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ABSTRACT

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No previous study has attempted to estimate the effect of intrauterine exposure to armed conflict, a potential source of stress, on pregnancy outcomes. Drawing on data from the 2004 Palestinian Demographic and Health Survey, we examine the relationship between fatalities caused by Israeli security forces (a measure of conflict intensity) and birth weight. Our estimates suggest that first-trimester fatalities are positively related to the probability that a child weighed less than 2,500 grams at birth. This result is consistent with medical studies showing a strong negative correlation between self-reported stress during the first trimester of pregnancy and birth weight.

JEL Classification: I10, I12

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

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1. INTRODUCTION

The al-Aqsa Intifada led to thousands of deaths (Jaeger and Paserman 2008) and, by all accounts, inflicted a great deal of psychological damage on noncombatants living in the West Bank and Gaza Strip (Thabet, Abed and Vostanis 2004; World Bank 2004; Khamis 2005; Musallam et al. 2005; Giacaman et al. 2007b; Espié et al. 2009; Mataria et al. 2009). The focus of this study is on a potential byproduct of this psychological damage: specifically, we are interested in the relationship between exposure to armed conflict in utero and birth weight.

Numerous medical studies have documented a negative relationship between self-reported prenatal stress and birth weight (Beydoun and Saftlas 2008). Among the potential mechanisms for this relationship 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). Although it has been shown that experiencing the shock of a terrorist attack in the first trimester of pregnancy can lead to low birth weight (Camacho 2008), no previous study has attempted to estimate the effect of intrauterine exposure to armed conflict.

The primary data source is the 2004 Palestinian Demographic and Health Survey (PDHS), conducted by the Palestinian Central Bureau of Statistics. The PDHS was administered to approximately 5,800 households located in the West Bank and Gaza. It contains information on fertility, pregnancy complications, birth weight, and infant mortality. In addition, it asked mothers about prenatal care and where their infant was delivered (i.e., at a clinic, hospital, or home). Using information from the PDHS on children born to mothers living in the West Bank, coupled with information on the number of Palestinians killed by Israeli security forces collected by B'Tselem (The Israeli Information Center for Human Rights in the Occupied Territories), we explore whether within-district changes in violence over the course of the al-Aqsa Intifada were related to birth weight.

Our results show that conflict-related fatalities occurring during the first trimester of pregnancy were positively related to the probability of giving birth to an infant weighing less than 2,500 grams, the standard cutoff for low birth weight used in the medical literature. Although there is some evidence to suggest prenatal care visits were reduced due to the conflict, this reduction does not appear to have been the primary driver of the relationship between first-trimester exposure to conflict and low birth weight. Finally, we find evidence that conflict-related fatalities occurring in the months after delivery were positively related to infant mortality, a relationship almost entirely explained by 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 the Gaza Strip 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, in response to Palestinian suicide attacks, launched a large-scale military offensive, Operation Defensive Shield. 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 fatalities in Ramallah and 6 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 restrictions on travel in the form of roadblocks and checkpoints (World Bank 2004; Mansour 2010). These restrictions appear to have been only weakly correlated with conflict-related fatalities, 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 (CIA World Factbook 2008).

2.2 The importance of birth weight

Birth weight is a commonly-used measure of infant health. In fact, it is the most popular measure of infant health among economists (Almond, Chay and Lee 2005). One of the reasons it is so popular is that it is correlated with long-run outcomes of interest to economists such as test scores, educational attainment, employment, and earnings (Currie and Hyson 1999; Case, Fertig and Paxson 2005).

Why is birth weight related to these outcomes? In theory, a difficult-to-measure, omitted factor could be at work. For instance, it could be that mothers who are unwilling (or unable) to eat nutritious food while pregnant also tend to spend less time helping their children with homework. Under this scenario, a policy that successfully increased birth weight could have no effect whatsoever on academic performance (Currie and Hyson 1999, p. 24; Almond, Chay and Lee 2005, p. 1034). Recent research by economists has attempted to tackle the omitted factor problem by comparing the outcomes of twins with unequal birth weights (Black, Devereux and Salvanes 2007; Royer 2009). Although there is some evidence that the estimated relationship between birth weight and, for instance, earnings is reduced in magnitude when this approach is taken, it appears that the effects of birth weight cannot entirely be ascribed to the influence of omitted factors (Royer 2009).

A related, and rapidly growing, body of research examines the effects of early-life shocks on adult outcomes. This research suggests that a wide variety of early-life shocks can have profound and long-lasting consequences. For instance, using data from the 1980-2000 Peruvian civil war, Grimard and Laszlo (2010) examined the effects of exposure to conflict in utero on measures of adult health. They found that exposure to conflict in utero, as measured by battle-related fatalities and disappearances, was negatively related to women's height, but could not pinpoint the trimester of exposure nor the mechanism. Other studies in this area include: Almond (2006), who examined the effects of being exposed to the 1918 flu pandemic in utero on educational attainment, earnings, welfare receipt, and incarceration; and Maccini and Yang (2009), who, using data from Indonesia, examined the relationship between rainfall at birth and outcomes such as height and educational attainment.

2.3 Previous estimates of the relationship between prenatal stress and birth weight

Most studies from the medical literature have focused on the relationship between self-reported psychological stress and birth weight (Beydoun and Saftlas 2008). For instance, Paarlberg et al. (1999) examined 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 child of low birth weight. 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

[1] For instance, they were asked about their relations with neighbors, and whether they had had a conflict with a colleague at work.

weight.[2]

More recently, there have been attempts to examine the effects of arguably more exogenous changes in prenatal stress. For instance, using vital statistics records from California, Lauderdale (2007) compared infants born to women with Arabic names who were in utero during the months immediately after the attack on the World Trade Center with infants born to women with Arabic names who were born a year earlier. She found evidence that being born to a mother with an Arabic name after the attack was associated with an increased risk of low birth weight, and concluded the likely cause was "ethnicity-related stress or discrimination during pregnancy" (p. 197).

A study by Glyn et al. (2001) provides additional evidence that stress experienced in the early stages of pregnancy is more important than stress experienced in the later stages. These authors examined the effects of a 1994 earthquake that took place in Northridge California. Using data on 281 women who were receiving prenatal care at the teaching hospital associated with the University of California, Irvine, they found that first-trimester exposure to the earthquake was associated with the greatest reduction in gestation length. Exposure in the second trimester was associated with a much smaller reduction in gestation length, and exposure in the third trimester was associated with a statistically insignificant reduction.

Finally, Camacho (2008) focused on estimating the impact of prenatal exposure to terrorist attacks in the form of landmine explosions, which, she argued, could be thought of as

[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 experienced early in the pregnancy led to significantly lower birth weight, but stress administered later in the pregnancy did not.

"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.[3]

Although Camacho's results are consistent with the hypothesis that prenatal 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 the overall level of violence. 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).

2.4 Prenatal care and nutrition

Of course, it is possible that armed conflict impacts birth weight through routes other than stress. For instance, limited access to prenatal care as a result of incursions, road blocks, border closures or curfews might also have impacted birth outcomes. Studies have, in fact, shown that lack of prenatal care leads to lower birth weight (Grossman and Joyce 1990; Rous, Jewell and Brown 2004; Evans and Lien 2005; Jewell and Triunfo 2006). However, the effect of prenatal care appears to be strongest in the later stages of pregnancy (Jewell

[3] In addition to Glyn et al. (2001), Lauderdale (2007) and Camacho (2008), see Lindo (2010) and Burlando (2010). Lindo used data from the Panel Study on Income Dynamics to examine the effect of job loss on birth weight. His results suggest that birth weight is reduced by four and a half percent when a father losses his job, and he argued that this relationship could be driven by both income and stress. Burlando found that prentatal exposure to a month-long blackout in Zanzibar led to reductions in birth weight, but concluded that the primary driver of this relationship was nutrition. Aizer, Stroud and Buka (2009) found that prenatal exposure to the stress hormone cortisol negatively impacts cognition and educational attainment, but not birth weight.

and Triunfo 2006), and there is little evidence that skipping a prenatal care visit in the first trimester matters (Rous, Jewell and Brown 2004).

Nutrition represents yet another potential route through which armed conflict could affect the health of newborns (Grimard and Laszlo 2010), but there is compelling evidence that even severe reductions in caloric intake during the first trimester of pregnancy do not impact birth weight (Stephenson and Symonds 2002). For instance, Lumey and Stein (1997) examined the effects of prenatal malnutrition resulting from the Dutch famine of 1944-45. These authors found that reduced nutrition during the first trimester had no discernable impact on birth weight, but reduced nutrition during the third trimester resulted in significantly lower birth weight.

At the height of the al-Aqsa Intifada, CARE International and the US Agency for International Development funded a survey of Palestinians living in the West Bank and Gaza Strip with the goal of assessing levels of malnutrition and anemia.[4] The survey found that many children and women of reproductive age were not consuming sufficient meat, poultry, and dairy products (CARE International 2002). This problem was most acute in the Gaza Strip, and was attributed, in large part, to curfews, border closures and road blocks.

In the empirical analysis below we attempt to isolate the effect of prenatal stress due to armed conflict by: (1) focusing on children born to mothers living in the West Bank, where food shortages were less severe than in Gaza; (2) focusing on the effects of conflict-related fatalities that occurred during the first trimester, when nutritional deficiencies and prenatal visits have little to no impact on birth weight; (3) examining the relationship

[4]There is evidence from the medical literature that anemia is an independent risk factor for low birth weight (Levy et al. 2005).

between conflict-related fatalities and number of prenatal care visits; and (4) controlling for whether a curfew was in place and whether a mother suffered from anemia, an indication that the mother had not consumed sufficient meat, poultry, and dairy products during pregnancy.

3. DATA AND MEASURES

As noted, 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).

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 the Gaza Strip. A detailed description of the data collection efforts can be found in the DHS User Guide, which is available for purchase from the PCBS.

Table 1A provides 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.[6] 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

[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

[6] We exclude 197 infants born to women living in East Jerusalem from the analysis. Their inclusion does not qualitatively change the results.

prenatal care, pregnancy complications, place of delivery (hospital, home or clinic), district of residence at the time of birth, birth weight, and date of birth for any child born after April 1, 2001.[7] No information on children over 5 years of age was solicited by the PDHS.

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 used in the medical literature.[8] However, an additional 5 percent were reported to weigh exactly 2,500 grams at birth. Below, we experiment with including children who were reported to weigh 2,500 grams in the low-birth-weight category.[9] The mother of the average child in our sample was 27 years of age and reported having received 10 years of formal education. Twenty percent of the children in the sample were born to mothers who self-identified as refugees.

Following Jaeger and Paserman (2008) and Grimard and Laszlo (2010), we use the number of Palestinians killed by Israeli security forces as our measure of conflict intensity. Data on Palestinian fatalities were collected by B'Tselem and are available on a monthly basis at the district level.

Figure 1 shows mean birth weight and fatalities in the West Bank by quarter for the period 2001-2004. Lending support to the the prenatal-stress hypothesis, fatalities rose from 39 in the second quarter of 2001 to 197 in the second quarter of 2002 while mean birth weight

[7]For 25 percent of the sample, birth weight came from an official health card. When a health card was not available, mothers were asked to recall birth weight. Our results are qualitatively unchanged if we exclude children whose birth weight was based on recall.

[8]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).

[9]Low birth weight is defined by the World Health Organization (WHO) as weighing less than 2,500 grams at birth. However, bunching (or "heaping") at multiples of 500 grams is common in developing countries (Boerma et al. 1996; Blanc and Wardlaw 2005; Channon et al. forthcoming), 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).

fell in the fourth quarter of 2001 and remained relatively low through all of 2002. After the end of Operation Defensive Shield in May of 2002, the conflict became much less intense. Birth weight began to rise two quarters later, and by the second quarter of 2004 had almost reached its pre-Intifada level.

Although interesting, the trends in Figure 1 do not provide proof of a causal link between conflict intensity and birth weight. The following section describes our estimation strategy, which, if successful, will isolate the effect of conflict-induced stress on birth weight.

4. THE EMPIRICAL MODEL

For each newborn, i, in the PDHS we created three measures of prenatal exposure to violence: *FirstTriFat*, equal to the number of conflict-related fatalities that occurred in district d during the first trimester of the pregnancy resulting in the birth of newborn i; *SecondTriFat* equal to the number of fatalities that occurred in district d during the second trimester of the pregnancy resulting in the birth of newborn i; and *ThirdTriFat* equal to the number of fatalities that occurred in district d during the third trimester of the pregnancy resulting in the birth of newborn i.[10] Because we do not know date of conception or gestation length, we matched conflict-related fatalities to children based on their date of birth. For instance, if a child was born between October 1 and 15, then first- trimester exposure to violence was measured as the total number of conflict-related fatalities that occurred in January, February, March, and April.[11] If, for instance, a child was born in between October 16 and 31, then

[10] Information on conflict-related fatalities by month is available from B'Tselem (http://www.btselem.org/English/).

[11] Median gestation length is 38 weeks (measured from the date of conception), so a child born in the first half of October was likely to have been conceived in the first three weeks of January. If a child was born between October 1 and 15, second-trimester exposure to violence was measured as the total number of fatalities that occurred in May, June, and July; and third-trimester exposure was measured as the total number of fatalities that occurred in August, September, and October.

first-trimester exposure was measured as the total number of conflict-related fatalities that occurred in February March, and April.[12]

Equation (1) relates the birth weight of child i born in district d to the above measures of intrauterine exposure to violence:

$$\begin{aligned} Birth\ Weight_{idt} &= \alpha + \pi_1 FirstTriFat_{dt} + \pi_2 SecondTriFat_{dt} \\ &\quad + \pi_3 ThirdTriFat_{dt} + \beta' X_{idt} + \sum_{j=1}^{4} \delta_j^Y D_{jt}^Y + \sum_{j=1}^{12} \delta_j^M D_{jt}^M + u_d + \varepsilon_{idt}, \end{aligned} \tag{1}$$

where t indexes month of birth ($t = 1...39$); the vector X_{idt} includes mother's age when i was born, her age at marriage, her educational attainment, and refugee status[13]; 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, fertility and the ability to move between districts in response to changes in conflict intensity.[14]

[12] If a child was born between October 16 and 31, second-trimester exposure to violence was measured as the total number of fatalities that occurred in May, June, and July; and third-trimester exposure was measured as the total number of fatalities that occurred in August, September, and October.

[13] 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 2 indicators are included to control for mother's educational attainment (the excluded category is composed of mothers who had fewer than 12 years of education).

[14] We do not observe changes in district of residence during the course of a pregnancy. Therefore, if women belonging to high-income families were able to move to a safer district in response to conflict-related fatalities occurring during the first trimester of pregnancy, then our estimate of π_1 from equation (1) could

In an effort to ensure that our estimates are unbiased, we restrict our sample to siblings and estimate the following:

$$\begin{aligned} Birth\ Weight_{imdt} &= \alpha + \pi_1 FirstTriFat_{dt} + \pi_2 SecondTriFat_{dt} \\ &+ \pi_3 ThirdTriFat_{dt} + \beta' X_{imdt} + \sum_{j=1}^{4} \delta_j^Y D_{jt}^Y + \sum_{j=1}^{12} \delta_j^M D_{jt}^M + w_m + \varepsilon_{imdt}, \end{aligned} \tag{2}$$

where $Birth\ Weight_{imdt}$ represents the birth weight of child i born to mother m, and X_{imdt} consists of indicators for mother's age when i was born. With the inclusion of 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.[15]

5. THE RESULTS

5.1 Conflict-related 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

be capturing the effect of socioeconomic status as opposed to violence. It is also possible that the mix of women giving birth could have changed as a result of violence or predictions of violence. For instance, better-educated women might have been less likely to become pregnant during periods of high political uncertainty. Including mother fixed effects will purge our estimates of any bias resulting from fertility decisions of this kind.

[15] Descriptive statistics for the sibling sample are given in Table 1B. 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). No two siblings from the same family were born in different districts, reflecting the generally low level of mobility in the West Bank during this period. As a result of this low mobility we cannot include both district and mother fixed effects in equation (2).

Miller 2010; Cohen and Dupas 2010).[16] Although estimates of the relationship between conflict intensity and birth weight in grams are uniformly negative, they are never statistically significant.

In columns (3) and (4) of Table 2, birth weight in grams is replaced with an indicator of whether the child weighed less than 2,500 grams at birth. These estimates provide evidence that prenatal exposure to violence impacted the lower tail of the birth-weight distribution, where the attention of medical researchers has been focused. In the full sample, an additional fatality in the first trimester is associated with a 0.0009 increase in the probability that a child weighed less than 2,500 grams at birth. When the sample is restricted to siblings and mother fixed effects are included (our preferred specification), an additional fatality in the first trimester is associated with a 0.0032 increase in the probability that a child weighed less than the 2,500 gram cutoff, and an additional third-trimester fatality is associated with a 0.0014 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 first-trimester fatality is associated with a 0.0015 increase in the probability of being low birth weight, and an additional third-trimester fatality is associated with a 0.0018 increase in this probability. When the sample is restricted

[16] 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 *FirstTriFat*, *SecondTriFat* and *ThirdTriFat*. The critical values for 1%, 5% and 10% significance are 3.71, 2.45 and 1.94, respectively. Experiments with using the wild bootstrap procedure as suggested by Cameron, Gelbach and Miller (2008) produced comparable results to those reported with one notable exception: in column (3) of Table 2, we indicate that the estimated coefficient of *FirstTriFat* is statistically significant at the 10% level based on critical values from a t_{G-K-1} distribution. However, one thousand replications of the wild bootstrap procedure produced t-statistics between 1.06 and 8.04 with probability 0.95. Following Dee and Jacob (2010), we calculate a p-value of 0.44, equal to the fraction of these replications that produced a t-statistic less than 2.4 ($2.4 = 0.00086/0.00036$).

to siblings and mother fixed effects are included, the estimated effect of an additional first-trimester fatality increases to 0.0044, but the estimate of π_3 , although larger, becomes statistically insignificant.[17]

5.2 The role of socioeconomic and refugee status

In this section we explore whether our estimates of π_1 through π_3 differ by socioeconomic or refugee status. Although Currie and Hyson (1999), Lin, Liu and Chou (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, to our knowledge no previous study has examined if socioeconomic status can help mitigate the effects of exposure to stress in utero.[18]

In columns (1) through (4) of Tables 3A and 3B we divide the sample based on mother's educational attainment, the best available measure of socioeconomic status in the PDHS. There is little evidence that better-educated women were somehow shielded from the effects of the conflict. In fact, when the sample is restricted to siblings and mother fixed effects are included, the estimated impact of first-trimester fatalities on the probability of weighing less than 2,500 grams at birth is larger among women with at least 12 years of schooling than among women with fewer than 12 years of schooling.[19]

In columns (5) through (8) of Tables 3A and 3B, we divide the sample based on mother's

[17] As suggested by Boerma et al. (1996), we experimented with randomly assigning half the children whose birth weight was equal to 2,500 grams to the low-birth-weight category. This had very little impact on these estimates. In Appendix Table 2, 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 or equal to 1,500 grams at birth. However, we find evidence that that first-, second-, and third-trimester fatalities are positively related to the probability of weighing less than 3,000 grams at birth, a pattern of results that is consistent with the hypothesis that the Intifada, in addition to causing stress, reduced the nutritional intake of mothers in during the later stages of pregnancy.

[18] Using data from Palestinian households collected in 2005, Mataria et al. (2009) provided evidence to suggest that education might serve to protect against the psychological stress induced by the Israeli occupation.

[19] However, this difference is not statistically significant at the 10% level.

refugee status. Although the estimated impact of first-trimester fatalities is always positive, its relationship to being in the low-birth-weight category is strongest when the sample is restricted to siblings born to refugee mothers and mother fixed effects are included. However, the estimated relationship between second-trimester fatalities and being in the low-birth-weight category is statistically significant, negative and of comparable magnitude. In addition, there is evidence that third-trimester fatalities are positively related to the probability of being in the low-birth-weight category for the children of non-refugee mothers.

5.3 Conflict-related fatalities and the use of medical services

The positive relationship between first-trimester fatalities and low birth weight is consistent with the prenatal-stress hypothesis. However, restricted access to medical care represents an alternative explanation for the positive relationship between first-trimester fatalities and low birth weight. For instance, if fighting or roadblocks prevented women from reaching clinics or hospitals during the first stages of pregnancy, then our estimates of π_1 may not be capturing the effects of prenatal stress.

In order to explore this hypothesis, we estimate the relationship between conflict-related fatalities and two measures of medical care usage: total number of prenatal visits during the pregnancy resulting in the birth of i, and whether i was born in a hospital or clinic as opposed to at home.

The results, which are reported in Table 4, provide some evidence that conflict-related fatalities in the third trimester reduced the amount of prenatal care received. In the full sample, an additional third-trimester fatality is associated with a 0.012 decrease in the number of prenatal visits. When the sample is restricted to siblings and mother fixed effects are included, this estimate retains its sign and magnitude, but is no longer statistically significant. There is some evidence that second-trimester fatalities were positively related to delivery in a hospital or a clinic, a result that is inconsistent with the hypothesis that the conflict restricted access to medical care.[20]

5.4 Controlling for prenatal visits, anemia, and curfews

Given that first-trimester fatalities are not significantly related to prenatal visits, it seems unlikely that our estimates of π_1 are capturing access to prenatal care. Nonetheless, we test whether prenatal visits mediate the relationship between first-trimester fatalities and low birth weight in columns (1) and (2) of Tables 5A and 5B. Including number of prenatal visits as an additional control does little to the estimated effect of first-trimester fatalities on the probability of being in the low-birth-weight category. In fact, the estimates of π_1 are slightly larger when number of prenatal visits is included.

As noted above, 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 our results are being driven by anemia or other nutritional deficiencies. In columns (3) and (4) of Tables 5A and 5B, we report estimates of π_1 through π_3 controlling for whether the mother of child i reported being anemic. These estimates are similar to those reported in Table 2.

Finally, many districts in the West Bank were subject to frequent and sometimes lengthy

[20] The positive relationship between first-trimester fatalities and delivery in a hospital or clinic is, however, consistent with the idea that mothers exposed to conflict in the first trimester were more likely to develop easily-observable pregnancy complications. We explore the relationship between fatalities and complications in Appendix Table A3. The results show that fatalities in the third trimester are positively related to 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 further evidence on the relationship between prenatal exposure to violence and pregnancy complications.

curfews during the Intifada.[21] These curfews potentially restricted access to medical care and have been blamed for food shortages (CARE International 2002). In a further effort to isolate the effect of stress on low birth weight, we use information at the district level available from the Palestinian Red Crescent Society to calculate first-, second-, and third-trimester exposure to curfews.[22] In columns (5) and (6) of Tables 5A and 5B we report estimates of π_1 through π_3 controlling for curfew exposure measured in hours. Again, these estimates are similar to those reported in Table 2, as are estimates (available upon request) from specifications in which prenatal visits, anemia, and curfew exposure are included simultaneously as controls.[23]

5.5 Conflict-related fatalities and infant mortality

There have been numerous attempts to link prenatal stress to outcomes such as birth weight, motor development, Attention Deficit Hyperactivity Disorder, and even sexual orientation (Beydoun and Saftlas 2008). In contrast, only a handful of animal studies have examined the impact of prenatal stress on neonatal mortality. Among them, Kavanagh et al. (forthcoming) examined the pregnancy outcomes of 153 vervet monkeys. These authors found that infants born to mothers of low social status were less likely to survive, and concluded that the underlying cause was "chronic stress." Van den Hove et al. (2008) subjected pregnant rats to stress by restraining them three times per day in transparent cylinders and exposing them to bright lights. They found that pregnant rats exposed to stress in the form of bright lights

[21] 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.

[22] Information on the Palestinian Red Crescent Society is available at: www.palestinercs.org.

[23] Although it should be noted that when the sample is restricted to siblings and mother fixed effects are included, the estimated effect of first-trimester fatalities on weighing less than 2,500 grams at birth decreases in magnitude (to 0.0023) and becomes statistically indistinguishable from zero. 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 signficance.

gave birth to lower-weight pups than their counterparts in a control group, but there was no evidence of an effect of prenatal stress on pup mortality.[24]

In an attempt to explore the relationship between conflict intensity and infant mortality, we estimate equations similar to (1) and (2), replacing birth weight with two new dependent variables: an indicator of whether the child died within one month of being born, and an indicator of whether the child died within two months of being born. Because conflict at the time of the delivery and into the postnatal period could potentially have impacted infant mortality, we expand our set of explanatory variables to include a measure of conflict-related fatalities in the first full month after delivery (*TenthMonthFat*), and a measure of conflict-related fatalities in the second full month after delivery (*EleventhMonthFat*).

The results of this exercise are reported in Table 6. The estimated relationship between fatalities and infant mortality is never statistically significant in the full sample. However, when the sample is restricted to siblings and mother fixed effects are included, we find evidence that an additional conflict-related fatality in the tenth-month is associated with a 0.0037 increase in the probability of infant mortality (although the estimated coefficient of *FirstTriFat* remains statistically insignificant).

This result suggests that the quality of care received by newborns might have been impacted by the conflict. Indeed, at the height of the al-Aqsa Intifada, Israeli security forces "routinely" fired upon medical personnel and blocked the import of medical supplies (Ruether and Ruether 2002, p. 125), actions that may have reduced the quality of care and increased mortality. Interestingly, when we control for low birth weight, the estimated relationship

[24] See also Smith et al. (1971), who also used rats to examine the effects of prenatal stress on birth weight and neonatal mortality.

between tenth-month fatalities and infant mortality becomes statistically indistinguishable from zero. This result is consistent with the results of previous studies showing that babies who weight less than 2,500 grams at birth are especially vulnerable to infections such as meningitis, neonatal tetanus, pneumonia and septicaemia, leading causes of infant mortality in the developing world (Vergnano et al. 2005).

6. ROBUSTNESS CHECKS

Up until this point in the analysis, assignment of first-trimester fatalities 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 we measure first-trimester exposure to violence for any child born in, for instance, the month of October as the total number of fatalities that occurred in January, February, March and April (*Fatalities Months 0-3*), our estimates of π_1 become smaller and less precise, but are still positive and, with one exception, statistically significant at the 10% level.

If we measure first-trimester exposure for any child born in, for instance, October as the total number of fatalities that occurred in January, February and March (*Fatalities Months 0-2*), and second trimester exposure as the total number of fatalities that occurred in April, May, June, and July (*Fatalities Months 3-6*), our estimates of π_1 become still smaller, but our estimates of π_2 become larger. In the full sample, an additional fatality occurring in months 3-6 is associated with a statistically significant increase of 0.0015 in the probability of weighing less than or equal to 2,500 grams at birth.[25]

[25] Because there is a close link between birth weight and gestation length, we also experimented with assigning a shorter gestation length to low-birth weight children. Again, the estimated relationship between first-trimester fatalities and low birth weight was positive and statistically significant.

We also experimented with interacting the year and month indicators introduced in Section 4 in order to estimate the following equation:

$$\begin{aligned} Birth\ Weight_{idt} &= \alpha + \pi_1 FirstTriFat_{dt} + \pi_2 SecondTriFat_{dt} \\ &\quad + \pi_3 ThirdTriFat_{dt} + \beta' X_{idt} + \nu_t + u_d + \varepsilon_{idt}, \end{aligned} \tag{3}$$

The results of this exercise are reported in columns (1) and (3) of Table 8. They continue to show a strong positive relationship between first-trimester fatalities and low birth weight. However, there is little evidence from this specification that third-trimester fatalities are positively related to low birth weight.

Finally, we controlled for district-specific linear trends by interacting the district indicators with a variable equal to 1 in April of 2001, 2 in May of 2001, and so forth. The results, which are reported in columns (2) and (4) of Table 8, are similar in magnitude and precision to those appearing in columns (1) and (3) of Table 8.

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. 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.

The al-Aqsa Intifada, also known as the Second Intifada, claimed the lives of more than

4,100 Palestinians (Jaeger and Paserman 2008), and although Israeli incursions during the al-Aqsa Intifada were ostensibly targeted, noncombatants living in the West Bank and Gaza Strip were clearly impacted (World Bank 2004). The focus of our 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. Comparing siblings exposed to different levels of violence in the first trimester of pregnancy, we find that an additional conflict-related fatality is associated with at least a 0.0032 increase in the probability of giving birth to an infant weighting less than 2,500 grams, the standard cutoff for low birth weight used in the medical literature.

This result is consistent with the hypothesis that prenatal exposure to armed conflict is related to birth weight through stress. A number of studies have found that stress experienced in the early stages of pregnancy reduces birth weight (Paarlberg et al. 1999; Schneider et al. 1999; Glyn et al. 2001; Camacho 2008), but the impact of nutritional deficiencies on birth weight is largely confined to the later stages of pregnancy (Stephenson and Symonds 2002). Likewise, to the extent that prenatal visits protect against low birth weight, their impact appears to be confined to the later stages of pregnancy (Rous, Jewell and Brown 2004; Jewell and Triunfo 2006). Adding to our confidence that stress is indeed the causal mechanism, controlling for prenatal care visits, anemia, and curfews does not have an appreciable impact on the estimated relationship between conflict-related fatalities in the first trimester and low birth weight.

It is helpful to focus on particular district and quarter to put our estimate of the impact of exposure to armed conflict on low birth weight in perspective. There was intense fighting during the spring of 2002 in the district of Nablus; over the months of March, April and

May, 96 Palestinians were killed by Israeli security forces operating in Nablus. If each of these fatalities led to a 0.0032 increase in the probability of being in the low-birth-weight category, then roughly 241 of the estimated 786 children born in November to mothers living in Nablus were pushed below the 2,500 gram cutoff as a result of being exposed to armed conflict during their first trimester in the womb.[26]

Of course the fighting was at its most intense in Nablus during these months, while other districts were calmer. For instance, there were 30 Palestinians killed by Israeli security forces in March, April, and May of 2002 in the district of Tulkarm. If we again use the 0.0032 estimate, roughly 37 of the estimated 389 children born in November to mothers living in Tulkarm were pushed below the 2,500 gram cutoff as a result of being exposed to violence during the first trimester.[27]

Although our results suggest that prenatal exposure to violence was positively related to low birth weight, we find little evidence that it led to increased infant mortality. However, comparing siblings exposed to different levels of violence in the months immediately after delivery, we find that an additional conflict-related fatality is associated with a 0.0037 increase in mortality. This result suggests that the quality of care received by newborns might have

[26] A number of assumptions went into producing this figure. First, we assume that infants born in November to mothers living in Nablus were conceived sometime in February or early March and were therefore exposed to approximately 96 fatalities during their first trimester in the womb. In addition, according to the PCBS (1999), there were 60,455 women between the ages of 15 and 54 living in Nablus in 1997. By 2007, the population of women living in Nablus and belonging to this age group had increased to 80,701 (PCBS 2009), suggesting a growth rate of a 3.34 percent per year and a 2002 population of 71,455. Using data on female Nablus 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 0.011, and an average of 786 births per month in 2002 (0.011 x 71,455=786).

[27] According to the PCBS (2009), there 40,252 women between the ages of 15 and 54 living in Tulkarm in 2007. Assuming a population growth rate of 3.34 percent, there were 38,859 women between the ages of 15 and 54 living in Tulkarm in 2002. Using data on female Tulkarm 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 0.010, and an average of 389 births per month in 2002 (0.010 x 38,859=389).

been compromised as a result of the fighting. Controlling for birth weight, the relationship between postnatal fatalities and infant mortality essentially disappears.

Recently, Hoynes, Page and Stevens (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 prenatal stress due to armed conflict is an open question. Nonetheless, at a minimum, our results are consistent with those of medical studies showing a positive relationship between self-reported prenatal stress and low birth weight, and suggest a heretofore-unexplored rationale for intervention when armed conflict occurs.

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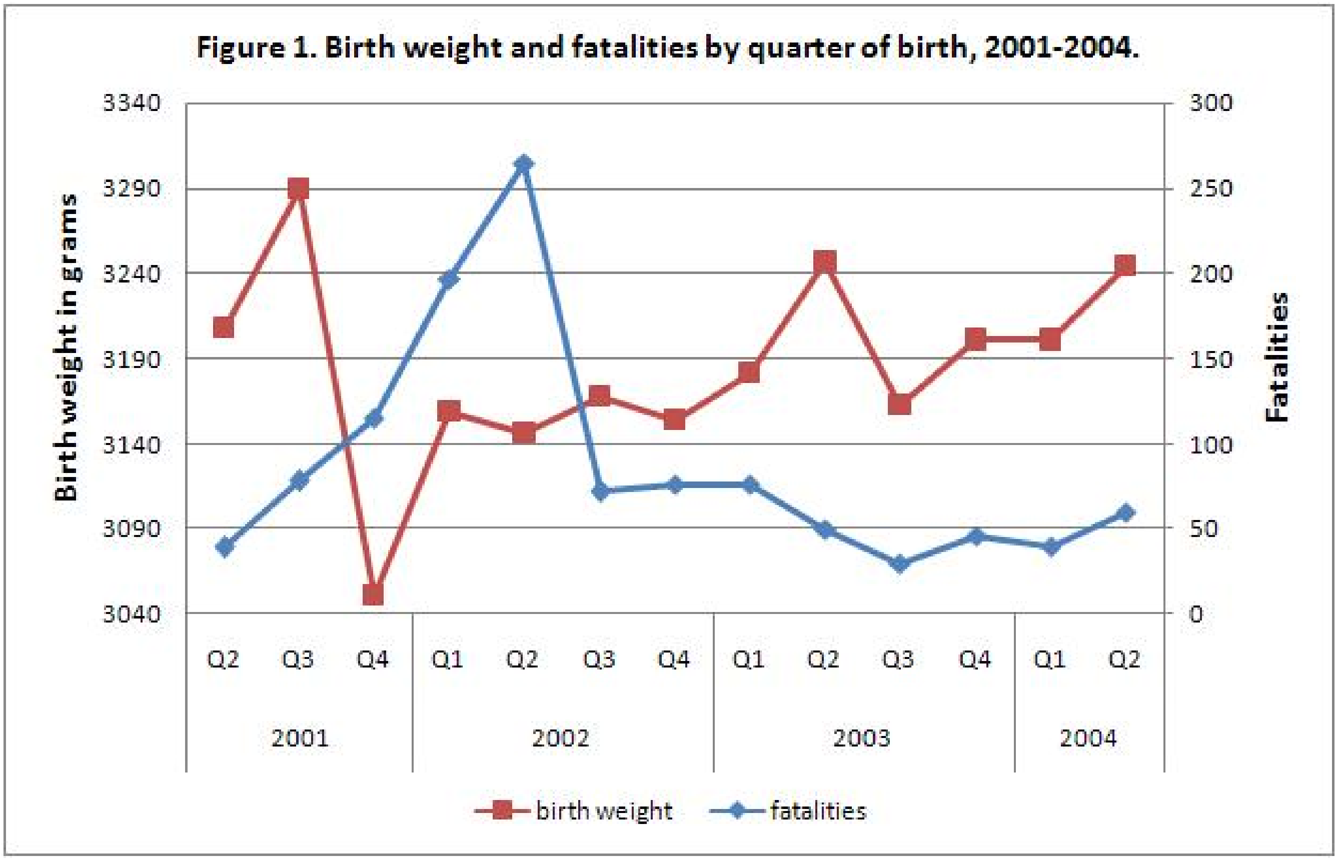
Figure 1. Birth weight and fatalities by quarter of birth, 2001-2004.
Birth weight in grams
Fatalities
3340
3290
3240
3190
3140
3090
3040
300
250
200
150
100
50
0
Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2
2001
2002
2003
2004
birth weight
fatalities

Table 1A. Descriptive Statistics - Full Sample

	Mean	Standard Deviation	N
Mother's characteristics			
mother's age at birth	26.8	6.1	1,224
mother's education	10.2	3.2	1,224
mother's age at marriage	19.1	3.3	1,224
refugee status	0.20	-	1,224
Infant outcomes			
birth weight in grams	3,184.2	606.0	1,224
birth weight $<$ 2500 grams	0.09	-	1,224
birth weight $\leq$ 2500 grams	0.14	-	1,224
died within one month of birth	0.01	-	1,224
died within two months of birth	0.01	-	1,224
Use of medical care			
number of prenatal visits	7.8	4.2	1,170
delivered in hospital	0.95	-	1,224
Pregnancy complications			
any complication	0.62	-	1,224
anemia	0.20	-	1,224

Notes: All statistics are based on weighted data for the period April 2001 through June 2004.

Table 1B. Descriptive Statistics - Siblings Sample

	Mean	Standard Deviation	N
Mother's characteristics			
mother's age at birth	24.8	5.2	501
mother's education	10.4	3.1	501
mother's age at marriage	19.2	3.4	501
refugee status	0.19	-	501
Infant outcomes			
birth weigh in grams	3,117.1	656.3	501
birth weight $<$ 2500 grams	0.12	-	501
birth weight $\leq$ 2500 grams	0.18	-	501
died within one month of birth	0.02	-	501
died within two months of birth	0.02	-	501
Use of medical care			
number of prenatal visits	7.9	4.5	476
delivered in hospital	0.93	-	501
Pregnancy complications			
any complication	0.57	-	501
anemia	0.18	-	501

Notes: All statistics are based on weighted data for the period April 2001 through June 2004. These births occured to 244 mothers, 13 of whom reported 3 births.

Table 2. The relationship between conflict-related fatalities and low birth weight

	Birth weight in grams		birth weight < 2500g		birth weight ≤ 2500g	
	(1)	(2)	(3)	(4)	(5)	(6)
FirstTriFat	-0.75	-3.69	**0.0009***	**0.0032****	**0.0015****	**0.0044*****
	(0.69)	(2.44)	**(0.0004)**	**(0.0011)**	**(0.0005)**	**(0.0011)**
SecondTriFat	-1.05	-1.38	0.0004	-0.0000	0.0013	0.0014
	(0.60)	(2.37)	(0.0005)	(0.0012)	(0.0007)	(0.0023)
ThirdTriFat	-1.73	-0.62	0.0007	**0.0014***	**0.0018****	0.0027
	(0.90)	(0.94)	(0.0005)	**(0.0006)**	**(0.0007)**	(0.0015)
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, and mother's age at birth. Regressions without mother fixed effects include district fixed effects, mother's education, refugee status, and age at marriage.

Table 3A. The relationship between conflict-related fatalities and low birth weight (< 2500g) by mothers' education and refugee status

	mother's education < 12 year		mother's education ≥ 12 year		refugee mothers		non-refugee mothers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FirstTriFat	**0.0010***	0.0027	0.0005	**0.0034****	0.0019	**0.0127******	0.0004	0.0019
	(0.0005)	(0.0017)	(0.0008)	**(0.0010)**	(0.0017)	**(0.0021)**	(0.0002)	(0.0012)
SecondTriFat	0.0010	0.0001	-0.0001	**0.0034***	0.0002	**-0.0106******	0.0004	0.0008
	(0.0006)	(0.0011)	(0.0006)	**(0.0017)**	(0.0012)	**(0.0022)**	(0.0006)	(0.0018)
ThirdTriFat	0.0011	0.0011	0.0002	**0.0078***	-0.0015	0.0087	**0.0013****	**0.0026***
	(0.0009)	(0.0012)	(0.0010)	**(0.0035)**	(0.0014)	(0.0060)	**(0.0005)**	**(0.0011)**
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 3B. The relationship between conflict-related fatalities and low birth weight ($\leq$ 2500g) by mothers' education and refugee status

	mother's education < 12 year		mother's education $\geq$ 12 year		refugee mothers		non-refugee mothers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FirstTriFat	0.0011	**0.0036***	**0.0019****	0.0031	0.0011	**0.0129*****	**0.0015***	**0.0037*****
	(0.0011)	**(0.0015)**	**(0.0008)**	(0.0018)	(0.0025)	**(0.0023)**	**(0.0007)**	**(0.0007)**
SecondTriFat	0.0013	-0.0025	0.0017	**0.0100*****	0.0011	**-0.0183*****	0.0013	0.0021
	(0.0010)	(0.0024)	(0.0010)	**(0.0026)**	(0.0016)	**(0.0027)**	(0.0009)	(0.0026)
ThirdTriFat	0.0020	0.0030	0.0011	**0.0068****	-0.0003	**0.0130***	**0.0024*****	0.0039
	(0.0011)	(0.0020)	(0.0007)	**(0.0027)**	(0.0020)	**(0.0066)**	**(0.0005)**	(0.0024)
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 conflict-related fatalities and use of medical care

	number of prenatal visits		Delivery in a hospital or clinic	
	(1)	(2)	(3)	(4)
FirstTriFat	-0.002	-0.015	0.0009	0.0012
	(0.009)	(0.009)	(0.0005)	(0.0013)
SecondTriFat	-0.011	-0.034	0.0007	**0.0017***
	(0.010)	(0.021)	(0.0005)	**(0.0008)**
ThirdTriFat	**-0.012****	-0.017	-0.0009	-0.0003
	(0.004)	(0.025)	(0.0006)	(0.0011)
mother fixed effects	no	yes	no	yes
N	1,345	563	1,502	638

*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 5A. The relationship between conflict-related fatalities and low birth weight ($<$ 2500 grams) controlling for anemia and prenatal care

	(1)	(2)	(3)	(4)	(5)	(6)
FirstTriFat	**0.0011*****	**0.0039*****	**0.0009***	**0.0032****	**0.0013***	0.0023
	(0.0003)	**(0.0009)**	**(0.0004)**	**(0.0011)**	**(0.0005)**	(0.0015)
SecondTriFat	0.0005	0.0007	0.0005	0.0000	0.0008	-0.0006
	(0.0005)	(0.0014)	(0.0005)	(0.0009)	(0.0005)	(0.0014)
ThirdTriFat	**0.0007***	0.0012	0.0007	**0.0014****	0.0007	**0.0016***
	(0.0004)	(0.0009)	(0.0005)	**(0.0006)**	(0.0005)	**(0.0006)**
anemia	no	no	yes	yes	no	no
prenatal visits	yes	yes	no	no	no	no
curfews	no	no	no	no	yes	yes
mother fixed effects	no	yes	no	yes	no	yes
N	1,170	476	1,224	501	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 5B. The relationship between conflict-related fatalities and low birth weight ($\leq$ 2500 grams) controlling for anemia and prenatal care

	(1)	(2)	(3)	(4)	(5)	(6)
FirstTriFat	**0.0017*****	**0.0049*****	**0.0015****	**0.0044*****	**0.0019****	**0.0034***
	(0.0003)	**(0.0011)**	**(0.0005)**	**(0.0012)**	**(0.0005)**	**(0.0014)**
SecondTriFat	0.0013	0.0023	0.0013	0.0015	**0.0013***	0.0009
	(0.0007)	(0.0018)	(0.0007)	(0.0022)	**(0.0005)**	(0.0026)
ThirdTriFat	**0.0018****	0.0027	**0.0018****	0.0027	**0.0018***	0.0025
	(0.0006)	(0.0018)	**(0.0007)**	(0.0015)	**(0.0006)**	(0.0015)
anemia	no	no	yes	yes	no	no
prenatal visits	yes	yes	no	no	no	no
curfews	no	no	no	no	yes	yes
mother fixed effects	no	yes	no	yes	no	yes
N	1,170	476	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 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 conflict-related fatalities and infant mortality

	Infant died within one month of birth				Infant died within two months of birth			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FirstTriFat	0.0002	0.0003	0.0017	0.0016	0.0001	0.0003	0.0016	0.0014
	(0.0004)	(0.0005)	(0.0011)	(0.0014)	(0.0004)	(0.0005)	(0.0011)	(0.0015)
SecondTriFat	0.0001	0.0001	**0.0006***	0.0000	0.0001	0.0002	0.0006	0.0000
	(0.0002)	(0.0002)	**(0.0003)**	(0.0005)	(0.0002)	(0.0002)	(0.0003)	(0.0005)
ThirdTriFat	-0.0000	0.0000	**-0.0007***	-0.0002	0.0000	0.0001	-0.0005	0.0001
	(0.0002)	(0.0003)	**(0.0003)**	(0.0005)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
month 10	0.0005	-0.0002	**0.0037***	0.0012	0.0006	-0.0001	**0.0037***	0.0011
	(0.0005)	(0.0003)	**(0.0016)**	(0.0010)	(0.0005)	(0.0003)	**(0.0018)**	(0.0009)
month 11	-	-	-	-	0.0000	0.0003	0.0002	0.0000
	-	-	-	-	(0.0002)	(0.0002)	(0.0004)	(0.0004)
mother fixed effects	no	no	yes	yes	no	no	yes	yes
low birth weight ($\leq$ 2500g)	no	yes	no	yes	no	yes	no	yes
N	1,504	1,224	638	501	1,504	1,224	638	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 conflict-related fatalities and low birth weight: alternative measures of first trimester exposure to violence

	birth weight < 2500g		birth weight ≤ 2500g		birth weight < 2500g		birth weight ≤ 2500g	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fatalities Months 0-3	0.0006	**0.0018***	**0.0016***	**0.0028***	-	-	-	-
	(0.0004)	**(0.0009)**	**(0.0007)**	**(0.0013)**	-	-	-	-
Fatalities Months 0-2	-	-	-	-	0.0005	**0.0016***	0.0014	0.0023
	-	-	-	-	(0.0004)	**(0.0007)**	(0.0007)	(0.0014)
SecondTriFat	0.0004	-0.0001	0.0013	0.0013	-	-	-	-
	(0.0005)	(0.0009)	(0.0007)	(0.0021)	-	-	-	-
Fatalities Months 3-6	-	-	-	-	0.0005	0.0006	**0.0015***	0.0023
	-	-	-	-	(0.0003)	(0.0012)	**(0.0008)**	(0.0012)
ThirdTriFat	0.0006	0.0011	**0.0017****	0.0022	0.0006	0.0010	**0.0017****	0.0023
	(0.0005)	(0.0006)	**(0.0006)**	(0.0016)	(0.0005)	(0.0006)	**(0.0007)**	(0.0015)
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.

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 conflict-related fatalities and low birth weight: estimates of equation (3)

	birth weight < 2500g		birth weight ≤ 2500g	
	(1)	(2)	(3)	(4)
FirstTriFat	**0.0020*****	**0.0019*****	**0.0028*****	**0.0027****
	(0.0004)	**(0.0004)**	**(0.0007)**	**(0.0008)**
SecondTriFat	-0.0008	-0.0009	-0.0008	-0.0009
	(0.0007)	(0.0007)	(0.0012)	(0.0012)
ThirdTriFat	0.0006	0.0003	0.0010	0.0010
	(0.0008)	(0.0008)	(0.0009)	(0.0010)
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.

Table A1. Number of fatalities by district in the West Bank

	Jenin	Tubas	Tulkarm	Nablus	Qalqiliya	Salfit	Ramallah	Jericho	Bethlehem	Hebron
7/00	0	0	0	0	0	0	0	0	0	0
8/00	0	0	0	0	0	0	0	0	0	0
9/00	0	0	0	2	0	0	4	0	0	0
10/00	8	0	5	18	2	1	17	3	2	8
11/00	8	0	7	5	3	0	3	3	9	8
12/00	5	0	1	5	0	0	3	1	4	5
1/01	1	0	2	2	0	1	0	0	0	2
2/01	0	0	2	1	0	0	1	0	3	3
3/01	2	0	0	6	1	0	6	0	0	1
4/01	2	0	1	0	2	0	2	0	1	1
5/01	3	0	1	12	0	0	9	0	2	0
6/01	0	0	0	1	0	0	1	0	1	0
7/01	6	0	1	11	0	0	1	0	4	0
8/01	0	0	4	6	0	0	1	0	2	6
9/01	12	4	2	1	1	0	4	1	2	9
10/01	2	0	11	5	6	0	9	0	18	10
11/01	1	5	3	4	0	0	2	0	1	1
12/01	7	0	8	5	0	10	2	0	0	5
1/02	0	0	4	7	0	0	6	0	0	0
2/02	9	0	3	19	0	0	3	1	1	4
3/02	17	4	26	17	5	1	51	0	10	9
4/02	59	8	2	73	3	0	11	0	25	28
5/02	5	0	2	6	0	0	1	1	3	2
6/02	8	1	2	8	3	0	2	1	3	8
7/02	3	0	1	6	5	0	1	0	3	0
8/02	5	6	5	8	0	0	1	1	0	1
9/02	4	1	2	7	0	0	5	0	0	7
10/02	7	1	4	6	0	2	1	0	0	0
11/02	6	1	8	8	2	0	0	0	1	3
12/02	6	0	5	5	0	0	4	0	1	5
1/03	7	0	5	4	0	0	0	0	1	1
2/03	0	1	5	15	3	0	0	0	0	1
3/03	9	5	3	4	1	0	0	0	6	5
4/03	2	0	2	3	2	1	2	2	2	3
5/03	6	0	4	4	0	0	3	0	0	2
6/03	4	0	4	1	0	0	0	0	0	3
7/03	2	0	1	0	1	0	0	0	0	0
8/03	0	0	2	4	0	0	0	0	1	0
9/03	3	0	0	7	0	0	1	0	0	8
10/03	1	0	7	2	1	0	0	0	0	3
11/03	5	0	2	6	0	0	1	0	0	1
12/03	1	0	1	8	0	0	7	0	0	0
1/04	1	0	1	8	0	0	0	0	0	1
2/04	2	0	0	6	0	0	1	2	1	0
3/04	6	0	2	3	0	1	0	0	1	4
4/04	3	1	7	2	3	0	2	0	1	1
5/04	1	0	3	7	1	0	1	0	0	2
6/04	5	0	1	14	0	0	1	0	1	0
7/04	2	0	9	9	1	0	0	0	0	2

Table A2. The relationship between conflict-related fatalities and low birth weight

	birth weight $< 1500g$		birth weight $\leq 1500g$		birth weight $< 3000g$		birth weight $\leq 3000g$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FirstTriFat	-0.0002	0.0002	-0.0001	-0.0002	**0.0019*****	**0.0021****	0.0010	0.0036
	(0.0002)	(0.0002)	(0.0001)	(0.0009)	**(0.0003)**	**(0.0006)**	(0.0008)	(0.0026)
SecondTriFat	-0.0001	**-0.0010***	-0.0002	-0.0008	**0.0014*****	0.0030	**0.0024***	**0.0048****
	(0.0002)	**(0.0005)**	(0.0002)	(0.0005)	**(0.0004)**	(0.0016)	**(0.0011)**	**(0.0018)**
ThirdTriFat	0.0001	0.0001	-0.0001	0.0001	**0.0021***	**0.0015***	**0.0020*****	0.0009
	(0.0002)	(0.0009)	(0.0002)	(0.0010)	**(0.0009)**	**(0.0007)**	**(0.0005)**	(0.0010)
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.

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 A3. The relationship between conflict-related fatalities and pregnancy complications

	Any complication		Sings of premature delivery		Vaginal bleeding	
	(1)	(2)	(3)	(4)	(5)	(6)
FirstTriFat	0.0012	-0.0010	0.0010	**0.0025****	-0.0000	-0.0003
	(0.0008)	(0.0023)	(0.0007)	**(0.0010)**	(0.0005)	(0.0004)
SecondTriFat	-0.0013	-0.0019	-0.0002	**-0.0023****	-0.0006	0.0005
	(0.0008)	(0.0023)	(0.0006)	**(0.0007)**	(0.0005)	(0.0003)
ThirdTriFat	-0.0006	**0.0030****	-0.0000	0.0010	-0.0001	0.0015
	(0.0015)	**(0.0008)**	(0.0008)	(0.0009)	(0.0009)	(0.0009)
prenatal visits	yes	yes	yes	yes	yes	yes
mother fixed effects	no	yes	no	yes	no	yes
N	1,345	563	1,345	563	1,345	563

*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 A3 (continued). The relationship between conflict-related fatalities and pregnancy complications

	Anemia		Hypertension	
	(7)	(8)	(9)	(10)
FirstTriFat	-0.0004	-0.0013	-0.0009	0.0004
	(0.0006)	(0.0012)	(0.0005)	(0.0007)
SecondTriFat	-0.0012	**-0.0043****	0.0010	0.0002
	(0.0008)	**(0.0015)**	(0.0005)	(0.0007)
ThirdTriFat	**-0.0017****	-0.0010	-0.0002	**0.0014***
	(0.0005)	(0.0018)	(0.0009)	**(0.0007)**
prenatal visits	yes	yes	yes	yes
mother fixed effects	no	yes	no	yes
N	1,210	497	1,345	563

*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. Cririnal 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.