

Infant Mortality and Mother's Religious Involvement in Brazil

Abstract

Although several variables have been recognized as determinants of infant mortality in Brazil, almost no attention has been given to the implications of religion involvement for this phenomenon. This paper helps to fill this gap employing data from the 1996 Brazil Demographic Health Survey (DHS) and a Cox proportional hazards model to examine the potential association between infant mortality and mother's religious involvement, as measured by religious affiliation and service attendance. Unadjusted results show that differences in the hazard ratios of infant mortality by mother's religious involvement are large in magnitude and statistically significant. When controlling for demographic and socioeconomic variables, the baseline relationship disappears, supporting the selectivity hypothesis. Based on our quantitative results and using available ethnographic evidence, we conclude by suggesting that Protestantism and attendance at religious services may be indirectly associated with infant mortality through mediating factors, such as marriage and the age at first child.

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Introduction

The last decades have witnessed a rapid and widespread pluralization of Brazil's religious landscape, which has been remarked by a tremendous variety of religious beliefs and practices and ease with which people adopt new religious patterns (Pierucci and Prandi, 2000; Perez, 2000; Decol, 1999; Chesnut, 1997; Burdick, 1996; Bruneau, 1982). Among some changes associated with this process of religious transformations, the growth of Protestantism has attracted special attention. Protestant churches in Brazil increased its participation from 3 percent in 1940 to fifteen percent in 2000 (Mariano, 2004). This growth, however, has not been gradual; it was largely concentrated in the 1990s, a decade that experienced an explosive increase in the number of people converting to Protestantism, led by the Pentecostal Protestant denominations.

The growth of Protestantism in Brazil may be related to changes in behaviors and attitudes that may affect mortality and health-related outcomes. Some researchers have suggested, for instance, that Protestantism, and more recently Pentecostal Protestantism, may positively change behavior associated with reduced alcohol consumption, smoking, drug use, violence, family conflict, sexual risk attitudes, and poverty (Chesnut, 1997 and 2003; Burdick, 1996; Mariz, 1994). These changes are very often translated into changes in male behavior, which can affect gender relations and equity, values of family life, encouraging, for instance, the responsible fathering of children (Wood, Willians, and Chijiwa, 2007; McKinnon, Potter and Garrard-Burnett, 2008). Recent transformations in Brazil's religious landscape are, therefore, likely to improve the welfare of infants and children, including positive results in their health outcomes and risk of death. Trying to understand better this connection, the purpose of this article is to examine the potential

associations between mother's religious involvement (as measured by mother's religious affiliation and religious service attendance) and infant mortality in Brazil.

Our main findings indicate that mother's religion affiliation and attendance do not have an independent association with infant mortality net of socioeconomic and demographic factors. However, this non-significant association of religion may suggest that its connection is indirect and operates through mediating variables, such as marriage and age at first child.

Protestantism in Brazil

The nineteenth century was marked by the settlement and growth of Protestantism in Brazil (Chesnut, 2003 and 1997; Read and Ineson, 1973). This phenomenon, which is recognized as the emerging pluralization of Brazil's religious landscape, was characterized by the arrival of several Protestant missionary churches in this country.

The first Protestant church was organized in Brazil in 1837 by German Lutherans, who had settled first in São Paulo, Rio de Janeiro, and Rio Grande do Sul in 1823. They were followed by missionaries of the Presbyterian Church, first coming from Scotland in 1855 and later coming from the United States of America in 1859. The formers were responsible for the beginning of the Evangelical Congregational Church in Brazil. Methodists, Baptists, Episcopalians, and the Seventh-day Adventists arrived latter, in 1867, 1881, 1889, and 1900, respectively (Read and Ineson, 1973). These denominations are referred to as traditional or mainline Protestants. Although they were tiny minorities, they acted as protagonists in remaking Brazil and all Latin America's religious landscape (Chesnut, 2003).

While traditional Protestants started gaining a presence in Brazil during the nineteenth century, Pentecostal Protestants, first represented by the Assemblies of God, are a twentieth century phenomenon that arrived in 1911 in Brazil (Alves and Novellino, 2006; Mariano, 2004; Decol, 1999). Pentecostalism is characterized on the workings of the Holy Spirit as manifested in the gifts of healing, prophecy, and speaking of tongues. In the 1970s, neo-Pentecostalism, led by Universal Church of Kingdom of God, emerged in Brazil, emphasizing in what is known as prosperity theology. Thus, neo-Pentecostal churches teach that material and spiritual blessings are connected and provide services that focus on financial prosperity and social mobility (Mariano, 2004).

The recent growth of Pentecostal Protestantism in Brazil has called attention to social consequences of religious conversion. It is important to emphasize that the great majority of Pentecostal Protestant converts in Brazil have been poor nonpracticing Catholics. In his book about the Pentecostal boom in Brazil, Andrew Chesnut (1997) explained how Pentecostalism enjoyed overwhelming success in appealing to the poor (or the poorest of the poor) based on the idea of a positive transformation for this group. He observed that the majority of his study's informants in Belém (state of Pará) had adhered to the faith in an attempt to cure an illness. The 1996 ISER (Institute of Religious Studies – Rio de Janeiro, Brazil) study, the largest survey conducted among Protestants in Latin America, revealed similar results: 55 % of Protestants reported converting to the faith at the time of a “serious problem” (Fernandes *et al*, 1998). Sickness, together with alcohol abuse and family conflict, accounted for more than a half of these problems. Assuring to solve them, Pentecostalism offers the power remedy of faith healing, which is considered a gift of the Holy Spirit. Hence, conversion to this religion would offer sufficient spiritual

power to inhibit some habits (or problems) and help transform individuals' behavior (Hill, Cleland and Ali, 2004; Chesnut, 2003). Indeed, believers cannot claim to be fully converted until they have completely abandoned certain practices. Pentecostal Protestant doctrine, for instance, strongly prohibits alcohol consumption, drug use, smoking, premarital and nonmarital sex (Mariano, 2004; Burdick, 1996).

Infant mortality and religion

Notwithstanding the declines in infant mortality observed in recent years, rates are still relatively high in many Latin American countries. According to the Population Reference Bureau (PRB), the Latin American infant mortality rate was 31/1,000 in 2001, which varies considerably across nations. Some countries such as Chile, Uruguay, and Argentina presented relatively low infant mortality rates (10, 17, and 19/1,000 respectively) when compared to countries like Peru and Bolivia, which exhibited rates equal to 41 and 63 infant deaths per 1,000 births, respectively, in 2001 (PRB). In the same year, the Brazilian infant mortality rate (35/1,000) was somewhat higher than the average for the Latin American countries.

A large set of demographic, socioeconomic, and health variables, as well as birth outcomes are described in the literature as most likely to exert an effect on infant survival in Brazil (Machado and Hill, 2003; Rutstein, 2000). However, although several variables have been recognized as determinants of infant mortality in Brazil, almost no attention has been given to religious involvement.

In fact, virtually nothing is known about the implications of religious participation for infant or child mortality in Brazil. One of the few works that has contributed to this

topic was conducted by Wood, Williams, and Chijiwa (2007). These authors analyzed the association between Protestantism and child mortality in Northeast Brazil in 2000. They were particularly interested in testing the hypothesis that the welfare of children (measured as child mortality) is associated with mother's religious affiliation. Using data from the 2000 Brazilian census, the authors have uncovered that children born to Protestant mothers in the Brazilian northeast are significantly more likely to survive childhood compared to children born to Catholic mothers, net of demographic and socioeconomic controls. This finding is compelling enough to encourage further research, given the recent significant growth of Protestantism in Brazil as well as in other Latin American countries (Chesnut, 2003 and 1997). Furthermore, Wood, Williams, and Chijiwa (2007) separated Protestants into traditional and Pentecostal subgroups, and demonstrated that the traditional subgroups had a lower mortality than the children of Pentecostal Protestants.

Results for Rio de Janeiro, however, are somewhat different. Iyer and Monteiro (2004) analyzed the risk of child and adolescent mortality among vulnerable populations in Rio de Janeiro, Brazil. They found that child mortality rates did not vary by religious affiliation after controlling for socioeconomic variables.

Conceptual Framework

Recent studies have suggested some hypotheses with regard to whether and how religious involvement may influence mortality and health outcomes (Hummer *et al*, 2004; Koenig, McCullough and Larson, 2000; Ellison and Levin, 1998). While the majority of

these studies examine adult mortality, a few of them investigate infant mortality (Gyimah, 2007) and child mortality (Wood, Williams, and Chijiwa, 2007).

These studies usually note two types of effects: direct and indirect ones. Direct effects studies of religious influence concern the idea that sacred teachings, beliefs and values offered by religious groups may directly affect peoples' health behavior and personal lifestyle. This notion is sometimes called the 'particularized theology' pathway and derives from the idea that religion often claims a strong therapeutic component and it is important enough to affect health and mortality regardless of other factors (Gyimah, 2007; Gyimah *et al.*, 2006). This straightforward influence, therefore, is found when some aspect(s) of religion have an independent effect on the outcome of interest net of other important independent influences (Regnerus, 2003).

One of the commonly mentioned ways through which religion may affect health outcomes is the proscription of unhealthy behaviors such as smoking and alcoholism. In a study linking religious involvement and health risk behaviors of pregnant and postpartum women, Page, Ellison, and Lee (2008) argued that some religious affiliations and specific religious subcultures may shape and direct behavior and lifestyle choices, including those associated with health. They, for instance, tend to discourage alcohol consumption, drug use, smoking, and some sexual risky behaviors, such as multiple sexual partners, which can improve mother's health and birth outcomes and may decrease the risks of infant mortality. As explained earlier in this article, Protestant churches in Brazil have strongly prohibited these habits and helped to inhibit them (Mariano, 2004; Chesnut, 2003; Burdick, 1996).

The absence of direct religious effects, however, does *not* mean that religion is not important (Regnerus, 2003). Indeed, the most common way that religion influences attitudes and behaviors is through indirect influences, which are “unintentional social byproducts when religious people doing things for religious reasons facilitate other distinctive outcomes” (Regnerus and Smith, 2005: 24). Research on indirect religious influences always call attention to mechanisms or pathways by which religion may help to bring about a desired outcome.

Several indirect pathways through which religious involvement may be associated with health risk behaviors of pregnant and postpartum women, and consequently with birth outcomes and infant mortality (Magaña and Clark, 1995). For example, organizational religiousness (e.g. attendance at religious services) may (a) promote the internalization of religious norms including moral directives; (b) provide positive role models that give church’s members examples of religious life practices to emulate; (c) allow for social networks and support and afford opportunities for wholesome social commitment; (d) provide formal or informal sanctions to those members who deviate from group standards (Page, Ellison, and lee, 2008).

Protestant churches in Brazil may provide an appropriate environment for the emergence of many of these pathways or mechanisms suggested above. For example, many religious communities in Brazil, especially the Protestant ones, have moral and ethnical teachings about family life and childrearing. Empirical research has linked religious involvement with greater marital quality and low risk of marital conflict. For instance, Pentecostal Protestant churches in Brazil have been very effective in spreading restrictions on extramarital sex, which have very often turned their adherents away from

problems, such as family conflict and disruption (Hill, Cleland and Ali, 2004; Chesnut, 2003; Burdick, 1993). Hence, individuals who are more religiously involved within their community may have a lower likelihood of divorce and more friendship networks (Hummer *et al.*, 2004), which might be positively associated with the amount of resources available in the household, including level of income and parents' attention, which can reduce infant mortality risks.

Moreover, Protestants and more recently Pentecostal Protestants in Brazil are recognized by promoting self-help networks that are national in scope. They usually offer not only psychological and spiritual support, but also financial assistance, opening their homes to people in need, trying to help others to find jobs, or even offering child help support (Wood, Williams, and Chijiwa 2007; Chesnut, 1997; Mariz, 1994).

Finally, because Protestant churches strongly discourage certain behaviors and habits, they also impose severe sanctions to those members who disobey their doctrine. In fact, different authors have emphasized that this forbidding regimen is sustained by social sanctions within closed communities (Burdick, 1996; Mariz, 1994).

Alternative Explanations

Although religion may use all these mechanisms to affect health outcomes and mortality, it is important to highlight the influence of religion is often under suspicion. As pointed out by Regnerus (2007), there is a skeptical view suggesting that the apparent religious influence would be actually caused at least by two different factors: (1) selection effects, or (2) reverse causation. The first one, the selection effects, assumes that both the predictor (e.g., religion) and the outcome (e.g., infant mortality) are, in fact,

a consequence of some other unobservable or unknown factor(s) that causes both independently (Regnerus and Smith, 2005). According to Hummer *et al.* (2004), the idea behind selectivity, or confounding, is that people who are more religiously involved may differ in key ways from others who are less involved, and such differences may be the real reasons behind an observed relation between religious involvement and mortality risks. These authors salient that at least demographic and socioeconomic factors should be controlled in order to assess whether the overall association between religious involvement and mortality occurs net of these variables, or works through the mechanisms mentioned above, or is simply spurious.

The second explanation, the reverse causation (or religious exit), highlights that causal direction may be inverse, that is, decisions about religion are a product of the outcome under consideration (e.g., infant mortality), and not the other way around. This hypothesis suggests that religious involved individuals may be predisposed toward risk-averse lifestyles, which may promote positive health behaviors (Regnerus, 2007; Ellison and Levin, 1998).

Data and Methods

The data for this work come from the 1996 Brazilian Demographic and Health Survey (DHS) children's file. This is a nationally representative survey of women aged 15-49 years, and detailed information on socio-demographic variables and child health. The sample design was based on a probabilistic two-stage sample using enumeration areas (EAs). Inside these EAs, households and selected women within them were then interviewed. Because the 1996 DHS is based on a stratified two-stage cluster design, it is

necessary to specify the sampling weights and primary sampling units (used in clustering). In *Stata*, it is done using the “*svyset*” command, which produces estimates that are corrected for the complex design of the survey. All descriptive analyses shown here are corrected by this command.

The total sample was composed of 12,612 women, from which 5,045 had at least one child in the five years preceding the survey. This work was restricted to the analysis of these recent births. This decision was made in part due to the quality of information on them is better than for those born several years ago and also because the use of this sample may reduce the occurrence of changing behaviors related to previous and current conditions.

The dependent variable is the risk of death of the newborn children before one year of age (0-12 months) measured as duration from birth to the age at death or censoring. Although the DHS children’s file contains information for children born five years preceding the survey, the question about age at death was collected only from those mothers who lost their child by the age of two. From the sample of 5,045 children born between 1991 and 1996, 227 died before turning two years of age (although only 12 died between 13 and 24 months of life). Because roughly 95% of all information about age at death was concentrated among child deaths younger than one year old, this study has restricted the analysis to them. That is, as mentioned above, this study will focus on predicting the risk of infant mortality (deaths before the first birthday).

It is worth mentioning that the majority of those children in the DHS sample were right censored at the time of the survey. In order to account for censoring in the estimation of exposure time, an event history model may be employed. Thus, the Cox

proportional hazards model is used here (Allison, 2005). The Cox proportional hazards model is a *semiparametric* method since it does not require that one chooses some particular probability distribution to represent the survival times (Allison, 2005). It may be written as:

$$h_i(t) = h_0(t) \exp(\beta X_i)$$

Where $h_i(t)$ is the transition rate; $h_0(t)$ is the baseline rate, which is the hazard function for an individual with the value zero on all covariates; and β is the vector of parameters for the covariates (X_i) in the model.

Since the objective of this study is to examine whether mother's religious involvement is associated with infant mortality, the main independent variables employed here are mother's religious affiliation and religious service attendance. The 1996 Brazil DHS classifies religious affiliation into seven groups: (1) Roman Catholic, (2) Protestant, (3) Kardecist Spiritual, (4) Afro-Brazilian religions, (5) Oriental religions, (6) Jewish, and (7) others. It also contains a no-religion category. Less than 5 percent of women reported belonging to the last five religious affiliation groups in 1996. Therefore, they were aggregated into one group called "others". We used Catholic as our reference group.

Information on attendance at religious services was captured through the following question: "How often do you go to church, temple, or other religious services?" Women were requested to choose one out of five options, which are: once a week, twice a month, once a month, less than once a month, and never. We aggregated the last four categories into two groups. Thus, mothers who responded that they usually go to church twice and once a month were placed together in one group, while those who identify low religious attendance (less than once a month and never) were combined to form the third

and last category of the religious attendance variable. Those who report attending church or services least frequently (less than monthly or do not attend) are the reference group.

Many factors are viewed as confounding or mediating the relationship between religious involvement and infant mortality. Therefore, this work controls for some demographic, socioeconomic, and household factors traditionally known as confounding or mediating variables for the association between religion and infant mortality.

The demographic controls used in this study are the mother's race, parity, geographic region and place of residence. Mother's race is measured as a white-nonwhite dichotomous variable. Those mothers who identified themselves as white are the reference group. Information on parity was separated into 3 categories: mothers with one child (the reference group), two children, and three and more. This can be a measure of competition for resources inside the household. Families with three or more children may have less financial resources, time, and provide less attention and supervision for each child than small-size families. Geographic region of residence is broken down into five categories, which include "South, Rio de Janeiro and São Paulo", "Middle West", "Middle East", "Northeast", and "North". Northeast, the poorest region in Brazil, was demarcated as the reference group. Finally, place of residence is measured as rural and urban areas (the reference category).

The socioeconomic variables included here are mother's education, marital status, and two measures of housing quality. Maternal education is categorized into two groups: "Below Secondary" and "Secondary and Higher" (the reference group). Maternal education and infant mortality may be related due to, among other things, the higher income of well-educated women, which would promote access to more appropriate pre-

natal, health care, and a better diet. Moreover, education increases knowledge about healthy practices during pregnancy (e.g., hygiene, nutrition), and increases women's ability to access information (Landale *et al.*, 2000). Thus, maternal education is expected to be negatively related to infant mortality.

Marital Status can be an important socioeconomic intermediating variable too because infants born to unmarried women may be at higher risk at mortality as a consequence of inadequate familial resources (Eberstein, Nam, and Hummer, 1990). Answers to marital status were divided into two categories: "Married" and "Unmarried", (this includes those who are single, divorced, widows, and living together¹). The second group (unmarried) is the reference category.

Two household variables were also employed as controls: household water source and toilet facility. Both were divided into two sub-groups. "Piped" (the reference group), and "Others" are the categories for the water source variable, and "Toilet" (the reference group) and "Others" (including household with "Latrine" and "No Facility") represent the toilet facility information. These are variables of housing quality, which may be strongly associated with socioeconomic status or standard of living; they might affect the risk of infant mortality. Infants living in houses with piped water and with a toilet may be exposed to lower mortality.

Finally, another variable included in the analysis is the mother's age at first birth, which was broken down into two categories: less than 20 years of age (the reference group) and 20 or over. Teenage childbearing has been recognized in some studies as a social response to socioeconomic disadvantages, which could expose women to environmental factors that elevate infant mortality (Geronimus, 1987). Teenage

¹ This group is formed by women who had partner but were not living together with him.

motherhood in Brazil is increasing more concentrated among socioeconomically disadvantaged populations, especially among the least-educated women, those with lower income, and residents of urban areas (Berquó and Cavenaghi, 2005). In a study about the determinants of neonatal and post-neonatal mortality in São Paulo City, Machado and Hill (2003) observed that infants of adolescent mothers had substantially higher odds of dying both in the neonatal and in the post-neonatal periods as compared to infants of mothers 20 to 24 years old. This difference was statistically significant net of demographic, socioeconomic, and child health variables.

Findings

Table 1 displays the weighted descriptive statistics for mother's religious affiliation and attendance and independent variables for the entire sample composed by all births (column 1) and for infant deaths (column 2) (both occurring between 1991 and 1996 in Brazil). Results for religious affiliation indicate that infant to Catholic mothers represent the majority of births and deaths in the sample. Also, like among Catholics, there is a small difference in the percentage of births and deaths to Protestant mothers. The religious attendance variable shows that births to mothers who attend religious services once a week exhibit an expressive lower percentage of deaths (22%) than a percentage of births (31%). Consequently, the same is not truth for those who attend religious service less frequently.

Table 1 - Weighted descriptive statistics of mothers' characteristics by infant deaths and the entire sample (births): Brazil 1996

Variables	Deaths	Births
Religious Affiliation		
Catholic	80%	78%
Protestant	10%	13%
No Religion	9%	6%
Others	1%	3%
Religious Attendance		
Once a week	22%	31%
Once or Twice a month	28%	23%
Less than once a month or don't attend	50%	46%
<i>Demographic Variables</i>		
Mother's race		
White	23%	37%
Nonwhite	77%	63%
Parity		
One	8%	25%
Two	26%	31%
Three or more	66%	44%
Place of residence		
Urban	62%	75%
Rural	38%	25%
Regions		
South, RJ, SP	27%	41%
Middle west	10%	12%
Northeast	52%	34%
North	5%	5%
Middle east	7%	7%
<i>Socioeconomic variables</i>		
Mother's education		
Below secondary	63%	47%
Secondary and higher	37%	53%
Marital Status		
Married	46%	60%
Unmarried	54%	40%
Mother's age at first birth		
Younger than 20	67%	47%
20 and over	33%	53%
Household water source		
Piped	54%	68%
Other	46%	32%
Toilet Facility		
Toilet	23%	39%
Other	77%	61%
Unweighted Sample	215	5,033

Source: The 1996 Brazilian Demographic and Health Survey

Those mothers who are white, with parity equal to one, have more education (secondary level and higher), and are older than 20 when had their first child, have children less likely to die. On the other hand, more than 50% of the infant deaths occur among mothers who lived in the Northeast of Brazil, although these mothers are responsible for just 34% of all births between 1991 and 1996. In addition, while 61% of all infant deaths occurred in urban areas in Brazil, the percentage of mothers living in these areas is higher (75%). Marital status seems to follow the same pattern. That is, although 46% of all infant deaths occurred among married mothers, these women contributed to 60% of all births. Finally, the household characteristics variables in Table 1 indicate that mothers living in household with toilet facilities and with a better quality household water source, gave birth to infants less likely to die.

Table 2 exhibits the bivariate distribution of births and deaths, as well as the unadjusted effects of the independent variables on infant mortality. These results show mother's religious affiliation and attendance differences in infant mortality at the bivariate level. Newborn children to Protestant mothers seem to be at lower risk of infant mortality than Catholic mothers. The number of infant deaths per 1,000 births and the unadjusted risk ratio among Protestants are lower than among Catholics. Among mothers who attended services weekly, there were 28 deaths per 1,000 births, while this rate increases to 50 among mothers who attended services once or twice a month and 47 for those who attended less than once a month or never. The unadjusted effects of mother's religious attendance suggest that the risk of death is about 41% lower among children born to mothers who attended religious services weekly compared with those who attended less than monthly or do not attend.

Table 2 - Bivariate distribution of births, deaths and unadjusted infant mortality risk ratios, Brazil 1996

Variables	Deaths	Births	Deaths per 1000 births	Unadjusted risk ratios (exp b)
Religious Affiliation				
Catholic	176	4,022	44	1.00
Protestant	18	617	29	0.65†
No Religion	20	309	65	1.41
Others	1	97	10	0.22
Religion Attendance				
Less than once a month or don't attend	41	1,446	28	1.00
Once or Twice a month	62	1,234	50	1.08
Once a week	110	2,347	47	0.59**
<i>Demographic Variables</i>				
Mother's race				
White	40	1,664	24	1.00
Non-White	175	3,369	52	2.18***
Parity				
One	18	1,214	15	1.00
Two	56	1,524	37	2.50***
Three or more	141	2,295	61	4.21***
Place of residence				
Urban	126	3,732	34	1.00
Rural	89	1,301	68	2.05***
Regions				
South, RJ, SP	31	1,208	26	0.43***
Middle west	15	496	30	0.51**
Northeast	131	2,239	59	1.00
North	19	551	34	0.58**
Middle east	19	539	35	0.60***
<i>Socioeconomic variables</i>				
Mother's education				
Below Secondary	143	2,478	58	2.06***
Secondary and Higher	72	2,555	28	1.00
Marital Status				
Married	92	2,903	32	0.54***
Unmarried	123	2,130	61	1.00
Mother's age at first birth				
Younger than 20	144	2,508	57	1.00
20 and over	71	2,525	28	0.48***
Household water source				
Piped	104	3,212	32	1.00
Other	111	1,821	61	2.02***
Toilet Facility				
Toilet	39	1,544	25	1.00
Other	176	3,489	50	1.99***
Unweighted Sample	215	5,033		

Source: The 1996 Brazilian Demographic Health Survey;

† p<0.1 * p<0.05 ** p<0.01 ***p<0.001

The unadjusted effects of mother's race, parity, place of residence, and region show that the hazard ratios of infant mortality for children born to nonwhite mothers and those who have more than one child, live in rural areas and in the Northeast are higher when compared with their counterparts. Moreover, infants born to well-educated and married women exhibit lower risk of mortality than those whose mothers have low education and are unmarried. The unadjusted effects of mother's age at first birth show that those newborns to mothers who had their first child at age 20 or older were at lower risk of infant mortality. Finally, Table 2 shows that lower hazard ratios are observed among children whose mothers live in households with toilet facilities and piped water.

Table 3 presents multivariate analyses including hazard ratios of infant mortality when controlling for mother's religious characteristics and demographic and socioeconomic variables. The inclusion of these factors significantly alters the magnitude of the religious association. Model 1 and Model 3 show that newborns to Protestant mothers lose their statically significant advantage in terms of infant mortality when controlling for demographic and socioeconomic factors, respectively. Likewise, children to mothers who attend religious services more frequently are no longer less likely to die before turning one year of age when controlling for mother's socioeconomic factors (Model 4). One exception is the results for Model 2: even when controlling for mother's demographic characteristics, infants of mothers who attend religious service weekly are less likely to die than are newborns to mothers who attend less than monthly or do not attend. However, when both measure of religion are included in Model 5, that advantage disappears.

Table 3 – Multivariate analyses including hazard ratios of infant mortality of mother's religious characteristics and other selected variables: Brazil 1996

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Religious Affiliation					
Catholic	1.00		1.00		1.00
Protestant	0.74		0.76		0.86
No Religion	1.42		1.22		1.25
Other	0.37		0.39		0.44
Religion Attendance					
Less than once a month or don't attend		1.00		1.00	1.00
Once or Twice a month		1.11		1.14	1.24
Once a week		0.71 †		0.75	0.88
<i>Demographic Variables</i>					
Mother's race					
White	1.00	1.00			1.00
Non-White	1.77**	1.77**			1.60**
Parity					
One	1.00	1.00			1.00
Two	2.34**	2.29**			2.37**
Three or more	3.33***	3.31***			3.17***
Place of residence					
Urban	1.00	1.00			1.00
Rural	1.52**	1.51**			1.17
Regions					
South, RJ, SP	0.67 †	0.69 †			0.85
Middle west	0.66	0.68			0.87
Northeast	1.00	1.00			1.00
North	0.75	0.78			0.69
Middle west	0.86	0.86			0.96
<i>Socioeconomic variables</i>					
Mother's education					
Below Secondary			1.53**	1.51**	1.11
Secondary and higher			1.00	1.00	1.00
Marital Status					
Married			0.62***	0.60***	0.59***
Unmarried			1.00	1.00	1.00
Mother's age at first birth					
Younger than 20			1.00	1.00	1.00
20 and over			0.61***	0.62***	0.67**
Household water source					
Piped			1.00	1.00	1.00
Other			1.64***	1.64***	1.48**
Toilet Facility					
Toilet			1.00	1.00	1.00
Other			1.45**	1.44**	1.29
- 2 Log likelihood	3549	3516,6	3556	3521,4	3478,3

Source: The 1996 Brazilian Demographic Health Survey;

† p<0.1 * p<0.05 ** p<0.01 ***p<0.001

Discussion

Using data from the 1996 Brazil Demographic and Health Survey, this article examined whether there are religious differences (measured as religious affiliation and service attendance) in infant mortality, and assessed whether such differences can be explained by mother's demographic and socioeconomic characteristics. The motivation behind this work derives from the recent transformation in Brazil's religious landscape, which has been marked by the significant growth of Protestantism that reached an explosive number of converted in the 1990s. Direct and Indirect effects of religion were mentioned in this study. The first one suggests that religion *per se* is capable of affecting an outcome of interest net of other important independent influences. By prescribing and/or prohibiting certain lifestyles and behaviors, religion may impact on health and survivorship.

At the bivariate level, there was some evidence of significant religious differences in infant mortality. Newborns of Protestant mothers were found to have a significantly ($p < 0.1$) lower risk of mortality than those of Catholics. This finding supports the results found by Wood, Williams, and Chijiwa (2007) and may indicate that some health lifestyles imposed by Protestant churches, such as the prohibition of alcohol consumption, smoking, and drug use may be positively affecting mothers' and children's health. In addition, infants of mothers who attended religious service weekly were significantly ($p < 0.05$) less likely to die before turning one year of life than their counterparts whose mothers attended less than monthly or did not attend.

In the multivariate analyses, after controlling for demographic and socioeconomic factors, the religious affiliation differences in infant mortality disappear, which is

consistent with the selectivity hypothesis. Those factors, therefore, are confounding, but may be also mediating the association between mother's religious identity and infant mortality. Of the socioeconomic factors, the potential mediating effect of being married and the age at first child might be considered. Our multivariate results show that infants to married mothers are statically less likely to die than those to unmarried mothers. Protestant doctrine in Brazil strongly emphasizes on certain forms of social organization, such as on the institution of marriage. Because marriage is so esteemed for Protestant denominations, they establish doctrines against premarital and extramarital sex and childbearing, and teach how to resist to these temptations. Not surprisingly, in Protestant churches, premarital sex and childbearing are considered a very serious sin. According to Burdick (1996: 131), "those who surrender to temptation [premarital sex] may be severely disciplined, even excluded from communion for a time, and may suffer the withdrawal of the Holy Spirit".

Likewise, the multivariate models indicate that infants to mothers who had their first child when they were younger than 20 years of age are at higher risk of dying than are their counterparts. Protestant churches may, therefore, indirectly affect infant mortality in Brazil if they discourage adolescent fertility. The study of McKinnon, Potter and Garrard-Burnett (2008) provides evidences for such discouragement. Using data from the 2000 Brazilian census, the authors explore the relationships between Protestantism and fertility and family formation among adolescents aged from 15 to 17 living in the metropolitan region of Rio de Janeiro. They note that the odds of ever having had a live birth for adolescent women belonging to Baptist, other Mainline Protestant, Assembly of God, and other Pentecostal Protestant churches is reduced by

about one third when compared with Catholics, adjusted by individual- and community-level controls. They also found that adolescents who belonged to the Assembly of God, other Pentecostal Protestant, or other mainline Protestant churches were much more likely to be married when compared with Catholics.

Our main findings indicate, therefore, that mother's religion affiliation and attendance do not have an independent association with infant mortality net of other important independent influences, as recommended by the particularized hypothesis. However, this non-significant association of religion after controlling for demographic and socioeconomic factors may suggest that its connection is indirect and operates through mediating variables, such as marriage and age at first child.

One important limitation of this study is the cross-sectional nature of the data, which makes it impossible to work with the notion of causal effects when analyzing the relationship between mother's religious involvement and infant mortality. It is not clear, for instance, whether or not some mothers may have changed their religious attitudes and behaviors (e.g., going more or less often to church, or converting from one religion to another) after the birth and/or death of their infants. Therefore, the use of cross-sectional data, such as the DHS, does not allow for the modeling of observing the causal direction of the relationship, that is, which event has caused the change and which has experienced the impact of the change. This kind of information is very often obtained through longitudinal data in which individuals are followed over time, or even using qualitative data, which permits asking in-depth and detailed questions regarding the time order of the events of interest. Even though this is an important limitation, at this point there no

alternative data sets for modeling the association between religious involvement and infant mortality in Brazil.

Two other limitations of this study is crude categorization of the measure of religious affiliation and the complexity of the concept of religion. The Brazil's religious landscape is characterized by large number of denominations and one could argue that a broad categorization hides important sub-denominations differences that may impact on infant health and mortality. In future surveys, including the DHS, a more nuanced categorization of religious affiliation would be needed. The last limitation mentioned here is that although the questions on religious affiliation and attendance generate important information with regard to religious involvement, they also may be quite superficial in terms of the potential power that religion may have on individual decisions. As suggested by Regnerus (2007), "religion is hardly a unidimensional concept" (p. 43) and those measures of religion may not capture all the specific religious practices relevant within the Brazilian context.

Finally, future studies should also pay attention to the usefulness of qualitative data in research on associations between mother's religion and infant mortality in Brazil. In-depth interviews and focus groups, for instance, may be essential in clarifying the causal direction, multiple mechanisms, and complex ways through which such associations are constructed.

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