.586	0.575	0.589	0.588
Mother's age	1.037*	1.029	1.027	1.034
Less than high school	0.810	0.780	0.754	0.807
Some college	0.652	0.658	0.672	0.649
College	0.794	0.805	0.868	0.806
Income-to-needs ratio	1.064	1.067	1.074	1.066
Married	0.848	0.881	0.914	0.866
Cohabitating	0.824	0.826	0.810	0.829
Immigrant	0.886	0.945	1.014	0.901
Medicaid	2.355***	2.276***	2.266***	2.344***
Uninsured	1.370	1.318	1.334	1.361
Obesity	0.687	0.690	0.723	0.692
Poor health	0.944	0.894	0.902	0.949
Low parity	0.470***	0.482***	0.460***	0.474***
High parity	0.663	0.640	0.641	0.664
Gestational age	0.366***	0.366***	0.366***	0.367***
Wald chi^2	949.36	987.62	1114.33	951.73
Pseudo R^2	0.51	0.51	0.52	0.51

Table 2b
Odds ratios for logistic regression of low birth weight on religious attendance and background factors.

	Model 5	Model 6	Model 7	Model 8
Religious attendance	0.842*	0.837**	0.835**	0.846*
Mental health problems				1.664*
Cigarette use				2.032***
Alcohol use				0.800
Illicit drug use	1.345			0.899
Poor nutrition		1.288		1.132
2nd Trimester			1.385	1.306
3rd Trimester			1.191	1.202
No prenatal care			0.526	0.422
Conservative Protestant	1.571	1.596	1.556	1.567
Other Protestant	1.122	1.139	1.127	1.086
Catholic	0.899	0.911	0.878	0.941
Muslim	2.045	2.030	2.111	2.100
Other religion	1.815	1.848	1.834	1.796
Other Christian	1.246	1.274	1.262	1.274
Male infant	0.761	0.753	0.742	0.740
Non-Hispanic White	0.694	0.677	0.678	0.554*
Hispanic	0.749	0.737	0.555	0.757
Other race	0.586	0.590	0.736	0.548
Mother's age	1.033	1.037	1.037*	1.024
Less than high school	0.798	0.802	0.826	0.747
Some college	0.658	0.647	0.657	0.680
College	0.820	0.794	0.817	0.884
Income-to-needs ratio	1.064	1.064	1.066	1.075
Married	0.868	0.853	0.864	0.934
Cohabitating	0.829	0.826	0.817	0.797
Immigrant	0.924	0.873	0.891	1.035
Medicaid	2.292***	2.323***	2.289***	2.152**
Uninsured	1.301	1.362	1.350	1.307
Obesity	0.705	0.685	0.689	0.711
Poor health	0.928	0.939	0.950	0.858
Low parity	0.469***	0.471***	0.466***	0.466***
High parity	0.660	0.666	0.640	0.604
Gestational age	0.367***	0.366***	0.364***	0.363***
Wald chi^2	966.14***	964.39***	1105.25	1541.42
Pseudo R^2	0.51	0.51	0.51	0.52

Notes: $n = 3583$. *$p < .05$, **$p < .01$, ***$p < .001$.
Notes: $n = 3583$. *$p < .05$, **$p < .01$, ***$p < .001$.

(0.846) implied that every unit increase in the frequency of religious service attendance reduced the odds of low birth weight by approximately 15%.

Models 2–4 of Table 2a and Models 5–7 of Table 2b add a sequence of six potential mediators to Model 1 of Table 2a. According to these results, alcohol use (Model 4), illicit drug use (Model 5), poor nutritional status (Model 6), and prenatal care (Model 7) were unrelated to the odds of low birth weight. Models 2 and 3 of Table 2a reveal that a history of mental health issues and cigarette use, respectively, were associated with the odds of low birth weight (Step 2). More specifically, the odds of low birth weight were elevated by approximately 72% for respondents with a history of mental health issues and nearly 106% for respondents who reported smoking during pregnancy.

In Table 3, we regress each of our potential mediators on religious attendance and all background factors. These results suggest that religious attendance is unrelated to mental health, alcohol use, illicit drug use, and prenatal care. We also observe that religious attendance is associated with lower odds of cigarette use and poor nutrition (Step 3).

Because alcohol use, illicit drug use, poor nutrition, and prenatal care are unrelated to the odds of low birth weight (Step 2), these factors are eliminated as potential mediators. Although mental health issues are associated with low birth weight, religious attendance is not associated with mental health issues (Step 3). This combination of patterns also excludes mental health from consideration as a potential mediator. Because religious attendance is associated with cigarette use (Step 3), and cigarette use is associated with low birth weight (Step 2), we may formally test whether the association between religious attendance and low birth weight is mediated by cigarette use.

In this paper, we used the method for assessing mediation with dichotomous variables outlined by Mackinnon and Dwyer (1993). To compare the effect of religious attendance across nested models (i.e., before and after cigarette use is added to the regression equation), we converted the odds ratios for religious attendance to unstandardized logistic regression coefficients by taking the natural log of the odds ratios. From Model 1 to Model 3 (when cigarette use is added to the regression equation), the coefficient for religious attendance is reduced by approximately 11% ([−0.179 to −0.160]/−0.179). According to the Sobel (1982) mediation test, there is a statistically significant indirect effect of religious attendance on low birth weight through cigarette use ($z = 2.94$, $p < .01$) (Step 4).

Discussion

Low birth weight is a major public health concern, especially for populations that are socially disadvantaged and underserved. In this paper, we tested whether religious attendance is protective against low birth weight among women who are predominantly African American, of lower socioeconomic status, and single. Building on previous research, we also identified and tested several potential mediators of the association between religious attendance and low birth weight.

Our first hypothesis stated that higher levels of religious attendance would be associated with lower odds of low birth weight. In support of our first hypothesis, we found that maternal religious attendance is protective against low birth weight. This result is generally consistent with previous research (Najman et al., 1988; Reichman et al., 2008).

Our second hypothesis stated that the association between religious attendance and low birth weight would be at least partially mediated or explained by lower rates of mental health problems, cigarette use, alcohol use, illicit drug use, poor nutrition, and late prenatal care. Our results provided weak support for our second hypothesis. Although lower rates of cigarette use help to

Table 3
Potential mediators regressed on religious attendance and background factors.

	Mental health problems	Cigarette use	Alcohol use	Illicit drug use	Poor nutrition	2nd Trimester prenatal care	3rd Trimester prenatal care	No prenatal care
Religious attendance	0.989	0.860***	0.887	0.894	0.765***	0.981	0.869	0.981
Wald chi^2	415.97***	481.80***	324.48***	367.23***	437.85***		–	
Pseudo R^2	0.10	0.16	0.09	0.15	0.10		0.07	

Notes: $n = 3583$. *$p < .05$, **$p < .01$, ***$p < .001$. The models for prenatal care present odds ratios obtained from a multinomial logistic regression. For these models, prenatal care beginning in the 1st trimester serves as the common reference category. The remaining models present odds ratios obtained from a series of binary logistic regressions. All models control for respondent's religious affiliation, race and ethnicity, immigrant status, age, education, income-to-needs ratio, marital status, health insurance status, body mass, parity, health status, infant sex, and gestational age.

partially mediate or explain the association between maternal religious attendance and low birth weight, we found no evidence to substantiate the mediating influence of mental health, alcohol use, illicit drug use, poor nutrition, or prenatal care.

Previous work has speculated that cigarette use might mediate or explain the link between religious attendance and low birth weight (Jesse et al., 2006; Jesse & Reed, 2004; Magaña & Clark, 1995; Page et al., 2009). The idea is that religious involvement discourages cigarette use by exposing women to religious environments that sanctify the body, parent–child relationships, and medical authority (Mahoney et al., 2003; Page et al., 2009; Regnerus & Burdette, 2006). To this point, empirical examinations of the mediating influence of cigarette use (Najman et al., 1988; Reichman et al., 2008) are unclear because they enter large blocks of behaviors (and other health-related factors) at one time and fail to formally test any indirect effects. To the best of our knowledge, we are the first to formally test the mediating influence of mental health problems, cigarette use, alcohol use, illicit drug use, poor nutrition, and prenatal care. We are also the first to isolate the mediating influence of cigarette use. This finding is notable because smoking is the most common negative health behavior among the women in our study and is one of the more consistent predictors of low birth weight (Valero de Bernabé et al., 2004).

The present study is limited in several respects. First and foremost, the estimates for our focal associations are likely biased due to unobserved heterogeneity. Although previous studies emphasize this issue when estimating associations between factors like maternal smoking and birth weight (Rosenzweig & Schultz, 1983; Schultz, 1984), we are unable to formally assess the influence of any exogenous area characteristics. The FFCWB medical records data do not contain geographic identifiers or contextual data, and those files are not allowed to be merged with the medical records data. Nevertheless, it is extremely important for future studies to perform these types of analyses because, in the absence of proper instruments, factors like maternal prenatal care can be overestimated, while factors like maternal smoking can be underestimated (Rosenzweig & Schultz, 1983; Schultz, 1984). It is also important to consider the influence of omitted variables on our key results. For example, Hill et al. (2011) note that if individuals with certain conventional and risk-averse personality types are attracted to or selected into religious activities, personality selection processes could account for at least some of the health effects of religious attendance through any apparent social or behavioral mechanisms. Again, the FFCWB data do not allow for any direct examination of these issues. Because we are unable to formally address the issue of endogeneity, our results are especially contingent upon further testing and replication and should be interpreted with caution.

We would also like to highlight some limitations related to measurement and external validity. First, our primary measure of religious involvement is limited to a single item – religious attendance. Although religious attendance is widely used and widely associated with most important indicators of religious involvement, single item measures tend to be high in random measurement error and, as a consequence, are likely to suffer from low reliability. Second, our measure of mental health problems is imprecise, including any known mental problems mentioned in the respondent's medical record. Third, the FFCWB data represent a very select group of disadvantaged urban mothers. As a result, it is unclear whether the general conclusions of our study would extend to, for example, disadvantaged mothers in rural areas.

With these limitations in mind, additional research is needed to fully explain the association between maternal religious attendance and low birth weight. If religious attendance is protective against low birth weight, why is it? It may be that the association between religious attendance and low birth weight is mediated or explained by other important psychosocial resources that are either unavailable or inadequately measured in the FFCWB data, including, for example, social support and control beliefs.

Religious attendance may protect against low birth weight by promoting social support among expectant mothers (Magana & Clark, 1995; Najman et al., 1988). Several studies show that greater religious attendance is associated with higher levels of social support (Bradley, 1995; Ellison & George, 1994; Krause, 2008). Krause (2008) explains that religious attendance is an interaction ritual that is characterized by repeated and patterned social interaction. Over time, regular social contact within the same religious community can expand social networks and foster greater contact with network members (Bradley, 1995; Ellison & George, 1994; Krause, 2008). Religious communities may also create generally supportive environments through religious socialization (e.g., by encouraging churchgoers to help the less fortunate or by sanctifying family relationships). Social support is extremely important to the health and wellbeing of expectant mothers (Glazier, Elgar, Goel, & Holzapfel, 2004). There is also some evidence to suggest that social support is inversely associated with a range of negative birth outcomes, including low birth weight (Elsenbruch et al., 2007).

Religious involvement is also positively associated with psychological resources, including self-control (McCullough & Willoughby, 2009) and personal control or mastery (Dillon & Wink, 2007; Schieman, Pudrovska, & Milkie, 2005). Religious involvement is characterized by social control and self-regulation. Within the context of religious communities, there are social (and perceived divine) sanctions associated with conformity to and deviance from established religious standards (e.g., behavioral and ritual standards and expectations). Religious involvement contributes to self-control by building generic self-regulatory strength over the life course (McCullough & Willoughby, 2009). Because religion is, in many respects, a routine practice of constraint and restraint, religious adults are more likely to believe that they can control their emotions and behavior. A strong sense of divine control may also help to promote a sense of personal control or mastery over various aspects of life when adults trust that anything is possible through faith and a strong partnership with a divine figure (Harvey & Silverman, 2007; Schieman et al., 2005). These processes are potentially important in light of research showing that higher levels of mastery are associated with lower levels of pregnancy-related anxiety and lower rates of low birth weight and being small for gestational age (Dunkel-Schetter, 2009; Goldenberg et al., 1991; Rini, Dunkel-Schetter, Wadhwa, & Sandman, 1999).

Although our results suggest that the health benefits of religious involvement may extend across generations (from mother to child), it is not possible to know from the current study whether maternal religious involvement continues to benefit children beyond birth weight. It is important for future research to consider broader religion–health connections by exploring the extent to which the noted health advantages of religious adults might be attributed to health advantages in early life, especially those related to healthy birth weight. Future work should explore how religious involvement might moderate or buffer the impact of consistent risk factors (e.g., race, economic disadvantage, and stress) on low birth weight. Finally, claims to the veracity and external validity of our results require replication across indicators of religious involvement (e.g., indicators of subjective religiosity), degrees of birth weight (e.g., very low birth weight), U.S. subpopulations (e.g., mothers of moderate to high socioeconomic status), and non-U.S. cultures where the nature and social influence of religion can vary to a large degree. Studies along these lines would certainly provide a deeper understanding of religious variations in birth weight.

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