Armed Conflict and Birth Weight: Evidence from the al-Aqsa Intifada

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December, 2011

Abstract

No previous study has estimated the effect of intrauterine exposure to armed conflict on pregnancy outcomes. Drawing on data from the 2004 Palestinian Demographic and Health Survey, which was conducted approximately four years after the start of the al-Aqsa Intifada, we find that an additional conflict-related fatality 9-6 months before birth is associated with a modest increase in the probability of having a child who weighed less than 2,500 grams. There is also evidence, albeit less consistent, of a positive relationship between fatalities in late pregnancy and low birth weight.

JEL Codes: I10, I12

Keywords: birth weight, prenatal stress, malnutrition, Israeli-Palestinian conflict

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1. INTRODUCTION

The al-Aqsa Intifada, also known as the Second Intifada, claimed the lives of more than 4,100 Palestinians (Jaeger and Paserman 2008). Athough Israeli incursions during the al-Aqsa Intifada were ostensibly targeted, noncombatants living in the West Bank and Gaza were clearly impacted (World Bank 2004). The focus of the current study is on whether this impact extended to a particular group of noncombatants: those who were in utero.

Specifically, we examine the relationship between intrauterine exposure to armed conflict and birth weight. There are several reasons why such a relationship might exist. By all accounts, the al-Aqsa Intifada inflicted intense psychological damage on noncombatants living in the West Bank and Gaza (Thabet et al. 2004; World Bank 2004; Khamis 2005; Musallam et al. 2005; Giacaman et al. 2007; Allen 2008; Espié et al. 2009; Mataria et al. 2009), and medical researchers have found that women who experience stress in the early stages of pregnancy are at increased risk of having a low birth weight child (Beydoun and Saftlas 2008). In addition, malnutrition and physical exertion are potential stressors that could have affected birth weight. CARE International and the US Agency for International Development found that many women of reproductive age living in the Occupied Territories were not consuming sufficient meat, poultry and dairy products at the height of the al-Aqsa Intifada (CARE International 2002), and there is anecdotal evidence that check points and road blocks forced Palestinians to walk when under normal circumstances they would have taken public transportation (Khouri 2001; Allen 2008, pp. 457-459). Finally, the al-Aqsa Intifada could have limited access to prenatal care; previous studies have found that lack of prenatal care, especially in the later stages of pregnancy, is associated with lower birth weight (Grossman and Joyce 1990; Reichman and Teitler 2003; Rous et al. 2004; Jewell and Triunfo 2006; Wehby et al. 2009).

The primary data source for this study is the 2004 Palestinian Demographic and Health Survey (PDHS), conducted by the Palestinian Central Bureau of Statistics approximately four years after the start of the al-Aqsa Intifada. The PDHS was administered to almost 6,000 households located in the Occupied Territories, and contains information on fertility, pregnancy complications, birth weight, and neonatal mortality. In addition, it asked mothers about prenatal care and where they delivered (i.e., at a clinic, hospital, or home). Using information from the PDHS on children born to mothers from the West Bank, coupled with information on fatalities caused by Israeli security forces collected by B'Tselem (The Israeli Information Center for Human Rights in the Occupied Territories), we find that intrauterine exposure to armed conflict is associated with a modest increase in the risk of giving birth to a child weighing less than 2,500 grams, the standard cutoff for low birth weight used in the medical literature. Controlling for self-reported anemia and prenatal care visits does not appreciably affect the estimated relationship between conflict and low birth weight.

2. BACKGROUND

2.1 The al-Aqsa Intifada

The controversial visit of Ariel Sharon to the al-Aqsa Mosque (Temple Mount) in Jerusalem on September 28, 2000 marks the start of what became known as the al-Aqsa (Second) Intifada. According to figures provided by B'Tselem, 266 Palestinians were killed and 11,074 were injured during the first four months of conflict. The majority of these casualties occurred in Gaza and three of the eleven districts that make up the West Bank, but no district of the West Bank was completely spared.

A period of relative calm began in February of 2001 and lasted until September of the same year. During this period, there were intensive international efforts to reach a ceasefire, but these efforts could not prevent a gradual escalation in the level of violence. In March 2002, the Israeli government launched a large-scale military offensive, Operation Defensive Shield, in response to Palestinian suicide attacks. This offensive was followed by another in June 2002, Operation Determined Path, which resulted in the reoccupation of large parts of the West Bank and Gaza and led to intense fighting centered on the districts of Jenin and Nablus. Some districts of the West Bank, however, experienced much lower levels of violence as a result of the reoccupation. For instance, there were only 14 conflict-related fatalities in Ramallah and 6 conflict-related fatalities in Tulkarm during the second quarter of 2002. The overall level of violence fell sharply after the summer of 2002 in part due to international diplomatic efforts. Nevertheless, the al-Aqsa Intifada continued to claim lives through 2004 and into 2005.

The Palestinian-Israeli conflict during this period was described by President Clinton as "a tragic cycle of violence," a description that suggests a certain degree of predictability. If the Palestinian population was in fact able to predict where and when the next Israeli incursion would occur, this could represent an obstacle to producing clean estimates of the effect of armed conflict on birth weight. However, the work of Jaeger and Paserman (2008) casts serious doubt on the cycle-of-violence hypothesis. These authors found that Palestinian attacks were "difficult to predict with past Israeli actions" (p. 1602), and concluded that "there is little evidence to suggest that both sides of the conflict react[ed] in a regular and predictable way to violence against them" (p. 1591). Although the Israeli responses to Palestinian attacks were found to have a systematic quality, the exact location and severity of these responses would have been extremely difficult to predict for noncombatants living in the West Bank.

Another important feature of the al-Aqsa Intifada is that the Israeli army imposed severe travel restrictions in the form of roadblocks and border closures (World Bank 2004; Allen 2008; Mansour 2010). These restrictions were in place with little interruption throughout the period we examine, and made it difficult for most families to migrate to calmer districts at the outbreak of violence. There is no evidence of significant out-migration from the West Bank during the al-Aqsa Intifada (Central Intelligence Agency 2008).

2.2 Potential Mechanisms

Numerous medical studies have estimated the relationship between self-reported psychological stress and birth weight (Beydoun and Saftlas 2008). For instance, Paarlberg et al. (1999) analyzed a sample of 396 Dutch women who were asked about "daily stressors" throughout their pregnancy.[1] They found that women who reported experiencing a greater number of daily stressors in the first trimester were more likely to have a low birth weight child. Neither the number of daily stressors experienced in the second trimester, nor the number of daily stressors experienced in the third trimester, were related to low birth weight.[2]

[1] For instance, they were asked about their relations with neighbors, and whether they had a conflict with colleagues. One drawback to relying on self reports is that the distinction between stressor and response becomes blurred. See McEwen (1998) and McEwen and Wingfield (2003) for more on this distinction. Among the potential explanations for the negative relationship between psychological stress and birth weight are increased levels of Corticotropin-Releasing Hormone and decreased uterine blood flow (Mulder et al. 2002; Wadhwa et al. 2004; de Weerth and Buitelaar 2005).

[2] Medical researchers have also conducted experiments on animals aimed at documenting the effects of prenatal stress on various pregnancy outcomes. See Mulder et al. (2002) and Beydoun and Saftlas (2008) for reviews. Most notably, Schneider et al. (1999) subjected pregnant rhesus monkeys to stress by removing them from their cage, placing them in a dark room, and administering "noise bursts." They found that stress

More recently, there have been attempts to examine the effects of arguably exogenous changes in prenatal stress. For instance, Camacho (2008) estimated the impact of prenatal exposure to terrorist attacks in the form of landmine explosions, which, she argued, could be thought of as "exogenous stress shocks," unrelated to the "persistent" level of violence in an area (Camacho 2008, p. 512). Using Colombian vital statistics records from the period 1998 through 2004, she found that first-trimester exposure to landmine explosions was associated with a reduction in birth weight of 8.7 grams; second- and third- trimester exposure to landmine explosions was unrelated to birth weight. Although these estimates suggest that psychological stress can negatively impact birth weight, landmine explosions were not the primary threat to the civilian population in Colombia, nor were they closely related to conflict intensity. In fact, landmines were responsible for just a small fraction of the injuries and deaths during the Colombian Civil War, and casualties due to landmines were only weakly correlated with casualties due to other causes such as aerial bombing and massacres (Restrepo and Spagat 2004). Other birth weight studies exploiting a plausibly exogenous source of psychological stress such a terrorist attack or earthquake include: Lauderdale (2006), Smits et al. (2006), Eskenazi et al. (2007), Khashan et al. (2008), and Torche (forthcoming). Eskenazi et al. (2007), Khashan et al. (2008), and Torche (forthcoming) found that psychological stress experienced in the early stages of pregnancy leads to low birth weight; Smits et al. (2006) and Khashan et al. (2008) found that psychological stress experienced in the later stages of pregnancy can also lead to low birth weight.

Of course, the al-Aqsa Intifada could have impacted birth weight through routes

experienced early in the pregnancy led to significantly lower birth weight, but stress administered later in the pregnancy did not. There was no evidence of a relationship between prenatal stress and gestation duration.

other than psychological stress. For instance, incursions, check points, curfews and road blocks could have limited access to prenatal care or compelled Palestinian women to walk when under normal circumstances they would have taken public transportation. Prenatal care, especially in the later stages of pregnancy, has been linked to low birth weight (Grossman and Joyce 1990; Reichman and Teitler 2003; Rous et al. 2004; Jewell and Triunfo 2006; Wehby et al. 2009), as has physical exertion (Bonzini et al. 2007; Chasan-Taber et al. 2007).[3]

Nutrition is another important determinant of birth weight (Stephenson and Symonds 2002). However, there is evidence that its impact is limited to the later stages of pregnancy. For instance, Lumey (1998) examined the effect of in utero exposure to the 1944-45 Dutch famine on birth weight. He found that famine exposure in the early stages of pregnancy was essentially unrelated to birth weight, while third-trimester exposure was associated with a statistically significant reduction in birth weight on the order of 6 to 9 percent. Using Michigan natality data for the period 1989-2006, Almond and Mazumder (forthcoming) found that first- and second-trimester exposure to Ramadan was associated with decreased birth weight among children born to Arab mothers, a pattern of results "consistent with the hypothesis that nutrition shortly after conception matters," but also consistent with the hypothesis that fasting causes psychological stress. In fact, Dikensoy et al. (2009) found increased levels of cortisol, a hormone secreted in response to stress, among women fasting in observance of

[3] Paradoxically, the relationship between recreational exertion and birth weight appears to be positive (Chasan-Taber et al. 2007), while the relationship between exertion at work and birth weight appears to be negative (Bonzini et al. 2007). See Khouri (2001) and Allen (2008, pp. 457-459) for descriptions of Palestinians having to walk in order to avoid waiting at an Israeli checkpoint. Allen (2008, p. 457) noted that, during the al-Aqsa Intifada, "[t]ravel between towns and villages throughout the West Bank became a physical, and in some ways a psychological, challenge." It is possible that psychological stress mediates the relationship between exertion at work and pregnancy outcomes (Hobel and Culhane 2003, p. 1710S).

Ramadan.[4]

At the peak of the Intifada, CARE International and the U.S. Agency for International Development funded a survey of Palestinians living in the West Bank and Gaza with the goal of assessing levels of malnutrition and anemia. The survey found that many children and women of reproductive age were not consuming sufficient meat, poultry, and dairy products (CARE International 2002). Food shortages were most acute in Gaza, and were attributed in large part to curfews, border closures and road blocks. Below, we attempt to distinguish the effects of psychological stress and physical exertion from those of prenatal care and malnutrition by: (1) restricting our attention to the West Bank, where food shortages were less severe; (2) controlling for whether the mother suffered from anemia, an indication that she had not consumed sufficient meat, poultry and dairy during pregnancy; and (3) controlling for number of prenatal care visits.

3. DATA AND MEASURES

Our primary data source is the 2004 Palestinian Demographic and Health Survey (PDHS), conducted by the Palestinian Central Bureau of Statistics (PCBS).[5] When weighted, data from the PDHS can be used to produce representative statistics on households and individuals in the Palestinian Territories (PCBS 2005).

[4] Other factors associated with low birth weight include maternal smoking (Andres and Day 2000) and influenza infection (Kelly 2009; Mendez-Figueroa et al. 2011; Pierce et al. 2011). Kelly (2009) found that the 1957-58 influenza pandemic in Great Britain led to decreased birth weight among children born to mothers who smoked prior to becoming pregnant and among children born to mothers who were less than 153 centimeters tall. Unfortunately, the PDHS did not ask mothers about their tobacco use prior to or during pregnancy, nor did it ask about influenza infection or height. According to the Palestinian Central Bureau of Statistics (2005), only three percent of Palestinian women ages 10 and above reported ever having used tobacco, and only one percent reported ever having smoked a cigarette.

[5] The 2004 PDHS questionnaires were developed and administered by the PCBS, but were based on standard DHS questionnaires available at: http://www.measuredhs.com/aboutsurveys/dhs/questionnaires.cfm.

The PDHS contains detailed information on the educational attainment of household members, their marital status, labor force participation, and district of residence. It had an overall response rate of 88.2 percent, and a total of 5,799 households were interviewed in May and June of 2004. About 65 percent of these households were located in the West Bank, and 35 percent were located in Gaza. A detailed description of the data collection efforts can be found in the PDHS User Guide, which is available for purchase from the PCBS.

The first two columns of Table 1 provide descriptive statistics for the full sample, which is composed of 1,224 children born between April 2001 and June 2004 (a period of 39 months) to 967 ever-married women living in the West Bank who were between the ages of 15 and 54 at the time of the interview. Ever-married women belonging to this age group were asked a series of questions about their health and fertility. In addition, they were asked for information about prenatal care visits, pregnancy complications, place of delivery, district of residence at the time of birth, birth weight, and date of birth for any child born after April 1, 2001. The PDHS did not collect information on gestation duration.

The mean birth weight in our sample is 3,184 grams. Nine percent of the children weighed less than 2,500 grams at birth, the standard cutoff for low birth weight in the medical literature, but an additional 5 percent were reported to weigh exactly 2,500 grams.[6] Fully 94 percent of the children in our sample were born to mothers who had lived in the same

[6] Low birth weight is defined by the World Health Organization (WHO) as weighing less than 2,500 grams at birth. According to the PCBS, 8.2 percent of infants born in the West Bank in 2004 weighed less than 2,500 grams at birth (PCBS 2005). Using vital statistics records from 2006, Martin et al. (2008) found that 8.3 percent of infants born in the United States weighed less than 2,500 grams. In 2005, the mean birth weight of singletons born in the United States was 3,389 grams (Donahue et al. 2010). Bunching (or "heaping") at multiples of 500 grams is common in developing countries (Boerma et al. 1996; Blanc and Wardlaw 2005; Channon et al. 2011), and it has been argued that half of all infants whose birth weight is reported as exactly 2,500 grams should be considered as having been born below the WHO-recommended cutoff (Boerma et al. 1996). Below, we experiment with including children who were reported to weigh 2,500 grams at birth in the low-birth-weight category.

community since September 2000, a reflection of how difficult it was to move during this period.

Data on fatalities caused by Israeli security forces were collected by B'Tselem and are available on a monthly basis at the district level.[7] Three conflict intensity variables were created by matching the number of Palestinians killed by Israeli security forces to children in the PDHS based on their date of birth and district of residence. Conflict intensity through early pregnancy is measured by *9-6 Months Before Birth.* If, for instance, a child was born between October 1 and 15, then *9-6 Months Before Birth* was calculated as the total number of fatalities that occurred in their district of residence during the months of January, February, March, and April.[8] If, for instance, a child was born between October 16 and 31, then *9-6 Months Before Birth* was calculated as the total number of fatalities that occurred in their district of residence during the months of February, March, and April. Conflict intensity in the later stages of pregnancy is measured by *5-3 Months Before Birth* and *2-0 Months Before Birth.* For any child born in October, *5-3 Months Before Birth* was calculated as the total number of fatalities that occurred in their district of residence during the months of May, June, and July; *2-0 Months Before Birth* was calculated as the total number of fatalities that occurred in their district of residence during the months of August, September, and October.

4. THE EMPIRICAL MODEL

Equation (1) relates the birth weight of child i born in district d to the three measures

[7] Table 1 of the online appendix gives fatalities by district and month for the period July 2000 through July 2004.

[8] Given a median gestation duration of 38 weeks, a child born between October 1 and 15 was likely to have been conceived at least one week before the start of February.

of conflict intensity discussed above:

$$\begin{aligned} \textit{Birth Weight}_{idt} &= \alpha + \pi_1(\textit{9-6 Months Before Birth})_{dt} \\ &\quad + \pi_2(\textit{5-3 Months Before Birth})_{dt} + \pi_3(\textit{2-0 Months Before Birth})_{dt} \\ &\quad + \beta' X_{idt} + \sum_{j=1}^{4} \delta_j^Y D_{jt}^Y + \sum_{j=1}^{12} \delta_j^M D_{jt}^M + u_d + \varepsilon_{idt}, \end{aligned} \tag{1}$$

where t indexes month of birth ($t = 1...39$); the vector X_{idt} includes indicators for whether i was a twin, i's gender, whether i was the firstborn, father's education, father's occupation, mother's age when i was born, her age at marriage, her educational attainment, and her refugee status[9]; δ_1^Y through δ_4^Y are year fixed effects; and δ_1^M through δ_{12}^M are month fixed effects. Because u_d is included on the right-hand side of the estimation equation, only within-district variation is used to identify the parameters π_1 through π_3. The influence of any factor at the district level that does not change over time (for instance, urbanicity) will be captured by the district fixed effects, u_d.

One drawback to using the PDHS is that we do not have information on potentially important variables such as family income or wealth, which could be linked to birth weight as well as fertility decisions made in response to conflict exposure (or predicted exposure). In an effort to ensure that our estimates are unbiased, we restrict our sample to siblings and

[9] Four indicators are included to control for father's educational attainment (the excluded category is composed of fathers who had fewer than 7 years of education), and 32 indicators are included to control for father's occupation (the omitted category is composed of fathers whose occupation was missing). Sixteen indicators are included to control for mother's age when i was born (the excluded category is composed of mothers who were 15 or 16 years of years of age when i was born), 6 indicators are included to control for mother's age at marriage (the excluded category is composed of mothers who were 12 through 14 years of age at marriage), and 4 indicators are included to control for mother's educational attainment (the excluded category is composed of mothers who had fewer than 7 years of education).

estimate the following:

$$\begin{aligned} \textit{Birth Weight}_{imdt} &= \alpha + \pi_1(\textit{9-6 Months Before Birth})_{dt} \\ &+\pi_2(\textit{5-3 Months Before Birth})_{dt} + \pi_3(\textit{2-0 Months Before Birth})_{dt} \\ &+\beta' X_{imdt} + \sum_{j=1}^{4} \delta_j^Y D_{jt}^Y + \sum_{j=1}^{12} \delta_j^M D_{jt}^M + w_m + \varepsilon_{imdt}, \end{aligned} \quad (2)$$

where $\textit{Birth Weight}_{imdt}$ represents the birth weight of child i born to mother m, and X_{imdt} consists of indicators for whether i was a twin, i's gender, whether i was the firstborn, and mother's age when i was born. With the inclusion of mother fixed effects, w_m, on the right-hand side of equation (2), only within-family variation is used to estimate π_1 through π_3. We observe birth weight for 501 siblings, born to 244 mothers. Descriptive statistics for the sibling sample are reported in the third and fourth columns of Table 1. Mean of mother's age when i was born, mother's age at marriage, and mother's years of education are similar to the full sample means, but children in the sibling sample were more likely to have been in the low-birth-weight categories (p-value $< .05$). Because no two siblings from the same family were born in different districts, we cannot include both district and mother fixed effects in equation (2).

5. THE RESULTS

5.1 Fatalities and birth weight

Estimates of the relationship between conflict intensity and birth weight in grams are presented in the first two columns of Table 2. Standard errors clustered by district are reported in parentheses. Because there are 10 administrative districts in the West Bank under the control of the Palestinian Authority and three regressors that vary at the district level, we use critical values from a t_{G-K-1} distribution, where G is 10 and K is 3 (Cameron and Miller 2010; Cohen and Dupas 2010).[10] Although these estimates are uniformly negative, only one is statistically significant: an additional fatality 2-0 months before birth is associated with a decrease in birth weight of 2.1 grams in the full sample.

In columns (3) and (4) of Table 2, birth weight in grams is replaced with an indicator for low birth weight. In the full sample, the estimate of π_1 is positive, but not significant, while an additional fatality 2-0 months before birth is associated with a 0.0010 increase in the probability of having a child who weighed less than 2,500 grams. When the sample is restricted to siblings and mother fixed effects are included (our preferred specification), the estimates of π_1 and π_3 increase in magnitude, indicating the importance of controlling for unobservables such as family wealth.[11] An additional fatality 9-6 months before birth is associated with a 0.0027 increase in the probability of having a child who weighed less than 2,500 grams, and an additional fatality 2-0 months before birth is associated with a 0.0019 increase in this probability.

Next, we experiment with including children who were reported to weigh exactly 2,500 grams at birth in the low-birth-weight category. The results are reported in columns (5) and (6) of Table 2. In the full sample, an additional fatality 9-3 months before birth is associated with a 0.0013 increase in the probability of having a child who weighed less than

[10] Children born to women living in the district of East Jerusalem, which is governed by Israel, were not included in the analysis. The three regressors that vary at the district level are *9-6 Months Before Birth*, *5-3 Months Before Births,* and *2-0 Months Before Births*. The critical values for 1%, 5% and 10% significance are 3.71, 2.45 and 1.94, respectively. We experimented with using the wild bootstrap procedure as suggested by Cameron et al. (2008) to produce t-statistics. The results were consistent with those reported.

[11] Wealthier women could have, for instance, been shielded from the conflict and therefore more likely to have conceived during especially violent periods as compared to their poorer counterparts.

or equal to 2,500 grams; an additional fatality 2-0 months before birth is associated with a 0.0022 increase in this probability. When the sample is restricted to siblings and mother fixed effects are included, the estimate of π_1 increases to 0.0039, but the estimates of π_2 and π_3, although larger, lose statistical significance.[12]

5.2 Magnitude

It is helpful to focus on particular district and quarter to put the magnitude of our estimates in perspective. There was relatively intense fighting during the spring of 2002 in the district of Bethlehem; over the months of March, April and May, 38 Palestinians were killed by Israeli security forces operating there. If we use the 0.0027 estimate of π_1 from column (4) of Table 2, then roughly 26 of the estimated 252 children born in November to mothers living in Bethlehem were pushed below the 2,500 gram cutoff as a result of being exposed to armed conflict 9-6 months before birth.[13]

To take another example, over the months of March, April and May of 2002, 8 Palestinians were killed by Israeli security forces operating in the district of Qalqiliya, a fatality count much closer to the average.[14] If each of these fatalities led to a 0.0027 increase in the probability of being in the low-birth-weight category, then the impact of the al-

[12] In Table 2 of the online appendix, we explore whether fatalities caused by Israeli security forces are related to low birth weight using cutoffs of 1,500 and 3,000 grams. There is little evidence that prenatal violence impacted the probability of weighing less than 1,500 grams at birth. However, we find evidence that fatalities are positively related to the probability of weighing less than 3,000 grams at birth.

[13] A number of assumptions went into producing this figure. First, we assume that infants born in November to mothers living in Bethlehem were conceived sometime in February or early March and were therefore exposed to approximately 38 fatalities during their three months in the womb. In addition, according to the PCBS (1999a), there were 30,815 women between the ages of 15 and 54 living in Bethlehem in 1997. By 2007, the population of women living in Bethlehem and belonging to this age group had increased to 42,322 (PCBS 2009a), suggesting an annual growth rate of 3.17 percent and a 2002 population of 36,019. Using data on female Bethlehem residents between the ages of 15 and 54 from the 2004 PDHS, we calculate that the probability of giving birth in any given month was 0.007, and an average of 252 births per month in 2002 (0.007 x 36,019=252).

[14] From July 2000 through July 2004, the mean number of fatalities per district, per month was 2.73 (3 x 2.73 = 8.19).

Aqsa Intifada appears quite a bit smaller: roughly 4 of the estimated 166 children born in November to mothers living in Qalqiliya were pushed below the 2,500 gram cutoff as a result of being exposed to armed conflict 9-6 months before birth.[15]

An alternative approach to gauging magnitude is to compare our estimates to those in the medical literature. For instance, Paarlberg et al. (1999) found that an additional stressor, such as a conflict with colleagues at work, was associated with a one to 4 percent increase in the odds of having a low birth weight child. A marginal probability of 0.0027 corresponds to an odds ratio of 1.026, or a 2.6 percent increase in the odds of having a low birth weight child. Using data on mothers living in New York City and upstate New York, Eskenazi et al. (2007) found that exposure to the terrorist attacks of September 11th 2001 during the early stages of pregnancy led to a 29 to 32 percent increase in the odds of having a child who weighed less than 1,500 grams at birth. Reichman and Teitler (2003) found that witnessing or experiencing verbal/physical abuse while pregnant was associated with an 18 percent increase in the odds of having a low birth weight child.

5.3 The role of socioeconomic and refugee status

Next, we explore whether our estimates of π_1 through π_3 differ by mother's educational attainment or refugee status. Currie and Hyson (1999), Lin et al. (2007), and Oreopoulos et al. (2008) tested whether wealthier families are able to shield their children from the long-run effects of low birth weight, but no previous study has examined what

[15] According to the PCBS (1999b), there were 15,714 women between the ages of 15 and 54 living in Qalqiliya in 1997. By 2007, the population of women living in Qalqiliya belonging to this age group had increased to 21,744 (PCBS 2009b), suggesting an annual growth rate of 3.25 percent and a 2002 population of 18,439. Using data on female Qalqiliya residents between the ages of 15 and 54 from the 2004 PDHS, we calculate that the probability of giving birth in any given month was 0.009, and an average of 166 births per month in 2002 (0.009 x 18,439=166).

factors might mitigate the effects of being exposed to armed conflict in utero.

In columns (1) through (4) of Table 3 we split our sample based on mothers' educational attainment. There is little evidence of a relationship between conflict intensity and low birth weight when the sample is restricted to any child whose mothers had 12 or more years of education. This result is consistent with the hypothesis that better-educated mothers were somehow shielded from the effects of conflict, but could also be a reflection of fertility decisions. In fact, when the sample is restricted to siblings born to mothers with at least 12 years of education and mother fixed effects are included, the estimates of π_1 through π_3 become positive and statistically significant.

In columns (5) through (8) of Table 3, we divide the sample based on mother's refugee status. We find only limited evidence that the conflict impacted the children of refugees differently from the children of non-refugees. Although the estimates of π_1 are positive and significant when the sample is restricted to siblings born to refugee mothers and mother fixed effects are included, the estimates of π_2 are negative and of comparable magnitude. Fatalities that occurred 2-0 months before birth are positively related to the probability of being in the low-birth-weight category for the children of non-refugee mothers, an indication that the impact of the conflict extended to the general population.

5.4 Fatalities and the use of medical services

As noted above, restricted access to medical care represents a potential explanation for the positive relationship between conflict intensity and low birth weight. In an effort to explore this hypothesis, we take advantage of the fact that the PDHS asked mothers whether i was born in a hospital, clinic or at home, and how many prenatal care visits they made during the course of their pregnancy (although it did not ask about services obtained or when during the pregnancy these prenatal care visits took place).

Table 4 presents estimates of the relationship between fatalities and two measures of medical care: whether i was born in a hospital or clinic, and the number of prenatal care visits during the pregnancy resulting in the birth of i. When the sample is restricted to siblings and mother fixed effects are included, fatalities 5-3 months before birth are positively related to delivery in a hospital or a clinic.[16] Although the estimated relationship between conflict intensity and prenatal care visits is always negative, it is never statistically significant.

5.5 Controlling for prenatal visits, anemia, and curfews

Given that fatalities are not significantly related to prenatal visits, it seems unlikely that the estimates of π_1 through π_3 are capturing access to prenatal care. Nonetheless, we test whether prenatal visits mediate the relationship between fatalities and low birth weight in columns (1) and (2) of Table 5.[17] Including prenatal visits in the vector X has a negligible impact on the estimates of π_2 and π_3; the estimates of π_1 are slightly larger when prenatal visits are added as a control.

Many Palestinian women of reproductive age were not consuming enough meat, poultry and dairy products at the height of the conflict (CARE International 2002), raising the possibility that malnutrition was the primary stressor. Unfortunately, the PDHS does not

[16] This result is consistent with the hypothesis that mothers who were exposed to conflict were more likely to develop pregnancy complications and therefore more likely to deliver in a hospital or clinic. We explore the relationship between fatalities and complications in Table 3 of the online appendix. There is evidence of a positive relationship between fatalities and the probability of reporting any complication. There is also evidence that fatalities in the later stages of pregnancy are negatively related to anemia. See Zapata et al. (1992) for more on the relationship between prenatal exposure to violence and pregnancy complications.

[17] Table 5 does not include children who were reported to weigh 2,500 grams at birth in the low-birth-weight category. Table 4 of the online appendix shows these estimates. They are consistent with those reported in Table 5.

contain information on caloric intake or physical exertion, but mothers were asked whether they suffered from anemia during their pregnancy. In columns (3) and (4) of Table 5, we report estimates of π_1 through π_3 controlling for prenatal visits and whether the mother of child i was anemic. These estimates are similar to those reported in columns (1) and (2).

Finally, many districts in the West Bank were subject to frequent and sometimes lengthy curfews during the al-Aqsa Intifada. In addition to being a potential source of psychological stress, these curfews could have restricted access to medical care and have been blamed for food shortages (CARE International 2002). Columns (5) and (6) of Table 5 show estimates of π_1 through π_3 controlling for prenatal visits, whether the mother of child i was anemic, and curfew exposure measured in hours.[18] Again, these estimates are similar to those reported in columns (1) and (2).

5.6 Scaling fatalities by district population

According to a census conducted by the PCBS, there were well over 300,000 residents of Nablus in 2007, while other districts in the West Bank had fewer than 50,000 people. Despite these large differences in population, we have assumed that the effect of an additional fatality is the same across districts. To the extent that the relationship between fatalities and birth weight was caused by seeing someone killed by Israeli security forces or being personally connected to someone who was killed, scaling fatalities to reflect district size should produce sharper estimates of π_1 through π_3.

[18] We used information at the district level from the Palestinian Red Crescent Society to calculate exposure to curfews. This information is available at: www.palestinercs.org. During the period 2001-2004, 7 out of 10 districts had curfews imposed. Often, curfews were in effect for short periods of time (6-7 hours), but some nightly curfews lasted weeks, and some 24-hour curfews were in effect for as many as 6 days in a row. Because there are 6 regressors that vary at the district level, we use critical values from a t_{G-K-1} distribution, where G is 10 and K is 6, to determine statistical significance.

In order to explore this issue, we divided *9-6 Months Before Birth, 5-3 Months Before Birth, and 2-0 Months Before Birth* by the 2007 population of district d (in hundreds of thousands). The results are reported in Table 6. The estimated relationship between conflict intensity and the probability of having a child who weighed less than or equal to 2,500 grams at birth is positive, often significant, and two to three times larger than the estimates of π_1 through π_3 presented in Table 2 (the mean district population in the full sample is 296,931; in the sibling sample it is 284,907). However, estimates of the relationship between conflict intensity and the probability of having a child who weighed strictly less than 2,500 grams at birth are (with one exception) not statistically significant, casting doubt on the hypothesis that personal connections to friends, family members and neighbors killed by Israeli security forces were the primary stressor.

5.7 Fatalities and infant mortality

Relatively few studies have examined the impact of prenatal stressors on neonatal mortality. Hart (1993) found little evidence that prenatal exposure to famine led to increased neonatal mortality, while Scott et al. (1995) and Hernández-Julián et al. (2011) found the opposite result. Animal studies have explored the relationship between psychological stress and neonatal mortality. For instance, Kavanagh et al. (2011) found that infant vervet monkeys born to mothers of low social status were less likely to survive, and concluded that the underlying cause was "chronic stress." In contrast, Van den Hove et al. (2008) found that pregnant rats exposed to bright lights gave birth to lower-weight pups than their counterparts in a control group, but there was no evidence of an effect on pup mortality.

To examine the relationship between conflict intensity and infant mortality, we estimated equations similar to (1) and (2), replacing birth weight with an indicator for whether the child died within one month of being born or an indicator for whether the child died within two months of being born. Because conflict at the time of the delivery and into the postnatal period could have impacted infant mortality, we expanded our set of explanatory variables to include a measure of fatalities in the first full month after birth (*1 Month After Birth*), and a measure of fatalities in the first and second months after birth (*1-2 Months After Birth*). The results of this exercise, which are reported in Table 5 of the online appendix, provide little evidence of a relationship between conflict intensity and infant mortality.[19]

6. ROBUSTNESS CHECKS

Up until this point in the analysis, assignment of fatalities to early pregnancy has been based on whether a child was born in the first or second half of the month. In Table 7 we report the results of two experiments with this assignment. If early exposure for any child born in, for instance, the month of October is measured as the total number of fatalities that occurred in January, February, March and April, our estimates of π_1 tend to shrink, but three out of four are significant at the 10 percent level. If we measure early exposure for any child born in, for instance, October as the total number of fatalities that occurred in February, March and April, our estimates of π_1 become still smaller and only one remains significant, suggesting that low birth weight is especially sensitive to conflict exposure near the likely date of conception. Fatalities that occurred before the date of conception could be associated with birth weight through psychological stress, fertility decisions or migration.

[19] In the full sample, an additional fatality 5-3 months before birth is associated with a 0.0006 increase in the probability of that a child died within one month of birth, and an additional fatality 0-2 months before birth is associated with a 0.0007 decrease in the probability that a child died within one month of birth. These estimates shrink and become insignificant when we control for low birth weight.

However, there is little evidence of a relationship between pre-conception fatalities and low birth weight, and estimates of π_1 through π_3 for the sub-sample of children born to mothers who had lived in the same community since September 2000 are similar to those discussed above.[20]

Because it is possible that exposure to conflict could have systematically influenced parents' recollection of their children's weight, we experimented with restricting our attention to the approximately 25 percent of the sample whose reported birth weight came directly from a health card issued by a hospital or clinic. With this restriction in place, the estimates of π_1 are consistently positive and significant, while the estimates of π_3 shrink and become insignificant (Table 8). Although children whose birth weight was missing were much less likely to have been born in a hospital or clinic, there is little evidence that fatalities are related to the probability of missing birth weight (Table 8).[21]

Finally, we experimented with interacting the year and month indicators introduced in Section 4 in order to estimate the following equation:

$$\begin{aligned} \textit{Birth Weight}_{idt} &= \alpha + \pi_1(\textit{9-6 Months Before Birth})_{dt} \\ &\quad + \pi_2(\textit{5-3 Months Before Birth})_{dt} + \pi_3(\textit{2-0 Months Before Birth})_{dt} \\ &\quad + \beta' X_{idt} + \nu_t + u_d + \varepsilon_{idt}. \end{aligned} \tag{3}$$

[20] Table 6 of the online appendix provides estimates of the relationship between fatalities occuring before the likely date of conception and low birth weight. It also provides estimates of the relationship between fatalities that occurred after the month of birth and low birth weight. Table 7 of the online appendix provides estimates of the relationship between fatalities and low birth weight for the sub-sample of children born to mothers who had lived in the same community since September 2000. Estimates of the relationship between fatalities in neighboring districts and low birth weight are reported in Table 8 of the online appendix. Fatalities in neighboring districts do not appear to have had an impact on birth weight.

[21] Table 9 of the online appendix presents descriptive statistics by whether birth weight is missing. Less than half of children with missing birth weight were born in a hospital or clinic. In contrast, fully 95 percent of the 1,224 children in the full sample were born in a hospital or clinic.

The results of this exercise are reported in Table 9. They continue to show a strong positive relationship between fatalities 9-6 months before birth and the probability of having a child who weighed less than 2,500 grams. However, the estimates of π_3 are only significant when children who were reported to weigh 2,500 grams at birth are included in the low-birth-weight category. Controlling for district-specific linear trends produces almost identical estimates.

7. CONCLUSION

The fetal origins hypothesis has recently received a great deal of attention from medical researchers as well as economists. Numerous studies provide evidence that a wide variety of intrauterine shocks can have important, long-lasting consequences (Almond and Currie 2011). The present study contributes to this literature using data from the 2004 Palestinian Demographic and Health Survey (PDHS), which was conducted by the Palestinian Central Bureau of Statistics and contains nationally representative information on infants delivered during al-Aqsa Intifada.

Specifically, we examine the relationship between fatalities caused by Israeli security forces, a measure of conflict intensity, and birth weight. Although it has been shown that intrauterine exposure to a terrorist attack or severe famine can reduce birth weight (Lumey 1998; Eskenazi et al. 2007; Camacho 2008), no previous study has attempted to estimate the effect of armed conflict.

We find that an additional fatality 9-6 months before birth is associated with a modest increase in the probability of having a child who weighed less than 2,500 grams, the standard cutoff for low birth weight used in the medical literature. Psychological stress is a plausible explanation for this relationship. A number of studies have concluded that psychological stress experienced in the first trimester of pregnancy reduces birth weight (Paarlberg et al. 1999; Eskenazi et al. 2007; Camacho 2008; Torche forthcoming), while the effects of malnutrition and prenatal care appear to be strongest in the later stages of pregnancy (Lumey 1998; Jewell and Triunfo 2006). However, because the PDHS does not contain information on potential stressors such as physical exertion, and contains only limited information on nutritional intake and prenatal care, we cannot definitively attribute the positive relationship between fatalities 9-6 months before birth and low birth weight to psychological stress.

There is also evidence, albeit less consistent, that an additional fatality 2-0 months before birth is associated with a modest increase in the probability of having a child who weighed less than 2,500 grams. Although the effect of prenatal care on birth weight appears to be strongest in the third trimester (Jewell and Triunfo 2006), controlling for prenatal care visits does not have an appreciable impact on the estimated relationship between conflict exposure in late pregnancy and low birth weight. Other potential mechanisms include conflict-related malnutrition, increased physical exertion, and psychological stress.

A recent study by Hoynes et al. (2009) found that the introduction of WIC (Women, Infants and Children), a U.S. government program that increased the nutritional intake of low-income pregnant women, led to a 10 percent increase in birth weight. Whether a WIC-style intervention could potentially reverse the effects of armed conflict is an open question. Nonetheless, at a minimum, our results are consistent with those of medical studies showing a positive association between self-reported stress and low birth weight, and suggest a heretofore-unexplored rationale for intervention when armed conflict occurs.

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Table 1. Descriptive statistics

	Full sample		Sibling sample	
	Mean	SD	Mean	SD
Mother's characteristics				
mother's age at birth	26.8	6.1	24.8	5.2
mother's education	10.2	3.2	10.4	3.1
mother's age at marriage	19.1	3.3	19.2	3.4
refugee status	0.199	-	0.186	-
lived in same community since september 2000	0.940	-	0.926	-
husband's education	10.5	3.5	10.6	3.5
Infant outcomes				
birth weight in grams	3,184.2	606.0	3,117.1	656.3
birth weight $< 2{,}500$ grams	0.086	-	0.120	-
birth weight $\leq 2{,}500$ grams	0.140	-	0.179	-
died within one month of birth	0.011	-	0.016	-
died within two months of birth	0.011	-	0.019	-
female	0.479	-	0.490	-
twin	0.025	-	0.061	-
first born	0.175	-	0.190	-
Use of medical care				
number of prenatal visits	7.8	4.2	7.9	4.5
delivered in hospital or clinic	0.952	-	0.943	-
Pregnancy complications				
any complication	0.618	-	0.575	-
anemia	0.202	-	0.181	-

Notes: All statistics are based on weighted data. Sample size in the full sample is 1,224 execpt for husband's education amd number of prenatal visits were the sample sizes are 1,200 and 1,170, respectively. Sample size in the full sample is 501 execpt for husband's education amd number of prenatal visits where the sample sizes are 489 and 476, respectively. Children in the sibling sample were born to 244 mothers, 13 of whom reported 3 births.

Table 2. The relationship between fatalities and birth weight

	Birth weight in grams		birth weight < 2,500g		birth weight ≤ 2,500g	
	(1)	(2)	(3)	(4)	(5)	(6)
9-6 Months Before Birth	-0.29	-2.93	0.0007	**0.0027****	**0.0013***	**0.0039*****
	(1.01)	(2.27)	(0.0004)	**(0.0010)**	**(0.0006)**	**(0.0009)**
5-3 Months Before Birth	-0.86	-2.12	0.0004	0.0002	**0.0013***	0.0018
	(0.66)	(2.23)	(0.0004)	(0.0013)	**(0.0006)**	(0.0022)
2-0 Months Before Birth	**-2.12****	-1.40	**0.0010***	**0.0019***	**0.0022*****	0.0033
	(0.77)	(1.08)	**(0.0005)**	**(0.0008)**	**(0.0005)**	(0.0017)
mother fixed effects	no	yes	no	yes	no	yes
N	1,224	501	1,224	501	1,224	501

*Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.

Notes: Standard errors corrected for clustering at the district level are in parentheses. Critical values are from a t-distribution with 6 (10 - 4) degrees of freedom. All regressions are based on weighted data for the period April 2001 through June 2004, and include controls for season of birth, year of birth, mother's age at birth, a twin indicator, and infant's sex and birth order. Regressions without mother fixed effects include district fixed effects, mother's education, refugee status, age at marriage, and husband's education and occupation.

Table 3. The relationship between fatalities and low birth weight by mother's education and refugee status

Panel A — Birth weight < 2,500

	mother's education < 12 year		mother's education ≥ 12 year		refugee mothers		non-refugee mothers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
9-6 Months Before Birth	**0.0010****	0.0017	-0.0001	**0.0044*****	0.0026	**0.0132*****	0.0001	0.0014
	(0.0004)	(0.0016)	(0.0009)	**(0.0013)**	(0.0018)	**(0.0022)**	(0.0003)	(0.0011)
5-3 Months Before Birth	**0.0007***	-0.0000	-0.0003	**0.0040***	-0.0009	**-0.0112*****	0.0006	0.0008
	(0.0003)	(0.0017)	(0.0007)	**(0.0020)**	(0.0013)	**(0.0030)**	(0.0005)	(0.0019)
2-0 Months Before Birth	**0.0014***	**0.0024****	0.0004	**0.0075****	-0.0013	0.0060	**0.0015****	**0.0028***
	(0.0007)	**(0.0009)**	(0.0012)	**(0.0027)**	(0.0016)	(0.0058)	**(0.0005)**	**(0.0011)**
mother fixed effects	no	yes	no	yes	no	yes	no	yes
N	805	326	419	175	242	91	982	410

Panel B — Birth weight ≤ 2,500

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
9-6 Months Before Birth	0.0014	**0.0030***	**0.0010****	**0.0038***	0.0018	**0.0133*****	**0.0012***	**0.0032*****
	(0.0010)	**(0.0014)**	**(0.0005)**	**(0.0016)**	(0.0025)	**(0.0026)**	**(0.0005)**	**(0.0007)**
5-3 Months Before Birth	0.0011	-0.0021	0.0017	**0.0107*****	0.0007	**-0.0194*****	0.0017	0.0022
	(0.0007)	(0.0024)	(0.0011)	**(0.0033)**	(0.0016)	**(0.0035)**	(0.0007)	(0.0027)
2-0 Months Before Birth	**0.0027****	0.0042	0.0008	**0.0065****	-0.0008	0.0110	**0.0029*****	0.0043
	(0.0010)	(0.0023)	(0.0009)	**(0.0022)**	(0.0020)	(0.0068)	**(0.0004)**	(0.0026)
mother fixed effects	no	yes	no	yes	no	yes	no	yes
N	805	326	419	175	242	91	982	410

*Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.

Notes: Standard errors corrected for clustering at the district level are in parentheses. Critical values are from a t-distribution with 6 (10 - 4) degrees of freedom. All regressions are based on weighted data for the period April 2001 through June 2004. See notes to Table 2 for list of controls.

Table 4. The relationship between fatalities and the use of medical care

	number of prenatal visits		Delivery in a hospital or clinic	
	(1)	(2)	(3)	(4)
9-6 Months Before Birth	-0.004	-0.017	0.0009	0.0015
	(0.008)	(0.013)	(0.0005)	(0.0012)
5-3 Months Before Birth	-0.016	-0.034	0.0007	**0.0018***
	(0.011)	(0.020)	(0.0005)	**(0.0008)**
2-0 Months Before Birth	-0.007	-0.010	-0.0007	-0.0004
	(0.005)	(0.019)	(0.0006)	(0.0011)
mother fixed effects	no	yes	no	yes
N	1,345	563	1,484	627

*Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.

Notes: Standard errors corrected for clustering at the district level are in parentheses. Critical values are from a t-distribution with 6 (10 - 4) degrees of freedom. All regressions are based on weighted data for the period April 2001 through June 2004. See notes to Table 2 for list of controls.

Table 5. The relationship between fatalities and low birth weight (< 2,500 grams) controlling for anemia, prenatal care, and curfews

	(1)	(2)	(3)	(4)	(5)	(6)
9-6 Months Before Birth	**0.0009****	**0.0033*****	**0.0009****	**0.0033*****	**0.0013****	**0.0024****
	(0.0004)	**(0.0006)**	**(0.0004)**	**(0.0006)**	**(0.0004)**	**(0.0010)**
5-3 Months Before Birth	0.0003	0.0006	0.0003	0.0005	0.0005	0.0000
	(0.0004)	(0.0014)	(0.0004)	(0.0012)	(0.0006)	(0.0016)
2-0 Months Before Birth	**0.0010****	0.0017	0.0010	0.0017	**0.0010****	0.0018
	(0.0003)	(0.0010)	(0.0003)	(0.0010)	**(0.0003)**	(0.0010)
prenatal visits	yes	yes	yes	yes	yes	yes
anemia	no	no	yes	yes	yes	yes
curfews	no	no	no	no	yes	yes
mother fixed effects	no	yes	no	yes	no	yes
N	1,170	476	1,170	476	1,170	476

*Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.

Notes: Standard errors corrected for clustering at the district level are in parentheses. Critical values are from a t-distribution with 6 (10 - 4) degrees of freedom except in specifications that control for curfews when critical values are from a t-distribution with 3 (10 - 7) degrees of freedom. All regressions are based on weighted data for the period April 2001 through June 2004. See notes to Table 2 for list of controls.

Table 6. The relationship between fatalities and low birth weight dividing fatalities by district population (in hundreds of 1000s)

	birth weight < 2,500g		birth weight ≤ 2,500g	
	(1)	(2)	(3)	(4)
9-6 Months Before Birth	0.0018	0.0060	**0.0037****	**0.0100***
	(0.0015)	(0.0047)	**(0.0014)**	**(0.0044)**
5-3 Months Before Birth	0.0010	0.0002	**0.0039*****	0.0044
	(0.0012)	(0.0005)	**(0.0012)**	(0.0058)
2-0 Months Before Birth	**0.0034*****	0.0028	**0.0067*****	0.0062
	(0.0010)	(0.0032)	**(0.0009)**	(0.0049)
mother fixed effects	no	yes	no	yes
N	1,224	501	1,224	501

*Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.

Note: Standard errors corrected for clustering at the district level are in parentheses. Critical values are from a t-distribution with 6 (10 - 4) degrees of freedom. All regressions are based on weighted data for the period April 2001 through June 2004. See notes to Table 2 for list of controls.

Table 7. The relationship between fatalities and low birth weight: alternative measures of first-trimester exposure

	birth weight < 2,500g		birth weight ≤ 2,500g		birth weight < 2,500g		birth weight ≤ 2,500g	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
9-6 Months Before Birth[@]	0.0004	**0.0014***	**0.0013***	**0.0024***	-	-	-	-
	(0.0004)	**(0.0007)**	**(0.0006)**	**(0.0011)**	-	-	-	-
8-6 Months Before Birth	-	-	-	-	0.0002	0.0012	0.0011	**0.0024***
	-	-	-	-	(0.0005)	(0.0011)	(0.0007)	**(0.0012)**
5-3 Months Before Birth	0.0003	0.0002	**0.0013***	0.0017	0.0002	0.0000	**0.0013***	0.0015
	(0.0004)	(0.0013)	**(0.0006)**	(0.0020)	(0.0004)	(0.0013)	**(0.0006)**	(0.0021)
2-0 Months Before Birth	0.0009	0.0016	**0.0021*****	0.0029	0.0008	**0.0017***	**0.0021****	0.0031
	(0.0005)	(0.0008)	**(0.0005)**	(0.0019)	(0.0005)	**(0.0008)**	**(0.0006)**	(0.0018)
mother fixed effects	no	yes	no	yes	no	yes	no	yes
N	1,224	501	1,224	501	1,224	501	1,224	501

*Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.

[@]Equal to the sum of fatalities 9-6 months before birth regardless of whether the child was born in the first or second half of the month.

Note: Standard errors corrected for clustering at the district level are in parentheses. Critical values are from a t-distribution with 6 (10 - 4) degrees of freedom. All regressions are based on weighted data for the period April 2001 through June 2004. See notes to Table 2 for list of controls.

Table 8. The relationship between fatalities and low birth weight: sample restricted to children with health card

	birth weight from health card < 2,500g		birth weight from health card ≤ 2,500g		Missing birth weight	
	(1)	(2)	(3)	(4)	(5)	(6)
9-6 Months Before Birth	**0.0020*****	**0.0099*****	**0.0012***	**0.0094*****	-0.0007	-0.0012
	(0.0006)	**(0.0016)**	**(0.0006)**	**(0.0022)**	(0.0005)	(0.0014)
5-3 Months Before Birth	0.0007	**0.0086****	0.0017	0.0069	-0.0007	-0.0011
	(0.0007)	**(0.0031)**	(0.0011)	(0.0052)	(0.0005)	(0.0009)
2-0 Months Before Birth	0.0007	0.0014	0.0003	-0.0007	0.0007	-0.0004
	(0.0008)	(0.0037)	(0.0009)	(0.0047)	(0.0005)	(0.0005)
mother fixed effects	no	yes	no	yes	no	yes
N	306	137	306	137	1,486	627

*Statistically significant at the 0.10 level; **statistically significant at the 0.05 level;
***statistically significant at the 0.01 level.

Notes: Standard errors corrected for clustering at the district level are in parentheses. Critical values are from a t-distribution with 6 (10 - 4) degrees of freedom. All regressions are based on weighted data for the period April 2001 through June 2004. See notes to Table 2 for list of controls.

Table 9. The relationship between fatalities and low birth weight: estimates of equation (3)

	birth weight < 2,500g		birth weight ≤ 2,500g	
	(1)	(2)	(3)	(4)
9-6 Months Before Birth	**0.0020*****	**0.0019*****	**0.0028*****	**0.0027*****
	(0.0006)	**(0.0006)**	**(0.0007)**	**(0.0006)**
5-3 Months Before Birth	-0.0007	-0.0008	-0.0006	-0.0006
	(0.0005)	(0.0005)	(0.0010)	(0.0011)
2-0 Months Before Birth	0.0010	0.0008	**0.0016****	**0.0017***
	(0.0005)	(0.0005)	**(0.0006)**	**(0.0007)**
linear time trends	no	yes	no	yes
N	1,224	1,224	1,224	1,224

*Statistically significant at the 0.10 level; **statistically significant at the 0.05 level; ***statistically significant at the 0.01 level.

Notes: Standard errors corrected for clustering at the district level are in parentheses. Critical values are from a t-distribution with 6 (10 - 4) degrees of freedom. All regressions are based on weighted data for the period April 2001 through June 2004, and include 39 month-of-birth indicators. Additional controls are district fixed effects, mother's education, refugee status, age at birth and age at marriage.