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Violence and Child Health Outcomes: Evidence from Mexican Drug War

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Abstract

An emerging literature finds that early life exposure to conflict has important effects on subsequent physical and cognitive development. While this literature focuses on large-scale violent events and low intensity conflicts, there is a lack of studies examining high levels of criminal violence. This discrepancy is important as many areas in the world, particularly Central and South America, experience consistently high levels of organized crimes. This study examines whether these health effects also extend to criminal violence setting by focusing on the sharp increase in homicide rates in Mexico since 2007-08. Using sibling fixed effects, I study whether the levels and timing of municipality homicide rates affect children's physical health and cognitive and non-cognitive development in Mexico. The results show a strong effect of *in utero* exposure (depending on the trimester) on the physical health and cognitive development and no effect on socio-emotional behavior and chronic illnesses. Specifically, an average increase in the homicide rate between the pre-escalation period of 2005-06 and 2009 while in utero reduces both height-for-age Z-scores (HAZ) and cognition (measured by Raven's scores) by 0.08 standard deviation (SD). The results further provide suggestive evidence about maternal stress and prenatal care use as potential channels.

Keywords: Early Life shocks, Human capital formation, Violence, Mexico, Children,
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1. INTRODUCTION

The relationship between early life shocks and their subsequent effect on outcomes later in life is well studied (Barker 1992; Cunha and Heckman 2007; Almond and Currie 2011). Studies based on natural experiments advocate that exposure to unfavorable conditions early in life can have adverse effects on human capital accumulation during childhood. These effects may persist and lead to undesirable effects on health and education, productivity and wages, and other socioeconomic outcomes in adult life (Almond 2006; Van den Berg et al. 2006; Almond et al. 2010; Currie and Rossin-Slater 2013; Strauss and Thomas 2008). Recent studies extend this literature to include impact of conflict and conclude that early life exposure to violence adversely affects children's health and educational outcomes (see, for instance, Camacho 2008; Akresh et al. 2012; Minoiu and Shemyakina 2012; Valente 2011; Leon 2012). This is an alarming situation considering that 1.5 billion people are living in a chronically violent environment in the developing world (World Bank 2011).

While the literature on violence and child development covers large scale violent events (e.g. wars and genocides) and low intensity conflicts (e.g. insurgencies and terrorism), there is a lack of studies for areas with consistently high levels of criminal violence.[1] This discrepancy is important and requires further review, as many areas in the world, particularly countries in West Africa and Latin America, have been the victims of organized crimes. Criminal violence, though persistent, is usually lower in intensity than war atrocities.[2] Moreover, the motivations, goals, and potential targets for perpetrators of criminal violence (e.g. drug cartels) are different from those of enemy states and insurgents (Kan 2012).[3] Subsequently, this more prevalent but distinctive type of violence could possibly have different effects on the population in general and on children's well-being in particular.

Mexico is an intriguing case in the context of criminal violence for two reasons. First, the homicide rates in Mexico were stable until 2007 and escalated afterwards (see Figure 1) primarily because of military crackdown against the Drug Trafficking Organizations (DTOs) by President Calderón's administration. This sharp increase in violence is plausibly exogenous to the households living in those municipalities. The country observed not only an overall threefold

[1] Two notable exceptions are Brown (2015) and Duque (2014) for Mexico and Colombia respectively.

[2] However, high intensity crimes can produce more violence than low intensity conflicts in some cases (World Bank, 2011).

[3] For example, insurgents are usually motivated by political or religious ideology with the primary goal of getting territorial autonomy or access to resources and could cease violence through reconciliation or peace talks. On the other hand, organized criminals, such as drug cartels, are driven by illicit profits with the primary goal of expansion of power in a hypercompetitive illegal markets and may cease violence through cooperation with or elimination of rivals (Kan 2012). Criminal violence is mostly directed towards rival criminal organizations unlike insurgents and terrorists who may target non-combatant citizens in order to spread more fear to bring the state down on her knees.

increase in homicide rates between 2007 and 2010 but also considerable heterogeneity in violence across municipalities. Second, the Mexican Family Life Survey (MxFLS), a longitudinal survey representative of the Mexican population, has collected household data over three rounds between 2002 and 2009-12. Hence, the survey rounds provide information for both periods; before and after the crackdown on DTOs, which makes it possible to examine the effects of spatial-temporal variation in violence.

Violence has been found to have strong negative effects on birth weight in this settings (Brown 2015). It is, however, unclear whether these effects also persist across time, specifically with the idea that parents may endogenously respond to compensate for the less endowed child so that the child can catch-up with the well-endowed siblings (Griliches 1979; Behrman et al. 1982; Pitt et al. 1990; Yi et al. 2015).[4] [5] Subsequently, this paper considers a variety of medium run child health outcomes to answer two broad questions: (1) do high levels of criminal violence have comparable effects to large scale violence on children's stature, cognitive ability, socio-emotional behavior, and chronic illnesses? [6] Apart from physical health, these other dimensions of human capital like cognitive abilities and socio emotional behavior explain significant variations in educational attainment and wages later on in life (McLeod and Kaiser 2004; Heckman et al. 2006).[7] (2) Do these effects differ by exposure timing across in-utero (and trimesters) and childhood? Previous studies focus on the estimation of an aggregate effect. However, the timing of exposure (in-utero/trimesters vs. childhood) to a shock can be crucial for differential effects on diverse outcomes (stature vs. cognitive ability).[8]

[4] One relevant study is Duque (2014) which examines these medium run health effects in Colombia. Nonetheless, the measure of violence (massacres) used in the study is different from homicides in its intensity and, subsequently, in effects. Moreover, the sample used in the main analysis is limited to children from the lowest income quartile. Also, the use of cross-sectional data limits the author's ability to empirically validate important mechanisms.

[5] There is also evidence for parental investment reinforcing initial endowments (Becker and Tomes 1976; Rosenzweig and Zhang 2009)

[6] I am unaware of any study that examines the relationship between conflict shocks and chronic illnesses.

[7] Literature related to the impact of violence on other dimensions of human capital formation such as cognitive and non-cognitive development is rare and very few studies have looked into this aspect (Duque 2014; Rodriguez and Sanchez 2013; Sharkey et al. 2012). Duque (2014) investigates the effect of massacres on the cognitive and socio-emotional development of Colombian children and finds significant negative effects on cognitive development and adequate attention.

[8] Two recent studies attempt to fill this gap. Akresh et al. (2014) conclude that children experienced reduction in HAZ from both in-utero and childhood exposure to war between Ethiopia and Eritrea. Duque (2014) further disaggregates the in-utero exposure to Colombian conflict into trimesters and finds that the negative effect comes from exposure in second and third trimesters.

Combining municipality-level monthly homicide rates with MxFLS data and using sibling fixed effect, the identification strategy exploits the variation in homicide rates over time between the pre-escalation and escalation periods. I also check for systematic behavioral responses to increase in violence. Since surge in violence may cause migration, the study uses an intent-to-treat approach to safeguard the estimates from the effects of endogenous migration (Brown 2015; Velásquez 2015). The longitudinal nature of MxFLS also allows to control for time varying individual and household characteristics when using the sibling fixed effects strategy.

There are three main contributions of this study: first, it extends the previous work on conflict shocks and child development by exploring the effects of high intensity crimes in particular. Qualitatively, the paper finds similar effects of criminal violence on children's height-for-age Z-scores (HAZ) and cognitive development. The magnitudes of the effects are, however, smaller than the ones found in literature for wars and insurgencies. Specifically, an average increase in the homicide rate between the pre and post-escalation period of 2005-06 and 2009 respectively reduces both HAZ and cognitive ability (measured by Raven's scores) by 0.08 standard deviations (SD). However, increase in homicide rates does not affect socio-emotional behavior and chronic illnesses.

Secondly, the medical evidence assert that effects from exposure to shocks can vary across trimesters for diverse outcomes (Gluckman and Hanson 2005; Stein and Lumey 2000; Kramer 1987). This aspect has not been paid much attention in the literature on conflict shocks. Hence, the paper breaks down the effect of children's exposure to criminal violence into prenatal and childhood exposures and further disaggregates the in-utero exposure into trimesters. The results support the assertions from medical literature. For example, the effects on HAZ and cognitive ability can only be attributed to prenatal exposure to violence. A further breakdown of the in-utero effect reveals that exposure in first two trimesters has a negative impact on cognitive development whereas exposure in the third trimester has a positive effect. Hence, studies that estimate the accumulated effect of a shock could neglect potentially significant effect heterogeneity across trimesters.

Third, building on the previous point, the medical and phycology literature also state a positive association between exposure to shock in third trimester and cognitive development. This is because elevated levels of stress hormones such as Corticotrophin Releasing Hormone (CRH) and cortisol in the latter half of pregnancy not only insulate the fetus from further anxiety shocks but also play a vital role in brain development and lung maturation (Matthews et al. 2004; Davis and Sandman 2010). To my knowledge, this paper provides the first evidence of this positive relationship in Economics literature in context of violent shocks.

The study also searches for various pathways that are possible to explore using this data. Similar to prior studies in this setting (Brown 2015), I find negative impact on mothers' mental health and prenatal care use. The results further show that observed reduction in the use of prenatal care is coming from demand side. There is also evidence of improved parental quality which may potentially explain the insignificant effect of childhood exposure to conflict; improved parental quality might have played a role in nullifying this effect.

The rest of the paper is structured as follows: section 2 provides the background on drug violence in Mexico. Section 3 describes the theoretical framework and potential pathways. Data and empirical methodology are explained in section 4. The results are discussed in section 5. Section 6 concludes the study.

2. DRUG VIOLENCE IN MEXICO

The launch of a military-led crackdown by President Calderón against the drug trafficking organizations is believed to be the major reason for escalation of violence (Molzahn et al. 2012; Guerrero 2011). Felipe Calderón won the 2006 presidential elections and started operation against organized crime groups in the subsequent year. Drug related homicides were significantly high in the municipalities where Calderón's party, Partido Acción Nacional (PAN), won the mayoral elections (Dell 2011). This supports the view that violence may have been triggered as a result of PAN policies.

Prior to the military crackdown, the drug cartels operated in an oligopolistic equilibrium in the drug market which resulted in the relatively stable levels of violence (Velásquez 2015). For example, statistics from the Mexican National Institute for Statistics and Geography (INEGI in Spanish) show a stable and declining trend in homicides before 2007 (Figure 1: Monthly variation). The crackdown increased the violence through three channels: direct confrontations between the military and OCGs, internal power struggles following the arrest/death of major leaders, and attempts by rival organizations to take market share from weakened organizations (Guerrero 2012b). These groups also fought for the control of corridors critical for drug trafficking. Reductions in drug flows between Colombia and the US made existing routes in Mexico all the more important. This cycle of violence was self-reinforcing: crackdowns led to violence which incited both further government actions and confrontations among remaining OCGs. The power struggles also led to a splintering of drug trafficking organizations (DTOs) as the number increased from 6 to 16 within four years (2007-2010). In turn, this further reinforced the cycle of violence (Guerrero 2011). Subsequently, the number of homicides roughly tripled, from nearly 8,500 to around 25,000 in the same span of four years.

The surge in violence had several negatively externalities for the non-combatant civilian population. First, the splitting of OCGs and the subsequent increase in their number reduced their profit margins from the drug market. This encouraged them to target civilians through other criminal activities including extortions, kidnapping and thefts in order to increase their profits (Molzahn et al. 2012; Guerrero 2011). Second, OGC's also targeted the civilian population to establish a climate of fear and hamper cooperation with the law enforcing agencies (Brown 2015). Lastly, civilians were also victims of the cross-fire between heavily armed groups. The violence was not limited to men; women were also directly and brutally targeted through kidnapping, murders and rapes, and indirectly affected through family exposure (United Nations 2011). Subsequently, women significantly reduced their labor market participation and were deprived of the opportunity to earn income (Velásquez 2015). Moreover, the fear of victimization instilled terror in them, which could be detrimental for the mental health. These two outcomes in turn can alter their behavior especially towards their children.

The violence escalated both over time and across municipalities. Figure 1 shows the monthly variations in homicides rate over time. Maps 1-3 show the spatial spread of violence for years 2002, 2005 (the years before President Calderon's term), and 2009 respectively. The crackdown had reached full strength along with the reinforcing feedback by year 2009. This led to surge in violence in many municipalities that had not experienced it previously. On the other hand, some municipalities also observed a decrease in homicide rate. The increase in violence was not uniform across municipalities or time. Since this violence was driven by the crackdown against OGCs and the subsequent events (such as major arrests and the fights within and between OGCs), they were beyond the influence of ordinary citizens.

3. THEORETICAL FRAMEWORK AND POTENTIAL PATHWAYS

3.1 Theoretical Framework

Two strands of literature study the effects of shocks during formative years on children's subsequent human capital. The first advocates that human capital formation is a dynamic process and any adverse shock affecting early life conditions would have long-term consequences on her later-life outcomes (Cunha and Heckman 2007; Cunha et al. 2010). The second derives its inspiration from the Fetal Origins Hypothesis (FOH). According to this hypothesis, detrimental prenatal conditions can affect the programing of fetus that could potentially lead to adverse future health outcomes (Barker 1992). Given its broader coverage of the health dynamics and the fact that the focus of this study is both in-utero and childhood exposure to violence, I explain the theoretical model for dynamics of skill formation.

Heckman (2007), Cunha and Heckman (2007), and Cunha et al. (2010) develop the dynamic model of human capital formation in the face of early life shocks. This model studies the persistence of a negative across developmental stages in the light of life-cycle perspective. Two mechanisms are considered in this regard. First, the stock of future skills depends on the stock of past skills and any shock that occurs at a critical stage of human capital development is likely to affect the future accumulation of skills. These critical stages occurring at different stages in human life may vary for various dimensions of human capital.[9] This channel is termed as "self-productivity". Second, the productivity of current and future investments in human capital also depends on level of skills. Consequently, a negative shock in a critical stage today will reduce the productivity of investments resulting in further deterioration of future skills. This concept is named "dynamic complementarities" (Cunha and Heckman 2007).

Following Heckman (2007) and Cunha et al. (2010), the child's human capital production function for skill s in period $t+1$ can be written as a function of past skills ϕ_t, shock λ_t, parental investments I_t, and parental endowments θ_P:

$$\phi_{s,t+t} = f_s(\phi_t, I_{s,t,}, \theta_P, \lambda_t) \qquad (1)$$

where skills include children's cognitive abilities (CA), socio-emotional behavior (SE) and physical health (PH). The investments parents make in their children's human capital can be in the form of goods as well as time spent in child care. In addition, investments respond to child skills and are thus simultaneously determined with skills. Also, the shock is realized before the parental investment decision and hence they are expected to respond to the shocks. Thus, parental investments can be expressed as:

$$I_{s,t} = h_s(\phi_t, \theta_P, \lambda_t) \qquad (2)$$

For simplicity, I divide the lifetime from conception to childhood into three periods: (in-utero= -1), (birth/infancy= 0), and (childhood=1). The production function for capital formation and investment choices at birth then becomes:

$$\phi_{s,0} = f_s(\phi_{-1}, I_{s,-1}, \theta_P, \lambda_{-1}), \quad and \quad I_{s,-1} = h_s(\phi_{-1}, \theta_P, \lambda_{-1}) \qquad (3)$$

[9] For example, the growth trajectory (HAZ) may be affected only in-utero and first years of life (Stein and Lumey 2000; Victora et al. 2010) and cognitive development can be influenced till age 10 (Hopkins and Bracht 1975).

Where $I_{s,-1}, \phi_{-1}$ and λ_{-1} indicate prenatal investment, genetic skill at the time of conception, and the shocks during the gestation period respectively. Likewise, the production function and investment during childhood would become:

$$\phi_{s,1} = f_s(\phi_0, I_{s,0}, \theta_P, \lambda_0), \quad and \quad I_{s,0} = h_s(\phi_0, \theta_P, \lambda_0) \tag{4}$$

Where $I_{s,0}$ denote investment during birth/infancy, and λ_0 represents shocks to birth or infancy environment. In the current study, exposure to violence, used as shock, is captured by λ_0. Using the above setup, we can observe how exposure to violence (shock) in-utero (λ_{-1}) can affect human capital formation at birth and during childhood. Starting from the effect of shock on a child's skill at birth, we observe that:

$$\frac{d\phi_{s,0}}{d\lambda_{-1}} = \frac{\partial\phi_0}{\partial\lambda_{-1}} + \frac{\partial\phi_0}{\partial I_{-1}}\frac{\partial I_{-1}}{\partial\lambda_{-1}} \tag{5}$$

The first term on the right hand side shows the biological channel through which parental exposure to violence affect human capital formation at birth. For example, exposure to violence may lead to maternal stress and subsequently to release of stress hormones resulting in constricted intrauterine growth and reduced gestation period (de Catanzaro and Macniven 1992; Wadhwa et al. 1993). This term is expected to be negative. The second term shows the effect of conflict through parental investments. This could take the form of reduced prenatal care use, nutritional deprivation, or indulgence into risky maternal behavior (e.g. drinking); all of which could be harmful for the fetus. On the other hand, lower wages resulting from increased violence reduces the opportunity cost of labor market participation. The use of this time for more frequent prenatal health care visits can have beneficial effects on fetus development. The overall sign of the second term and consequently the net effect on skills at birth is unclear.

The lasting effect of prenatal exposure on skills formation in childhood is given by:

$$\frac{d\phi_{s,1}}{d\lambda_{-1}} = \frac{\partial\phi_1}{\partial\phi_0}\frac{d\phi_0}{d\lambda_{-1}} + \frac{\partial\phi_1}{\partial I_0}\frac{\partial I_0}{\partial\phi_0}\frac{d\phi_0}{d\lambda_{-1}} \tag{6}$$

It is worth-noting that the first term, which captures the biological effect, is amplified by the self-productivity channel. The parental investment could either augment or compensate for the deleterious effects of in-utero shock. This makes the net effect theoretically ambiguous and an empirical examination to assess the effect all the more relevant. The effect of exposure to shock during childhood on skill formation can be expressed in a similar way.

For the empirical assessment of net effect, I use exposure to changes in municipality level homicide rates as the exogenous shock. Based on the theoretical framework above, the potential pathways through which the external shock can affect children's health outcomes are discussed in the next section.

3.2 Potential Pathways

The theoretical model discussed above and the empirical literature on violence and child health points towards several potential pathways. The first group of channels highlights the impact through health and economic resources. For example, conflict may affect the provision of health services in the community by destroying the health infrastructure and frightening away the skilled medical staff. Similarly, it may force the government to divert resources from education and health care towards military expenditures for security purposes. In addition, private investors will be reluctant to invest in violence prone environment due to the uncertainty surrounding their overall profitability. The resultant fall in household incomes can have disastrous consequences for child development because of reduction in the demand for health care services as well as in their ability to afford and provide nutritional supplements for the child (Akbulut-Yuksel 2009; Minoiu and Shemyakina 2012).

The second strand of channels includes biological and psychological pathways. Specifically, the Fetal Origins Hypothesis suggests that nutritional deprivation and chronic maternal stress during pregnancy can have severe consequences for fetal health and may result in long-lasting changes in the child's body system (Gluckman and Hanson 2005; Denckel-Schetter 2011). For instance, exposure to violence can trigger the production of stress hormones - Corticotrophin Releasing Hormone (CRH), Adrenocorticotropic Hormone (ACTH), and cortisol, in the mother and fetus. High levels of stress hormones may result in reduced gestational age; low birth weight; damaged the motor and brain development; and chronic illnesses during childhood (Hobel and Culhane 2003; Lockwood 1999; Aizer et al. 2012).

The effect of maternal stress and nutritional deprivation can have potentially differential effects on diverse outcomes. For example, exposure to nutritional deficiency and excessive cortisol level (resulting from maternal stress) during early gestation can negatively affect birth weight and cognitive development (Gluckman and Hanson 2005). However, high levels of CRH

and cortisol in the later part of pregnancy not only protect the fetus from further anxiety shocks but also play a vital role in brain development and lungs maturation (de Weerth and Buitelaar 2005; Matthews et al. 2004; Schulte et al. 1990). This positive association between high cortisol levels in later pregnancy and cognitive development is found in the medical literature (see, for instance, Davis and Sandman 2010; DiPietro et al. 2006). On the other hand, nutritional deprivation in the second half of gestation period and during the post birth formative years can result in child stunting (Stein and Lumey 2000; Kramer 1987; Victora et al. 2010).

With regards to chronic illness, Chiu et al. (2014) suggests that prenatal community violence and air pollution as stressors contribute to respiratory problems such as asthma. Recent studies also link nutritional deficit in-utero, such as inadequate prenatal intake of Vitamin D, to asthma and wheezing among offspring (Litoniua and Weiss 2007; Camargo et al. 2011). Nutritional deficiency may also starve a fetus in-utero with long-term effects on the fetus' metabolism, which could increase the likelihood of obesity in childhood (Barker 1992).

Another important pathway is that of parental quality, both before and after birth, in a violent environment (Duque 2014). Prenatal quality can be affected reduction in prenatal care use. In other cases, violent conflicts can affect the parents' mental health, which can lead to lower attention and lesser time allocation for child care (Sharkey et al. 2012; Campbell 1991). Using the attachment theory in psychology, neurobiologists have found a positive association between strong and positive mother-child attachment in infancy and healthy development (Schore 2001). Hence, mental distress caused by violence may disrupt parent-children interactions that in turn can affect child development. Parents may also take protective measures to prevent direct victimization of their children by, for instance, refraining them to play outside. This may also affect a children's mental and physical growth.

Lastly, some studies also suggest with evidence other potential mechanisms through which war can affect child health. These channels include displacement of population, theft of assets, destruction of food crops, and exposure to disease and unclean water (see, for example, Bundervoet et al. 2009; Akresh et al. 2011; Akresh et al. 2012; Akresh et al. 2014). The MxFLS data allows me to check for some of the above potential mechanisms.

4. DATA AND IDENTIFICATION

4.1 Data

Violence is measured using data on monthly homicide rate at municipality level. The homicide data is obtained from the Mexican National Institute for Statistics and Geography (INEGI) which reports about all intentional homicides. Since this dataset contains information only on registered homicides, there is a concern about underreporting drug related homicides. However the trends

in overall homicides and drug related homicides (collected by the President's office) are similar (Velásquez 2015). In this study, INEGI data is preferred for the reason that it is available for a longer span of time (1990-2012) and allows the use of spatial-temporal variation in violence for pre-escalation and escalation periods.

The Mexican Family Life Survey (MxFLS) is a nationally representative longitudinal survey that contains data for three waves: 2002 (MxFLS1), 2005-06 (MxFLS2), and 2009-12 (MxFLS3).[10] The baseline survey in the year 2002 collected data from 8,440 households consisting of 35,600 individuals in 150 communities across 16 states (Rubalcava and Teruel 2013). The individuals in baseline households were re-interviewed in subsequent rounds. The attrition rates are very low; 11% and 13% in the second and third waves respectively. Despite the overall low attrition rates, violence may cause attrition. Previous studies have shown non-random attrition in a similar sample (Brown 2015); a finding which I confirm for my particular sample in Table 1 in the Appendix.[11] [12]

The sample used in this analysis consists of 2,147 children of aged 1-9 years. The sample size varies by health outcome. For this analysis, sibling fixed effects are used which is further discussed in the section on identification strategy. The sibling sample includes 893 children born to 416 mothers. Table 1 gives a comparison of descriptive statistics of full versus sibling samples.

This study focuses on four dimensions of children's human capital. The first dimension is *physical health* which is measured by the height-for-age *Z*-scores (HAZ) and calculated by utilizing the multicenter growth reference of World Health Organization (WHO). This is an appropriate indicator to measure a child's long-term nutritional condition and health (Martorell and Habicht 1986).[13] Another domain is *cognitive ability*: this is measured using Raven's colored progressive matrices instrument (Raven et al. 1998a; Raven et al. 1998b). It consists of a series of 18 color figures that measure visual reasoning ability. The advantages of this test lie in its simplicity and it being "culture free" as it does not require prior knowledge of any particular language or formal education to be undertaken. As such, it is meant to evaluate ability instead of achievement. The MxFLS used this test for children aged 5-12 years.[14] I standardized these test scores with zero mean and standard deviation equal to one by age group.[15]

[10] 94% of the data for the third wave was collected in the years 2009 and 2010.

[11] Although my sample of mothers largely overlaps with Brown (2015) but is slightly different.

[12] The attrition rate between 2005 and 2009 is even lesser (8.21%) and results are qualitatively similar.

[13] According to WHO, a stunted child has HAZ below -2 standard deviations: a severely stunted has below -3.

[14] Respondents above the age of 12 years were given the "standard progressive matrices" test with 12 matrices.

[15] For example, older children may be better able to solve these matrices compared to younger children even in the absence of formal schooling. Standardization by age takes care of this concern.

The third outcome variable is s*ocio-emotional behavior*. The MxFLS does not have a formal questionnaire, such as Penn Interactive Peer Play Scale (PIPPS), to properly capture the socio-emotional behavior of children. Hence, I use "interaction" and "sleeping" behaviors of a child to measure socio-emotional status. For the interaction behavior, the MxFLS has a question about the amount of time (in hours/minutes) the child spent last week participating "*in sports, cultural, or entertainment activities outside the household*." For the sleeping behavior, the survey inquiries about the number of hours per day the child slept last week. Both these indicators were normalized with zero mean and standard deviation equal to one. The age group for this outcome in my analytical sample is 3-9 years. Lastly, the impact of c*hronic illnesses* has also been inspected. I check for three types of chronic illnesses: hearing problem, asthma, and obesity. These are all dummy variables where an illness takes the value 1 if the child suffers from that illness and zero otherwise.

The MxFLS contain a rich set of information about maternal and household characteristics, which can be used to empirically investigate the potential mechanisms discussed earlier. For instance, data on a mother's smoking (cigarettes per week) and workout (minutes per day) routine can be used to check her health behavior. The amount of time mother spent on child care (hours per week) is used as proxy for parental quality.[16] Similarly, the condition of mental health gives an idea about maternal stress. The MxFLS uses module of twenty questions (authenticated by the National Institute of Psychiatrics) where the respondent reports his own perception about emotional status in the last four weeks. Each question is given a score from 1 to 4 (with 1 being normal and 4 being severe). These are added to construct an Index ranging between 20 and 80 which is partitioned as follows: normal (20-35); anxious (36-45); moderately depressed (46-65); and severely depressed (66-80). For the purpose of this analysis, the depression index is converted into a binary variable which takes the value 1 if the score is 36 or above and 0 otherwise.[17] In order to assess the effect of violence on nutritional deprivation, I use two measures: per capita food expenditures (PCFE) and employment of the mother. One of the mechanisms could be a decrease in prenatal care. I use two different measures; the number of prenatal care visits (Brown 2015), and whether the first visit was made in the first half (in the first five months) of pregnancy.

[16] The MxFLS does not have question that explicitly ask about time spend on children but it does have question that inquire about time spent taking care of children and elderly people.

[17] Ideally, I would have appreciated data on mothers' stress level during pregnancy. Unfortunately, the data is only available for mental health measured at the time of survey, which only allows tests to confirm whether conflict in the previous year is detrimental for current mental health.

4.2 Identification

The identification strategy exploits the variations in homicide rates over time between the pre-escalation and escalation periods. The empirical strategy could, however, face some potential concerns, which are explained here along with the remedies.

The first concern is whether the surge in violence is exogenous to municipalities' characteristics. Maps 1-3 show considerable heterogeneity in violence across time and municipalities. One can argue that this heterogeneity may in fact be reflecting the underlying trends in other municipality level characteristics and, therefore, the increase in violence could be picking up the influences of these municipality trends on children's health outcomes. Brown (2015) formally examined this question using data on pre-escalation trends for 135 baseline municipalities of MxFLS to predict each municipality's homicide rate in 2009. He concludes that the pre-escalation trends in municipality characteristics are not related to future level of homicide rates, confirming the exogeneity of rise in violence.[18]

Another potential threat to the identification strategy can be the presence of systematic behavioral changes to violence. One such example is migration: non-random migration in response to elevated crimes could hamper the estimation of accurate impact of violence on children's health outcomes. For example, if more educated mothers have higher likelihood of migration in response to increase in homicide rates and they are also the ones who are more concerned about their children health and take additional measures in this regard, the areas with high crimes would have disproportionately higher number of less educated mothers with less healthy children which cannot be associated to their exposure to violence alone. Consequently, the impact of criminal violence on children's health outcomes would be overestimated.

Following Brown (2015), two measures of migration behavior are used. The first measure is constructed by using a dummy variable to indicate whether the respondent's municipality changed between the second and third waves of the data. The second measure of migration is whether the respondent has moved out from her locality in 2005 (at the time of second wave) for at least a year. The first two columns provide results for permanent migration (change of municipality between the waves). Violence does not cause permanent migration for full sample as well as any specific group. The results for temporary migration (columns 3 and 4) suggest that future violence influences overall migration behavior but it is not specific to any group. While the results are broadly similar to Brown (2015) for the case of permanent migration, they are slightly different for temporary migration: he did find selective migration by mothers from rural households, mothers with higher earnings, and mother from wealthy families. Since the overall temporary migration is caused by crimes and these mothers cannot be traced with the available

[18] For details on how these trends were created, see Brown (2015).

data, I employ an intent-to-treat style approach. This approach is similar to the one used in Brown (2015) and Velásquez (2015) to shield the estimates against endogenous migration where the mother's municipality of residence in the baseline survey (MxFLS1) determines the exposure to violence.[19] In other words, a child's exposure to violence is calculated as the homicide rate during his life in the mother's baseline municipality of residence, rather than where the mother is residing at the time of interview in MxFLS3.

A second behavioral response could be changes in fertility choice. The birth rates in the affected areas can observe a decline due to (i) delaying the conception fearing negative health externalities and loss of financial resources; (ii) selective out-migration of families more likely to conceive; and (iii) loss of pregnancies resulting from acute maternal depression in an extremely violent environment. If the fertility response is heterogeneous, it can lead to compositional changes in the outcome of interest. The concern is dealt with in Table 3. Results indicate that a rise in homicide rate 6 and 12 months prior to conception does not affect the birth rate for both the overall sample and for families with lower socio-economic status (SES).[20] Women, on average, do not cancel or delay fertility in the face of elevated violence and this finding is consistent across income groups. This eliminates concerns about compositional changes. These results compliment those found in Brown (2015) and Torche and Villarreal (2014).[21]

An additional concern could be that the results are driven by time invariant unobservable mother/family characteristics. If these characteristics are correlated with violence intensity, it would bias the estimates. In order to take care of this concern, I use sibling fixed effects. By looking only at variation within the family, time-invariant maternal (including genetics) and household characteristics are controlled. The use of sibling fixed effects significantly strengthens the identification strategy and is, therefore, the preferred specification in this paper. The panel nature of MxFLS also allows one to control for time-varying mother and household characteristics when sibling fixed effects strategy is used.[22]

Hence, by making use of intent-to-treat approach to control for endogenous migration, and employing sibling fixed effect strategy, I estimate the causal effect of exogenous increase in violence on various child development outcomes using equation 7.

[19] For example, it is not possible to know the exact location, time and duration of migration which makes it difficult to assign the exact exposure to violence in that particular period and of that particular location.

[20] The lower SES families are identified using the bottom 50 percent families on the baseline (MxFLS1) per capita household expenditures.

[21] For a detail of how birth rate is constructed, see Brown (2015). One notable difference is that my analysis covers the time period from January 2003 to December 2009.

[22] The characteristics from MxFLS1 and MxFLS2 are assigned to children born before and after 2005 respectively. The characteristics from MxFLS3 are not assigned for the reason that they might have been affected by the surge in violence and may no longer be exogenous.

$$CDO_{ijtmk} = \alpha + \varphi_1 \text{hom}_{trim\,1_{kt}} + \varphi_2 \text{hom}_{trim\,2_{kt}} + \varphi_3 \text{hom}_{trim\,3_{kt}} + \varphi_4 \text{hom}_{childhood_{kt}} + \xi_m + \delta_{YOB} + \eta_{MOB} + \vartheta_{YOI} + \psi_{MOI} + \gamma_j + \sigma_{SOB*YOB} + \beta X_{itm} + u_{ijtmk} \quad (7)$$

Here CDO_{ijtmk} is a particular developmental outcome for child i born in municipality j in time t to mother m who resided in municipality k at baseline; $\text{hom}_{trim\,1_{kt}}$ and $\text{hom}_{childhood_{kt}}$ show the exposure to homicide rates in the first trimester and childhood in the municipality of mother's residence in the baseline, k, for the specified period; ξ_m are the sibling fixed effects; δ_{YOB} and η_{MOB} are the year and month of birth fixed effects; ϑ_{YOI} and ψ_{MOI} are the year and month of interview fixed effects; $\sigma_{SFE*YOB}$ shows the fixed effects of the interaction of state of birth with the year of birth; γ_j shows the municipality of birth fixed effects; X_{itm} is vector of individual and time varying mother and household characteristics.[23] It is important to mention here that the sample for the analysis of cognitive ability consists of children aged between 5 and 9 years. As such, these children were exposed to surge in violence on in early years of life. The in-utero exposure for this outcome relies on historical variation in violence to identify the effect. This is further discussed in the sub-section 5.2 in the results which are presented in next section.

5. RESULTS

5.1 Effect of Violence on Stunting

The results for effect of violence exposure in-utero and during childhood on children's HAZ are presented in Table 4. The first two columns show the OLS results for the entire sample whereas the results using sibling fixed effects are illustrated in columns 3 and 4. The last two columns exhibit the outcomes for falsification tests.

I start by estimating the impact of in-utero and childhood exposure to homicide rates on HAZ for all the children aged 1-9. Result in column 1 provides no evidence of the relationship between local homicide rates and stunting. However, recent literature proposes that the timing of exposure during pregnancy is also important. Hence, in column 2, I disaggregate the in-utero exposure into three trimesters.[24] The result suggests that violence exposure in first trimester

[23] The interaction of state of birth and year of birth fixed effects ($\sigma_{SFE*YOB}$) show the state linear time trends which capture the economic development differences across states that may vary linearly over time and could also influence child development.

[24] The data on exact duration of gestation period is not available. I counted back 9 months from the data of birth to identify each trimester.

reduces the HAZ by 0.011 standard deviation (SD). The average increase in homicide rate in Mexico between the pre-escalation period of 2005-06 and the year 2009 is about 10 homicides per 100,000 in the baseline (MxFLS1) municipalities. This translates to an increase of 2.5 homicides per 100,000 in the three months (trimester) homicide rate. Therefore, the violence exposure in the first trimester reduces HAZ by approximately 0.03 SD.

In order to take care of any time invariant unobservable family characteristics that may be driving these results, I introduce sibling fixed effects in column 3. The first thing to note is that the overall in-utero exposure becomes significant whereas the childhood exposure continue to be statistically insignificant. Secondly, the results depicts that the in-utero exposure reduces the HAZ by 0.08 SD. In column 4, I split the effect of homicide rate during pregnancy to each individual trimester and observe a significantly negative effect on HAZ in the first and third trimesters. Conditional on an average exposure of 2.5 homicide per 100,000 in each trimester, the total reduction in HAZ is 0.08 SD.[25] These results corroborate the view that controlling for the time-constant unobserved family characteristics is crucial for obtaining reliable estimates for the effects of violence on children's physical health.

The above findings are consistent both with Medical and Economics literatures. The Medical literature proposes that nutritional deficit, particularly in the second half of pregnancy, is detrimental for children's physical growth (Gluckman and Hanson 2005). The studies in economics associate in-utero exposure to nutritional shock with low birth weight. For example, Painter et al. (2005) puts forward that exposure to Dutch famine in third trimester resulted in lower average birth weight compared to those who were exposed in earlier trimesters. On the other hand, Brown (2015) unearths a negative and statically significant causal effect of first trimester exposure to violence on birth weight. However, the study emphasizes maternal stress as opposed to nutritional deficits as the potential pathway for this effect. In light of above studies, my results may suggest that both mechanisms, maternal stress and nutritional deficit, could be at play. Nonetheless, I formally try to explore some suggestive evidences of potential pathways in section 5.6.

Comparison of these estimates with the ones obtained for children exposed to war events suggest that my estimates are considerably smaller. The literature that shows the effect of high-

[25] It is important to mention that the year 2009 was just the early days of the surge in drug violence. By 2010, the annual rate had increased by an additional 4.5 homicides per 100,000. In this case, conditional on an average exposure of 3.6 homicide per 100,000 in each trimester, the total reduction in HAZ would be 0.11 SD. Since my sample consists of the births that took place till the year 2009, I am using the change in violence between pre-escalation and 2009. Nonetheless, the reduction of 0.08 SD in HAZ should be considered a conservative (lower bound) estimate.

level violence on HAZ records a reduction in the range of 0.2-1.0 SD (see, for instance, Akresh et al. 2012; Minoiu and Shemyakina 2012; Bundervoet 2012). However, for a relatively similar setup in terms of violence intensity, Duque (2014) finds almost similar reduction in HAZ due to exposure to massacres. In particular, the reduction due to in-utero exposure is exactly the same (0.08 SD). My estimate is also similar to Rosales (2013) who concludes that the 1998 El Nino weather shock in Ecuador resulted in an average decline of 0.09 SD in HAZ of children who were exposed in the third trimester. Yet, there is a difference of 0.03 SD between my total effect and the one found in Duque (2014), which comes from the fact that Colombian children also experienced a reduction in HAZ because of exposure to violence during childhood. This is not the case for Mexican children where the effect comes only from prenatal exposure. This may also be an indication for the different nature of violence experienced by these two Latin American countries. Another possible explanation could be the use of intent-to-treat (ITT) which lessens the estimated impact compared to when average treatment effect (ATE) is estimated.

There may be several possible reasons to explain the difference between estimates observed in Table 4 and the ones mentioned in literature. First, most of these studies were conducted for countries that observed episodes of intense violence due to wars, which lasted only for a few years. In case of Mexico, the conflict has been relatively low and stable and has been there for much longer period. People living in a particular environment for considerable amount of time adapt to the situation and learn to develop coping mechanisms accordingly; the same is true for being exposed to violence for prolonged periods of time. Compared to wars and genocides, criminal violence may also mean that the social fabric of society is not destroyed and people can at least cope with shocks *ex post* even if they fail to anticipate them. Also, criminal violence does not destroy the infrastructure and hinder provision of health services as will be discussed in next section on pathways. Second, many of the studies in the conflict and health literature are on African countries that suffer from nutritional deficits even in the absence of conflicts. In addition, the majority of population lack resources to cope with shocks *ex ante*. Those with resources are also left deprived due to high intensity of shocks and hence lose the incentive to abate the effects *ex post*. Third, it may also be the case that the general public may not feel as threatened from criminal violence since it is mostly directed specifically towards the gang members and personnel from law enforcement agencies and the chances of collateral damage are low. In comparison, the collateral damage in war events is considerably large and consequently put civilian population at higher risk of victimization leaving them feel more vulnerable. Children in particular are even more vulnerable to the effects of wars and violence in these countries.

A fourth possible reason could be the presence of government's social assistance programs such as *Oportunidades* (previously called *Progresa*). It is a conditional cash transfer program which provides monetary assistance to families with lower socio-economic status (mostly in rural areas) to invest in human capital of their children. One of the conditions for this program require families to take preventive health care measures in the form of regular health clinic visits and provision of nutritional support (Behrman and Parker 2011). The impact evaluation of *Oportunidades* shows that this program has positive sizable impact on children in rural communities who have been included at the beginning of intervention. The impact in urban, suburban, and the rural areas where children were included at a later date, has been modest (Farfan et al. 2011). Hence, it may also possible that the negative effects of violence on children health are mitigated by this program.[26]

5.1.1. Falsification Test

To further validate the identification strategy, I perform falsification tests in the last two columns of Table 4 by incorporating the exposure to violence one and two years before conception. If my results are driven by preexisting trends in violence, I should obtain significant coefficients for these variables. The outcomes of falsification tests suggest that this is not the case and so the results are not driven by preexisting trends in crimes.

5.1.2 Effect in First Years of Childhood

The findings in Table 4 indicate that reduction in HAZ of Mexican children comes only through prenatal exposure to violence. No effect was observed from exposure to violence during childhood. Nonetheless, the literature suggests that exposure in childhood to conflicts can adversely affect HAZ of children. Specifically, the first years of childhood, especially the infancy, are very sensitive with respect to child's nutritional requirement and health development. In order to explore the impact of violence in the early formative years, I disaggregate the childhood exposure into first and second years and rest of the childhood in Table 5. The finding that the effect is not significant even in the first two years of childhood is consistent with Rosales (2013) who does not observe an effect of the 1998 El Nino weather shock in the first year. The results in Table 3 are further validated.

[26] The reverse may also be true. It may well be the case that violence has reduced the positive effect of this program on children health. For example, the total family income which was raised by the conditional cash transfer might have seen a decline due escalation of violence in form loss of businesses and jobs (Velásquez 2015).

5.1.3 Heterogeneous Effects

In this section, I look at the heterogeneity in the effects of violence across three dimensions: socio-economic status, maternal education, and rural/urban status. Previous literature on shocks highlights that families with lower socio-economic status (SES) are more vulnerable to shocks (Currie and Hyson 1999; Currie and Vogl 2013). Higher values for the effect of conflict for lower SES families would mean that they are less able to protect their children against these negative effects. Column 2 of Table 6 provides estimates for the lower SES families. The negative effect on children's HAZ of these families is very high (0.13 SD) compared to the overall effect (0.08 SD). Coefficients of both the relevant trimesters especially the first trimester has increased substantially. This validates the view that children in these families are less likely to be protected from or compensated for the negative health shocks.

Another dimension of effect heterogeneity could be mothers' education. A mother with more education may be more able to protect her children from negative health shocks by taking preventive health care measures. I divide the sample according to whether a mother has received less than secondary education at the baseline. Column 3 in Table 6 shows that there is no evidence of heterogeneity in this dimension. The coefficients on the relevant trimesters are almost similar to that of the full sample. The net effect in terms of standard deviation is also the same; the result is consistent with Duque (2014).

A third dimension in this regard is residential status. People living in rural areas might not enjoy same quality of infrastructure in general and health facilities in particular, making them more vulnerable to shocks compared to urban residents. I split the sample based on residential areas in the first wave of survey.[27] The results in last column of Table 6 suggest that the total effect in terms of standard deviation is slightly higher (by 0.01 SD) for rural areas compared to the effect for overall sample in column 1. However, effects in trimesters are different; first trimester observes a sizable increase in coefficient. If the pathway for the effect through first trimester involves maternal stress, then this result emphasizes that mothers in rural areas experience more stress from violent shocks compared to their urban counterparts.

5.2 Effect of Violence on Cognitive Development

The results for the effect on cognitive development are given in Table 7. Since, cognitive questions were asked only from children of age 5 years and older; the sample size is reduced for this analysis. As was the case with HAZ, the effect is found only when sibling fixed effects are used. Likewise, the effect is observed only for prenatal exposure. The results further show that exposure to violence in the first two trimesters has a negative and statistically significant effect

[27] The reason for using baseline values is that the SES and education might be endogenous to violence.

on children's cognitive development. Interestingly, this effect turns positive in the third trimester. This result may appear surprising in the Economics literature but is well known in the Medical and Psychology literatures.

As was discussed earlier, maternal stress can be an important mechanism through which violence may affect child development in utero. Violence increases maternal stress which leads to the release of stress hormones during the early part of gestation, which can be harmful for child's cognitive ability. However, this high level of cortisol in the latter half of pregnancy can be beneficial for cognitive development (Matthews et al. 2004; Davis and Sandman 2010). In other words, excessive levels of stress hormones during late gestational period is beneficial for the child's neurodevelopment and this may be the reason for the positive and significant coefficient for third trimester. However, negative effects in the first two trimesters outweigh the positive effect in the third trimester leading to an overall decrease of 0.08 SD in cognitive development. It is also worth-mentioning that nutritional deficit, especially in the first trimester, may also have a negative impact on cognition (Gluckman and Hanson 2005). The fact that overall effect of violence on cognitive development is negative may also point towards starvation of the fetus in earlier periods of gestation. To my knowledge, this is the first study in economics that substantiates these findings from Epidemiology and Psychology literatures.

The absence of effects from childhood exposure could be justified by the stress mechanism for prenatal exposure. Several studies have shown that stress hormones may also have positive effects on maternal behavior post birth. For example, Corticotrophin Releasing Hormone (CRH) may be helpful in preparing the brain for motherhood in pregnancy. For instance, Bardi et al. (2004) finds that prenatal cortisol levels are associated with attentive mothering in baboons. These mothers spend more time taking care of the infants. Similar results have also been found in research on humans (see, for instance, Stallings et al. 2001).[28] Other studies show that the negative effects of prenatal maternal shocks on cognitive development may be eliminated through infant-mother attachment (Bergman et al. 2010). Hence, if maternal stress indeed is the channel, then it may also be reckoned that the resulting excessive levels of stress hormones in later pregnancy improves a mother's parenting behavior which consequently offsets the negative effect of exposure to violence during childhood but not from prenatal exposure.[29]

It is important to mention that the sample for this analysis consists of children aged 5-9 years. This means that all the children in this sample were born in 2006 or earlier. As far as prenatal exposure is concerned, these children were not exposed to the sharp increase in violence

[28] These excessive cortisol may also have unpleasant consequences especially in terms of mode swings during pregnancy and postpartum.

[29] Due to smaller sample size, the heterogeneity in results for cognitive development could not be checked.

post 2007. This could raise concerns about the identification strategy and consequently the causal effects of prenatal exposure to violence for this particular outcome. While I share this concern, it may be argued that the municipality level homicide rates may not necessarily be correlated with household characteristics making these exogenous for the children. For example, Michaelsen (2012) uses state level intentional homicide rates as an instrument to inspect a casual impact of mental health on labor supply in Mexico. Despite this argument, one must be careful while interpreting these effects as causal.

Looking at the results for HAZ and cognitive ability, it is obvious that the effects on child health outcomes differ, both qualitatively and quantitatively, based on the timing of exposure to violent shocks. This confirms the results from medical literature and emphasizes the need for disaggregation of exposure across trimesters and childhood.

5.3 Robustness Checks

One may argue that the results in Tables 4-7 may be driven by sibling sample and not by sibling fixed effects. In other words, these results are specific to sibling sample only. If this argument is true, I should get different results for full sample and sibling sample even without using sibling fixed effects. Table 8 presents robustness check for the results in Tables 4 and 7. The results of sibling sample in the absence of sibling fixed effects are not different from the OLS results of full sample for both HAZ and cognitive development.

In the last column of Table 8, I check the sensitivity of cognitive ability by including physical health as a control variable. This may also be seen as a way to identify the source of effect on cognition through in-utero exposure to violence (Rosales, 2013). For example, it could be that the effect on cognitive development occurs through the physical health. If this is indeed the case, then it should be captured in the child's HAZ and consequently the coefficients of trimesters should observe at least a decline in magnitude. Column 6 in Table 8 shows that this is not true as the HAZ coefficient is statistically insignificant and coefficients of trimesters are unaffected. The effect on cognition due to in-utero exposure to violence is independent of the child's HAZ. In other words, prenatal exposure to a shock has direct effect on cognitive development irrespective of physical health. This is another indication that the timing of in-utero exposure to a shock may have different effects on different health outcomes. It is worth mentioning that this regression should only be considered informative as it may suffer from reverse causality or omitted variable bias.

5.4 Effect on Socio-Emotional Behavior

The medical literature suggests that the exposure to shocks that results in maternal stress may also have an impact on a child's socio-emotional behavior. Specifically, they may face attentions

deficit problem as well sleep disturbance (see, for instance, O'Connor et al. 2002; O'Connor et al. 2007). Table 9 presents results for children's interactive behavior and sleeping hours based on a sample of children aged 3-9 years. Column 1 illustrates that exposure to violence in first trimester reduces the interaction hours by 0.03 SD.[30] However, the effect becomes insignificant when sibling fixed effects are introduced. Similarly, there is no effect of exposure, both in-utero and in childhood, on sleeping behavior; the reason for which could be the same attentive mothering discussed in case of cognitive development.[31]

5.5 Effect on Chronic Illness

I will now discuss the impact of violence exposure on chronic illnesses such as asthma, hearing problems, and obesity, which may result from exposure to a shock either in utero or during childhood. For example, Aizer et al. (2012) uncovers that prenatal maternal stress, resulting from excessive cortisol, increases the likelihood of chronic health conditions at age 7. Table 10 presents results for chronic illnesses and shows that there is no effect on hearing problem whereas an average increase in homicide rates in third trimester increases the likelihood of asthma by 0.38%. Childhood exposure to violence reduces the probability of obesity by 0.30% which may also be attributed to increase in maternal care after birth. Despite being statistically significant, these effects are economically negligible. Overall, we do not observe strong significant impact of exposure to local homicide rates on chronic illnesses in Mexican children.[32]

5.6 Pathways

I now turn to examine some of the potential channels. The findings discussed above indicate that negative effects on children's health outcomes are observed only through prenatal exposure. The childhood exposure does not affect any of the outcomes. One reason could be attentive mothering; mothers allocate more time for child care. Column 1 in Table 11 shows that this is indeed the case. Rise in violence increases child care time. Subsequently, this improved parental quality might have played a role in nullifying the effect of childhood exposure to conflict. This may also reflect on the smaller effect of prenatal exposure on HAZ and cognition as mothers may try to compensate for it through post birth parental investment.

For the case of prenatal exposure, several channels have been discussed in the literature. Brown (2015) has examined some of these mechanisms for Mexico. For example, he established

[30] The interactive behavior may also be considered as reverse of withdrawn behavior. Higher interaction would mean reduction in withdrawn behavior.

[31] Attentive motherhood may also be a reason for insignificant effect of a child's exposure to violence in childhood on her HAZ.

[32] I used the linear probability model for these analysis because the fixed effect logit models were not converging.

that violence (i) does not affect mothers' own health behavior; (i) delays the initiation of prenatal health care; (iii) leads to deterioration of mothers' mental health and therefore maternal stress could be the potential mechanism through which violence reduces birth weight. These findings broadly hold with my similar sample (Tables 11-13), providing at least suggestive evidence that violence during gestation could have increased the maternal stress thereby affecting the fetus, reducing the HAZ and hindering the cognitive development.

I further expand this to look at several other channels that are not being consider but are valid for this analysis. For example, a negative shock could reduce household income and reduce its consumption (Rosales 2013). As is the case with mental health, data is not available on household expenditures during gestation period. Using the data for last year's annual household expenditure from the time of interview, I estimate the effect of violence on per capita food expenditures (PCFE) and the results are given in columns 2 in Table 12. Although the effect on PCFE is negative, it is also statistically insignificant possibly due to the noise in the outcome variable.[33] As another measure, I look at the impact on employment of mothers. The result in column 3 suggests that violence has negative impact on mothers' employment but is imprecisely estimated.

Furthermore, the impact of violence on prenatal health care exhibits that the in-utero exposure to violence reduces the number of prenatal care visits as well as delays the initiation of health care and in both cases the effect is coming from second trimester (Table 13: columns 1 and 2).[34] Moreover, this effect is heterogeneous across income groups. Poorer families have a higher tendency of reducing and/or delaying prenatal care. The net effects are almost doubled compared to the overall estimates (Table 13: columns 3 and 4). This might also explain the higher reduction in HAZ for children from lower SES families. Combining this result with Table 4, one may assume that the effects of deficiency in prenatal care in the second trimester may transmit to the third trimester thereby making the exposure in third trimester harmful for the fetus. If the visits were not reduced or delayed in the second trimester and consequently proper information about diet and other precautionary measures was taken, the fetus might have been protected from negative effects. Hence, the increase in homicide rates not only directly affects the mother and the fetus (through maternal stress) but also indirectly by hindering her from taking proper prenatal care to be able to offset these negative effects of exposure.

Nonetheless, it is not obvious from Table 13 that this adverse effect on prenatal health care is due to reduction in supply of or demand for health resources. While it is not possible to

[33] The per capita food expenditure is constructed from information on different food items provided by the household. Since it was based on recall, the possibility of measurement error cannot be ignored.

[34] Brown (2015), however, did not observe an effect on the number of visits.

estimate the effect on demand for health resources using this data, the impact on supply can be investigated. Table 14 displays the effect of homicide rate on provision of health services in a community. Using community fixed effect models, the results show that the homicide rate one year before the round of survey has no effect on the existence of a hospital/clinic (column 1), number of health clinics in the community (column 2), and the number of days these clinics provide services per week (column 3). Subsequently, supply of health services, at least the quantity, does not prevent the prenatal care use and so the reduction could be from demand side. This result also serves an additional purpose: rise in drug violence has not affected health infrastructure. This indicates a specific nature of drug violence where other infrastructures such as health facilities are not the intended targets.

6. CONCLUDING REMARKS

Adult life outcomes rely on conditions faced in early life; as early as in utero. Exposure to adverse shocks in early life can have noteworthy effects on a child's physical health and cognitive development influencing various long-run outcomes such as education, health, marital status, and labor market participation. Violence is one of the shocks that potentially produce these effects. However, the literature on violence and child health has mainly focused on large-scale violence such as wars, and on physical health such as weight at birth and stunting. The effect of criminal violence on various developmental outcomes is understudied.

The current study fills this gap by inspecting the impact of spatial-temporal variations in the intensity of homicide rates on Mexican children's physical health, cognitive development, and socio-emotional behavior. Mexico experienced a sudden escalation in violence after 2007 when President Felipe launched a military crackdown on drug trafficking organizations. Using sibling fixed effects strategy, I find that exposure to violence negatively impacts physical health and cognitive abilities and that this impact solely carries from prenatal exposure. Exploring the channels for these effects, there is suggestive evidence regarding maternal stress and prenatal health care during pregnancy. Depending on the outcome, the impact of violence exposure varies across trimesters. For example, cognitive development is negatively affected from violence exposure in the first and second trimesters whereas the effect turns positive in the third trimester. This study provides the first empirical evidence of this latter relationship in the Economics literature.

Childhood exposure to crimes does not have detrimental effects on any of the outcomes. This might be explained from the results that exposure to violence does not reduce time spent by mothers in taking care of their children; instead it has a positive impact on parental quality. This is also supported by the Psychology literature suggesting that attachment between the mother and

infant can even offset the negative effects resulted from the in-utero exposure to shocks. This may also point to the success of the social assistance program *Oportunidades* which is a conditional cash transfer program that provides monetary assistance to families with lower socio-economic status to invest in human capital of their children. This finding that childhood exposure to violence does not constraint development may highlight the fact that mothers enrolled in *Oportunidades* are receiving the benefits in the form of safeguarding their children post birth against adverse conditions.

The ultimate purpose of the studies regarding adverse early life condition and children health is to contribute to the literature that links early health with later life outcomes. From a pure economic point of view, one must be interested in the impact on labor market outcomes such as wages. Relying on Vogl (2012) and Alderman et al. (1996) results for Mexico and Pakistan respectively, the back of envelope calculations estimate that Mexican children are likely to face a reduction of 2.2% and 1.6% in wages due the detrimental effects of violence on HAZ and cognitive development, correspondingly. Although, the effects of organized crimes on HAZ and cognition are relatively smaller in magnitudes, they put a much wider population at risk compared to wars due to extensive prevalence of criminal violence across the world.

Future studies may help extend this work further. For example, the data on families enrolled in the social assistance programs can be incorporated in the analysis to better understand their mitigation effects on negative shocks. Moreover, I was only able to find suggestive evidence for maternal stress as potential channel due to lack of data on mental health during gestation period. This aspect requires more attention and an in-depth analysis by collecting data on psychological state of mothers during pregnancy especially in the aftermath of a shock. Likewise, the impact of prenatal shocks on chronic illnesses can also be extended to other violence settings.

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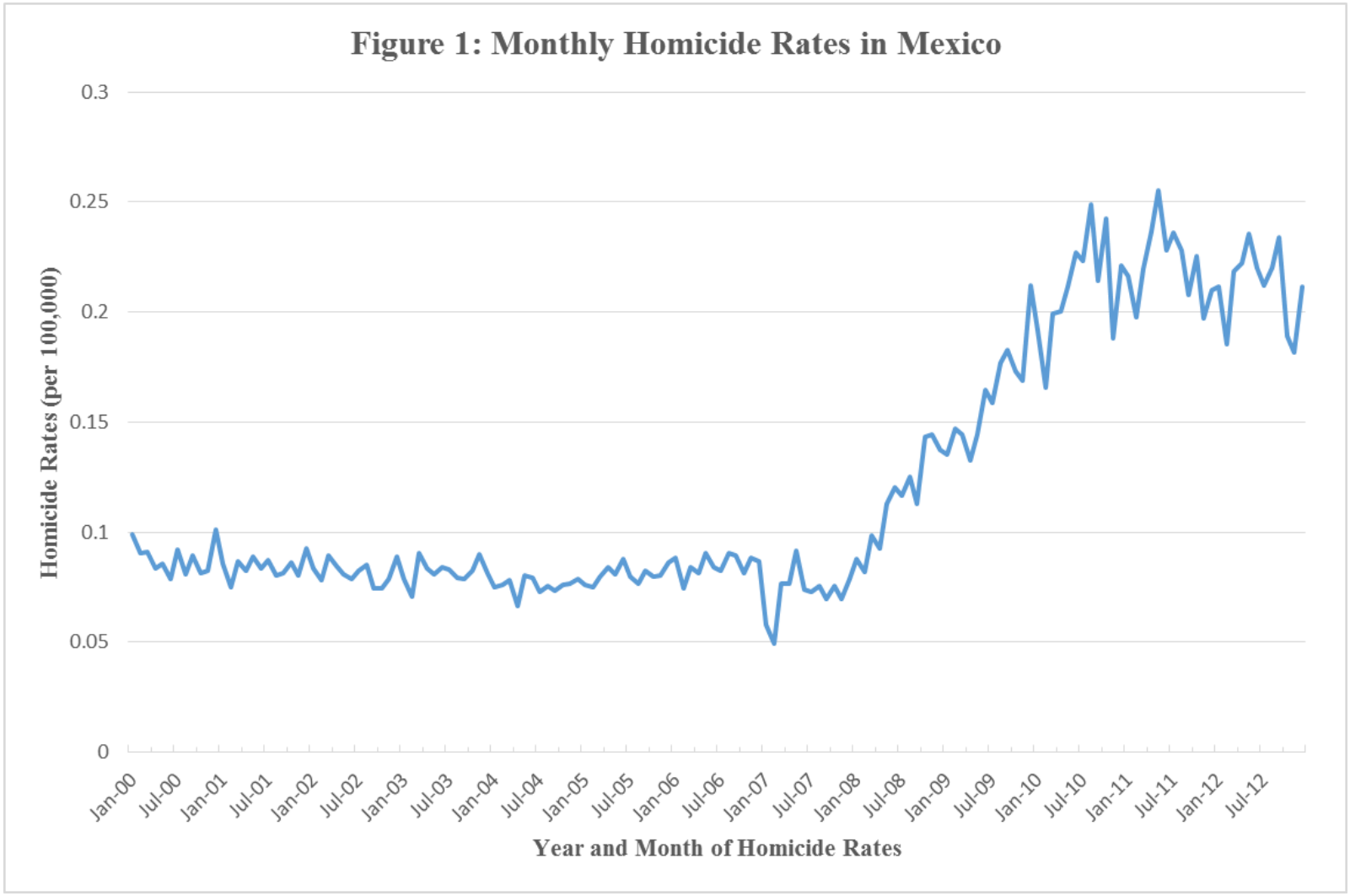
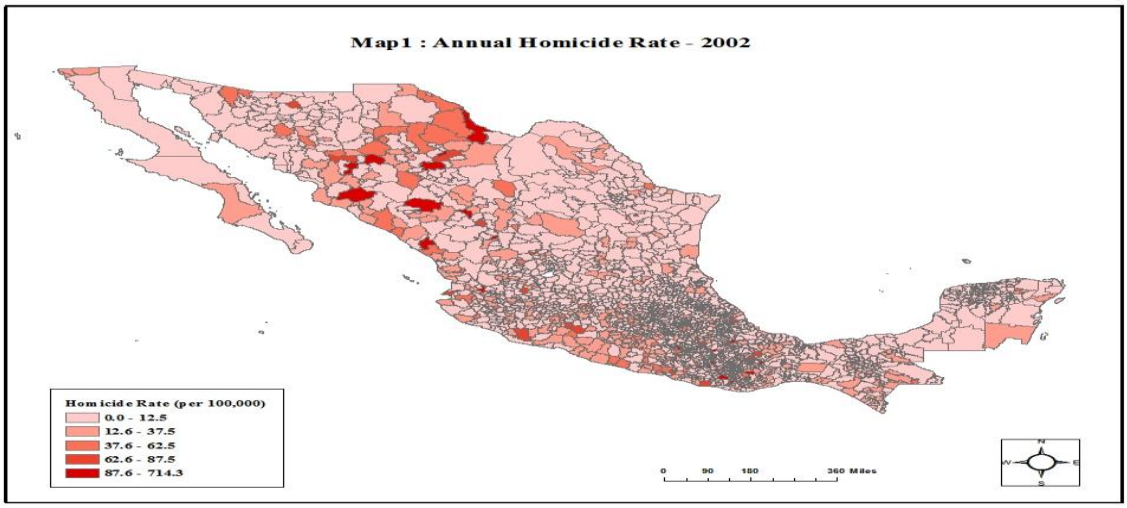
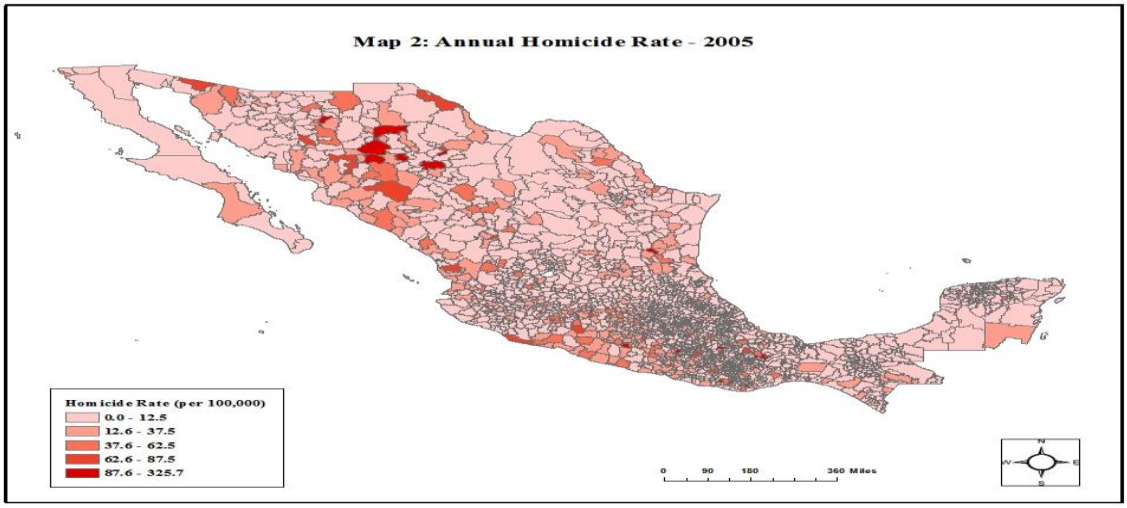


Figure 1: Monthly Homicide Rates in Mexico
Homicide Rates (per 100,000)
0.3
0.25
0.2
0.15
0.1
0.05
0
Jan-00
Jul-00
Jan-01
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Jan-05
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
Jan-08
Jul-08
Jan-09
Jul-09
Jan-10
Jul-10
Jan-11
Jul-11
Jan-12
Jul-12
Year and Month of Homicide Rates


Map1 : Annual Homicide Rate - 2002
Homicide Rate (per 100,000)
0.0 - 12.5
12.6 - 37.5
37.6 - 62.5
62.6 - 87.5
87.6 - 714.3
0 90 180 360 Miles
N
W
E
S


Map 2: Annual Homicide Rate - 2005
Homicide Rate (per 100,000)
0.0 - 12.5
12.6 - 37.5
37.6 - 62.5
62.6 - 87.5
87.6 - 325.7
0 90 180 360 Miles
N
W
E
S

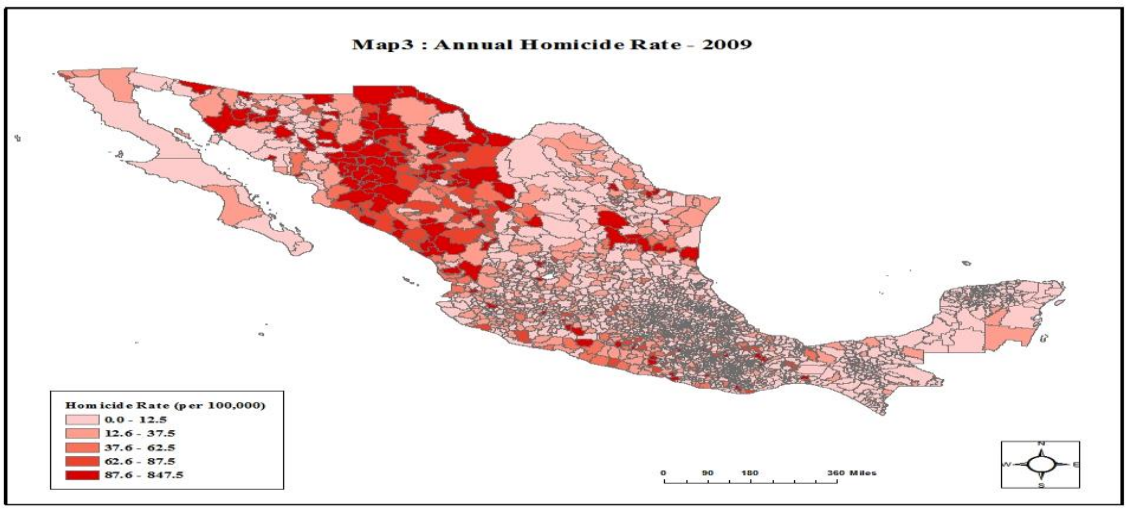

Map3 : Annual Homicide Rate - 2009
Homicide Rate (per 100,000)
0.0 - 12.5
12.6 - 37.5
37.6 - 62.5
62.6 - 87.5
87.6 - 847.5
0 90 180 360 Miles
N
W
E
S

Table 1: Descriptive Statistics

	Full Sample	Sibling Sample
Child Health Outcomes		
height-for-age Z-score (HAZ)	-0.45	-0.61
	(1.24)	(1.26)
Cognitive Development	0.00	0.00
Interaction Behavior	0.00	0.01
Sleeping Behavior	0.00	0.03
Hearing Problem	0.004	0.004
Asthma	0.03	0.03
Obesity	0.01	0.01
Children Characteristics		
Male	0.52	0.52
	(0.49)	(0.49)
Age in Months	66.30	65.21
	(24.33)	(24.69)
Birth Order	2.53	2.72
	(1.51)	(1.65)
Mothers' Characteristics		
Age in Years	32.80	31.76
	(6.59)	(5.90)
Married	0.60	0.61
	(0.48)	(0.48)
Years of Education	7.73	7.32
	(3.63)	(3.57)
Employed	0.26	0.23
	(0.44)	(0.42)
Earnings per Month	498.49	437.30
	(1600.17)	(1824.17)
Living in Rural Areas	0.48	0.48
	(0.49)	(0.48)
Household Characteristics		
Per Capita Household	15806	14806.54
Expenditure	(51899.93)	(55968.38)
Household Size	5.32	5.48
	(2.36)	(2.55)
Household Wealth	0.70	0.67
	(0.45)	(0.46)
Observations	2148	893
Mothers		416

Note: standard deviations are given in parenthesis.

Table 2: Migration between MxFLS2 and MxFLS3 and Potential Future Violence

	Change in Municipalities		Migration for at least 1 Year	
	(1)	(2)	(3)	(4)
Δ Homicide Rate (2009-05)	0.001	-0.005	0.084***	0.086***
	(0.018)	(0.021)	(0.018)	(0.019)
Δ Homicide Rate (2009-05) interacted with MxFLS 2:				
Age		-0.00003		-0.00006
		(0.00004)		(0.00004)
Education		-0.00001		-0.0001
		(0.0001)		(0.0001)
Marriage		0.0002		0.0008
		(0.0004)		(0.0007)
Employment		-0.0007		0.0015
		(0.0010)		(0.0018)
Rural		0.0061		0.0037
		(0.0060)		(0.0042)
Monthly Income		0.0001		0.00004
		(0.0001)		(0.0003)
Household Size		0.0002		-0.0002
		(0.0001)		(0.0002)
Household Wealth		-0.0002		-0.0009
		(0.0012)		(0.0015)
Observations	1835	1835	1835	1835
Mean of Dependent Variable	5.1%	5.1%	9.8%	9.8%

Note: Standard errors are clustered at municipality level. *** shows significance at 1 percent level.

Table 3: Impact of Violence on Monthly Birth Rates

	All		Lower SES Families	
Homicide Rate	(1)	(2)	(3)	(4)
In-utero	0.007	0.007	-0.001	-0.002
	(0.008)	(0.008)	(0.007)	(0.007)
01-06 Months Before Conception	-0.002		-0.003	
	(0.011)		(0.010)	
01-12 Months Before Conception		-0.001		0.010
		(0.008)		(0.007)
Mean Monthly Birth Rate (1000)	3.43	3.43	1.87	1.87
Observations (Month × Municipality)	11424	11424	11340	11340

Note: The homicide rates are per 100,000. Standard errors are clustered at municipality level. The birth rate is per 1000 women. The regressions control for municipality, month of birth, year of birth and the interactions of state of birth with the year of birth fixed effects.

Table 4: Impact of Violence on Children's HAZ

Homicide Rate	(1)	(2)	(3)	(4)	(5)	(6)
2 years before					0.002	-0.001
conception					(0.003)	(0.003)
1 year before					-0.0002	0.004
conception					(0.004)	(0.005)
In-utero	-0.002		-0.011*			-0.013**
	(0.003)		(0.006)			(0.006)
Trimester 1		-0.011*		-0.015*		
		(0.006)		(0.009)		
Trimester 2		-0.002		-0.002		
		(0.004)		(0.006)		
Trimester 3		0.002		-0.016**		
		(0.004)		(0.007)		
Childhood	0.0003	0.0003	-0.003	-0.003	-0.002	-0.003
	(0.0015)	(0.0015)	(0.002)	(0.002)	(0.002)	(0.002)
Sibling sample	No	No	Yes	Yes	Yes	Yes
Sibling FE	No	No	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
MOB and YOB FE	Yes	Yes	Yes	Yes	Yes	Yes
State*YOB FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2147	2147	893	893	893	893
Effect (SD)		-0.03	-0.08	-0.08		-0.03

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rates are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control for child gender, age, and birth order, mother's age, education, marital status, employment, income per month, household size, household wealth, rural status, and year and month of interview fixed effects. MOB and YOB FE represent the month of birth and year of birth fixed effects respectively. State*YOB FE shows the fixed effects for the interactions of state of birth with the year of birth. Columns 5 and 6 show the results for falsification tests.

Table 5: Impact of Violence on Children's HAZ: Early Years of Childhood

Homicide Rate	(1)	(2)	(3)	(4)
Trimester 1	-0.010	-0.009	-0.015*	-0.013
	(0.006)	(0.006)	(0.009)	(0.008)
Trimester 2	-0.001	-0.001	-0.002	0.0009
	(0.004)	(0.004)	(0.006)	(0.006)
Trimester 3	0.002	0.0008	-0.017**	-0.017**
	(0.004)	(0.004)	(0.007)	(0.007)
First Year of	-0.001	-0.0003	-0.006	-0.007
Childhood	(0.003)	(0.003)	(0.004)	(0.004)
Second Year of		-0.001		0.0003
Childhood		(0.003)		(0.003)
Rest of the	0.0004	-0.0005	-0.003	-0.004
Childhood	(0.002)	(0.001)	(0.003)	(0.003)
Sibling sample	No	No	Yes	Yes
Sibling FE	No	No	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
MOB and YOB FE	Yes	Yes	Yes	Yes
State*YOB FE	Yes	Yes	Yes	Yes
Observations	2145	2104	892	866
Effect (SD)			-0.08	-0.04

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rates are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control for child gender, age, and birth order, mother's age, education, marital status, employment, income per month, household size, household wealth, rural status, year of interview and month of interview fixed effects. MOB and YOB FE represent the month of birth and year of birth fixed effects respectively. State*YOB FE shows the fixed effects for the interactions of state of birth with the year of birth. The tests for the sum of coefficients for first year, second year, rest of the childhood are also insignificant for specifications in columns 2 and 4.

Table 6: Impact of Violence on Children's HAZ: Heterogeneous Effects

Homicide Rate	Total	Lower SES Families	<12 Years of Educ. in MxFLS1	Rural Status in MxFLS1
	(1)	(2)	(3)	(4)
Trimester 1	-0.015*	-0.031***	-0.013*	-0.022**
	(0.009)	(0.009)	(0.007)	(0.009)
Trimester 2	-0.002	-0.004	0.003	-0.002
	(0.006)	(0.006)	(0.006)	(0.008)
Trimester 3	-0.016**	-0.019***	-0.016**	-0.014**
	(0.007)	(0.006)	(0.006)	(0.006)
Childhood	-0.003	-0.004	-0.002	0.002
	(0.002)	(0.003)	(0.002)	(0.003)
Sibling sample	Yes	Yes	Yes	Yes
Sibling FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
MOB and YOB FE	Yes	Yes	Yes	Yes
State*YOB FE	Yes	Yes	Yes	Yes
Observations	893	478	793	450
Effect (SD)	-0.08	-0.13	-0.08	-0.09

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rates are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control for child gender, age, and birth order, mother's age, education, marital status, employment, income per month, household size, household wealth, rural status, year of interview and month of interview fixed effects. MOB and YOB FE represent the month of birth and year of birth fixed effects respectively. State*YOB FE shows the fixed effects for the interactions of state of birth with the year of birth.

Table 7: Impact of Violence on Children's Health: Cognitive Ability

Homicide Rate	(1)	(2)	(3)	(4)
Trimester 1	-0.010	-0.010	-0.020**	-0.020**
	(0.007)	(0.007)	(0.010)	(0.010)
Trimester 2	-0.011	-0.011	-0.036***	-0.037**
	(0.007)	(0.007)	(0.010)	(0.015)
Trimester 3	-0.007	-0.009	0.026***	0.027*
	(0.004)	(0.005)	(0.007)	(0.014)
Childhood		0.0005		0.001
		(0.002)		(0.010)
Sibling sample	No	No	Yes	Yes
Sibling FE	No	No	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
MOB and YOB FE	Yes	Yes	Yes	Yes
State*YOB FE	Yes	Yes	Yes	Yes
Observations	1175	1175	270	270
Effect (SD)			-0.08	-0.08

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rates are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control for child gender, age, and birth order, mother's age, education, marital status, employment, income per month, household size, household wealth, rural status, year of interview and month of interview fixed effects. MOB and YOB FE represent the month of birth and year of birth fixed effects respectively. State*YOB FE shows the fixed effects for the interactions of state of birth with the year of birth.

Table 8: Robustness Checks

	Height-for-Age		Cognitive Development		Cognition and HAZ	
Homicide Rate	(1)	(2)	(3)	(4)	(5)	(6)
Trimester 1	-0.011*	-0.006	-0.010	-0.001	-0.020**	-0.020**
	(0.006)	(0.008)	(0.007)	(0.017)	(0.010)	(0.010)
Trimester 2	-0.002	-0.0001	-0.011	-0.008	-0.037**	-0.038**
	(0.004)	(0.004)	(0.007)	(0.012)	(0.015)	(0.015)
Trimester 3	0.002	-0.002	-0.009	0.003	0.027*	0.027*
	(0.004)	(0.005)	(0.005)	(0.011)	(0.007)	(0.007)
Childhood	0.0003	-0.001	0.0005	-0.004	0.001	0.001
	(0.0015)	(0.002)	(0.002)	(0.010)	(0.010)	(0.010)
Height-for-Age						-0.020
						(0.064)
Sibling sample	No	Yes	No	Yes	Yes	Yes
Sibling FE	No	No	No	No	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
MOB and YOB FE	Yes	Yes	Yes	Yes	Yes	Yes
State*YOB FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2147	893	1175	270	270	270
Effect (SD)	-0.03				-0.08	-0.08

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rates are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control for child gender, age, and birth order, mother's age, education, marital status, employment, income per month, household size, household wealth, rural status, year of interview and month of interview fixed effects. MOB and YOB FE represent the month of birth and year of birth fixed effects respectively. State*YOB FE shows the fixed effects for the interactions of state of birth with the year of birth.

Table 9: Impact of Violence on Children's Health: Socio-Emotional Behavior

	Interactive behavior		Sleeping behavior	
Homicide Rate	(1)	(2)	(3)	(4)
Trimester 1	-0.011*	-0.001	-0.011	0.0003
	(0.006)	(0.006)	(0.007)	(0.005)
Trimester 2	-0.007	-0.002	0.005	-0.002
	(0.005)	(0.008)	(0.008)	(0.005)
Trimester 3	-0.001	0.0005	0.002	-0.003
	(0.002)	(0.003)	(0.004)	(0.004)
Childhood	-0.003	0.00004	0.001	0.003
	(0.001)	(0.004)	(0.001)	(0.003)
Sibling sample	No	Yes	No	Yes
Sibling FE	No	Yes	No	Yes
Municipality FE	Yes	Yes	Yes	Yes
MOB and YOB FE	Yes	Yes	Yes	Yes
State*YOB FE	Yes	Yes	Yes	Yes
Observations	1848	663	1840	660
Effect (SD)	-0.03			

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rates are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control for child gender, age, and birth order, mother's age, education, marital status, employment, income per month, household size, household wealth, rural status, year of interview and month of interview fixed effects. MOB and YOB FE represent the month of birth and year of birth fixed effects respectively. State*YOB FE shows the fixed effects for the interactions of state of birth with the year of birth.

Table 10: Impact of Violence on Children's Health: Chronic Illness

	Hearing Problem		Asthma		Obesity	
Homicide Rate	(1)	(2)	(3)	(4)	(5)	(6)
Trimester 1	-0.0001	-0.0004	-0.00004	0.0038	-0.0003	0.0001
	(0.0001)	(0.0003)	(0.0009)	(0.0023)	(0.0003)	(0.0006)
Trimester 2	-0.0000	-0.0004	-0.0005	0.0016	0.0008	0.0006
	(0.0001)	(0.0003)	(0.0006)	(0.0014)	(0.0006)	(0.0006)
Trimester 3	0.0001	-0.0002	0.0007	0.0015*	-0.0001	-0.0004
	(0.0001)	(0.0002)	(0.0010)	(0.0008)	(0.0002)	(0.0004)
Childhood	0.00002	0.00008	-0.00002	0.00002	0.00009	-0.0003*
	(0.00003)	(0.0001)	(0.0001)	(0.0004)	(0.0001)	(0.00016)
Sibling sample	No	Yes	No	Yes	No	Yes
Sibling FE	No	Yes	No	Yes	No	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
MOB and YOB FE	Yes	Yes	Yes	Yes	Yes	Yes
State*YOB FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2121	890	2121	890	2121	890
Effect				0.38%		-0.30%

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rates are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control for child gender, age, and birth order, mother's age, education, marital status, employment, income per month, household size, household wealth, rural status, year of interview and month of interview fixed effects. MOB and YOB FE represent the month of birth and year of birth fixed effects respectively. State*YOB FE shows the fixed effects for the interactions of state of birth with the year of birth. For these estimations, linear probability models are used since fixed effect logit model failed to converge.

Table 11: Impact of Violence on Mothers' Health Behavior and Parental Quality

	Time Spent on Children (hours per week)	Smoking (cigarettes per week)	Exercise Time (minutes per day)
Homicide Rate	(1)	(2)	(3)
01-12 Months Before	0.245*	0.0004	0.053
Interview	(0.134)	(0.001)	(0.174)
Individual FE	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
MOI and YOI FE	Yes	Yes	Yes
Observations	450	798	786
Mean of Dep. Variable	38.7	0.32	6.16
Effect	2.45		

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rate are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control for mother's age, education, marital status, employment, income per month, and household size, household wealth, and rural status. MOI and YOI represent month of interview and year of interview fixed effects.

Table 12: Impact of Violence on Maternal Depression and Household Consumption

	Effect on Mental Stress	Effect on PCFE	Effect on Employment
Homicide Rate	(1)	(2)	(3)
01-12 Months Before	0.0032**	-21.59	-0.001
Interview	(0.0016)	(20.76)	(0.001)
Individual FE	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
MOI and YOI FE	Yes	Yes	Yes
Observations	800	794	794
Mean of Dep. Variable	12.8%	6943.5	26.5%
Effect	3.2%		

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rate are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control mother's age, education, marital status, employment, income per month, and household size, household wealth, and rural status. MOI and YOI represent month of interview and year of interview fixed effects. PCFE represents per capita food expenditure. Although not reported here, the effect of violence on per capita total household expenditure is also found to be negative but insignificant. For the model in column 3, a linear probability model is used since a fixed effect logit model failed to converge.

Table 13: Impact of Violence on Mothers' Prenatal Care Use

	All		Lower SES Families	
Homicide Rate	No. of Visits	Initiation	No. of Visits	Initiation
	(1)	(2)	(3)	(4)
Trimester 1	-0.003	-0.001	-0.058	-0.007
	(0.028)	(0.003)	(0.039)	(0.005)
Trimester 2	-0.052**	-0.008***	-0.135***	-0.015***
	(0.024)	(0.002)	(0.025)	(0.004)
Trimester 3	-0.038	-0.004	-0.019	-0.003
	(0.032)	(0.004)	(0.059)	(0.007)
Sibling sample	Yes	Yes	Yes	Yes
Sibling FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
MOB and YOB FE	Yes	Yes	Yes	Yes
State*YOB FE	Yes	Yes	Yes	Yes
Observations	861	861	466	466
Mean of Dep. Variable	3.65	47.0%	3.62	48.0%
Effect	-0.13	2.0%	-0.34	-3.75%

Note: *, **, *** show significance at 10%, 5%, and 1% levels. The homicide rates are per 100,000. Standard errors are clustered at municipality level. The regressions additionally control for child gender, age, and birth order, mother's age, education, marital status, employment, income per month, and household size, household wealth, rural status, and year of interview and month of interview fixed effects. MOB and YOB FE represent the month of birth and year of birth fixed effects respectively. State*YOB FE shows the fixed effects for the interactions of state of birth with the year of birth.

Table 14: Impact of Violence on Supply of Health Service

	Presence of Health Centers in Community (Yes/No)	Number of Health Centers in Community	Number of Service days (per week)
Homicide Rate	(1)	(2)	(3)
01-12 Months Before	0.0001	-0.025	0.0005
Interview	(0.002)	(0.026)	(0.020)
Community FE	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes
Observations	285	285	285
Mean of Dep Variable	72.6%	2.0	3.90

Note: The homicide rate are per 100,000. Standard errors are clustered at community level. The regressions additionally control for interaction of round of survey with state fixed effects. These results are for unbalanced data. The result for balanced data are qualitatively similar.

Appendix

Table A1: Respondent Attrition and Potential Future Violence

	Attrition (2002-09)	
	(1)	(2)
Δ Homicide Rate (2009-02)	0.00028	0.00081
	(0.00018)	(0.00072)
Δ Homicide Rate (2009-02) interacted with MxFLS 2:		
Age		0.00001
		(0.00005)
Age Squared		0.0000
		(0.0000)
Marriage		-0.00003
		(0.00027)
Employment		-0.00002
		(0.00024)
Education		0.00003
		(0.00004)
Household Expenditure		0.0000
		(0.0000)
Household Size		-0.00011
		(0.00009)
Observations	12317	12317
Mean of Dependent Variable	12.62%	12.62%

Note: Standard errors are clustered at municipality level. Homicide rates are per 100,000. The sample consist of women of aged 7-49 years (current and potential future mothers).