Civil Uprisings and Child Health: Evidence from Egypt

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April 12, 2017

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Submitted to the Department of Economics at Amherst College in partial fulfillment of the requirements for the degree of Bachelor of Arts with honors.

Abstract

This paper uses the 2011 and 2013 Egyptian uprisings following the Arab Spring as a natural experiment to test the Fetal Origins hypothesis. The Arab Spring was an unprecedented event that reverberated across the Middle East and resulted in the ousting of many long-time dictators. According to the Fetal Origins hypothesis, exposure to adverse events in utero results in negative health and socioeconomic outcomes later on in life. Using the spatial and temporal variation in uprisings, I investigate the impact of prenatal and early childhood exposure to civil uprising fatalities on child nutritional status. In addition, I investigate whether households are reinforcing or compensating for shortfalls in health endowment at birth. I obtain child weight-for-age z-scores (WAZ) and household characteristics from the 2008 and 2014 Egyptian Demographic Health Survey. Based on each childs date of birth and governorate of birth information, I combine the DHS data with the Armed Conflict Location and Events Data Project, the most comprehensive collection of political violence data in developing nations, to construct estimates of total prenatal and early childhood exposure to riot fatalities. Using a fixed effects model, I find that prenatal, and not early childhood, exposure to riot fatalities has a significant negative effect on child weight-for-age z-scores, the results are robust to a host of controls, governorate fixed effects, birth year fixed effects, and governorate time trends. Given a prenatal exposure to 100 riot fatalities, WAZ is reduced by 0.044 standard deviations. Moreover, exposure to prenatal fatalities increases the likelihood of a child falling sick, such as with diarrhea or fever, in the two weeks prior to the time they are surveyed. These results are consistent with the Fetal Origins hypothesis. Additionally, I find that riot fatalities exposure in the second trimester has the greatest negative impact on child WAZ. The results for the impact of prenatal fatalities on WAZ are robust to a placebo, migration, and seasonality check.

Key words: Conflict Economics, Child Health, Egypt, Fetal Origins Hypothesis.

Acknowledgments

Thank you Professor Singh, for all your guidance and mentorship over this long process. You were an invaluable teacher and I am deeply grateful for all your help.

Thank you Professor Barbezat for being a mentor and friend throughout my entire time at Amherst. Our conversations together have been among my most formative experiences and I will carry the lessons learned beyond Amherst.

Thank you Juan Montecino for all your STATA and econometrics help.

I thank Andy Anderson for his amazing and patient work in helping me create the maps I used.

I am forever grateful to my parents and sister. I am here because of you and this thesis would not have happened without your support.

Thank you to all my friends at Amherst for carrying me throughout this thesis journey! Special shoutout to Ashley and Amita for their efforts in supporting my nocturnal life choices.

Contents

1 Introduction

The Fetal Origins hypothesis claims that negative shocks during prenatal development result in adverse immediate and later life health effects (Barker 1990). It is well documented in economics and epigenetics that negative shocks in utero have persistent consequences on health, cognition, and human capital formation in both the short and long-term (Almond, Edlund, and Palme 2009; Almond 2006; Barreca 2010; Petronis 2010). This highlights the role of parental and human capital investments in children to overcome negative shocks and subsequent negative endowments in child human capital caused by adverse event exposure in utero or early childhood (Chetty et al. 2011; Currie and Hyson 1999; Cunha and Heckman 2007).

In this paper I use the Egyptian uprisings, following the 2011 Arab Spring, as a natural experiment to investigate the impact of prenatal violence exposure on child malnutrition. The Fetal Origins hypothesis implies a strict window of exposure through which negative shocks impact human capital. Studies examining the impact of prenatal adverse event exposure on later life outcomes typically exploit the quasi-random variation offered by a combination of spatial and temporal variation in exposure to shocks. Usually, researchers identify a negative shock in history, such as a natural disaster, famine or civil war and compare outcomes across cohorts who were likely exposed or unexposed to the event to investigate the causal impact of the shock (Duque 2017; Meng and Qian 2009; King et al. 2012; Akresh et al. 2012). Almond and Currie (2011) provide a seminal review detailing the current state of research into the Fetal Origins hypothesis.

Though conflict economics has a rich literature documenting the link between large-scale armed conflict exposure and child malnutrition, there are no studies examining the nutritional legacy of political revolution and civil uprisings (Minoiu and Shemyakina 2014; Len 2012; Akresh, Lucchetti, and Thirumurthy 2012). With protests, unlike armed conflict, there are no clear battles between well-defined rebel groups and the government. Additionally, the scale of violence is less as compared to that of a civil war, which is often defined with a threshold of more than 1000 battle deaths per year (Small and Singer 1982). Finally, civil unrests constitute a vast proportion of population directly engaging in dissenting protests that create inefficiencies in the social and economic environment of a country. The Arab Spring of 2011 has profound implications for the Middle East's economic and political future. Both the 2011 (January 25) and the 2013 (June 30) uprisings brought paralyzing upheaval which resulted in the disruption of employment, schools, and businesses in the Arab world's most populous nation.

In this paper, I investigate the impact of riot exposure on child malnutrition on different early life periods, by combining riot fatality data from the Armed Conflict Location and Event Data Project (ACLED) on Egypt with child anthropometric data from two cross sections of the Egyptian Demographic and Health Survey taken in 2008 and 2014. Child anthropometric measurements are based on a child's height, age and weight and serve as important indicators for malnutrition and powerful predictors for a child's mortality (Chen, Chowdhury, and Huffman 1980; Pelletier, Frongillo, and Habicht 1993). Anthropometric measurements are useful estimates for a child's nutritional status because they are easy to take, universal, and a non-invasive method of assessing a child's nutritional status (WHO 2017). Moreover, a child's growth reflects their overall health (Waterlow et al. 1977). The effects of nutritional deprivation in early life have permanent negative effects on a child's future emotional, physical, and cognitive development. For example, Victora et al. (2008) finds that malnourished children attain less schooling and have lower economic productivity. The DHS reports anthropometric measurements in z-scores which allows direct comparisons for children by sex across different ages (WHO 2017). Anthropometric z-score standards are based on an international reference population chosen by the WHO to reflect the measurements of well-nourished children across the world by sex and age in months (WHO 2017). I focus my analysis primarily on weight-for-age z-scores (WAZ), as it is a more comprehensive indicator of short and long-term nutritional status and captures both wasting and stunting (Deaton and Dréze 2009) and is also less subject to measurement error as described later. Up to 80% of a person's height is determined by their genetics; moreover, height does not reflect current nutritional status and it is relatively independent of short term circumstances (Silventoinen et al. 2003; Pilia et al. 2006). Therefore, height-for-age z-scores (HAZ) may not be as sensitive an indicator to current nutritional conditions.

Prenatal civil uprisings exposure could impact child WAZ by having a direct biological effect on the mother in utero through an increase in stress, by changing health input behavior during pregnancy, or altering parental investments after birth. Violence exposure has been shown to decrease birth weight, increase fetal mortality, and increase the likelihood of pre-term births (Camacho 2008; Currie 2013; Quintana-Domeque 2017). However, it is unknown how parents respond to the shortfall in birth endowment. For example, if a mother has a child who was not prenatally exposed to an adverse event and a child who was exposed to an adverse prenatal event, she may change her investments based on their relative health. If parents value equity in their children they will divert household resources towards the child with the lower health endowment in order to compensate for negative shocks sustained (Datar, Kilburn, and Loughran 2010; Griliches 1979; Pitt, Rosenzweig, and Hassan 1990; Yi et al. 2015). Alternatively, parents could reinforce negative prenatal shocks by either not increasing parental investment for the child with lower health endowment or diverting resources to the healthier child (Becker and Tomes 1976; Rosenzweig and Zhang

2009). Moreover, the health impacts of adverse exposure can vary based on the intensity of the shock, whether the period of exposure was during pregnancy (and in which trimester), or whether the shock was in early childhood (Akresh, Lucchetti, and Thirumurthy 2012; Kramer 1987; Lumey et al. 2009; Stein, Ravelli, and Lumey 1995).

I use a fixed effects model to examine the impact of riot fatalities exposure during pregnancy and early childhood on child WAZ and HAZ. I identify exposure to riot fatalities based on the child's date of birth and governorate of birth. I find that prenatal riot fatalities exposure reduces WAZ, whereas riot fatalities exposure after birth does not. Given one standard deviation in prenatal riot fatalities exposure, WAZ is reduced by 2.9%. Moreover, I find that second trimester exposure to riot fatalities reduces WAZ which suggests that the deficit in WAZ comes from exposure in the second trimester. This timing of exposure does not correspond to the most critical periods of fetal development but is consistent with the fetal programming found in epigenetics (Harding and Bocking 2001; Petronis 2010). There are no significant effects of in-utero exposure to riot fatalities on average HAZ.

These results are robust to a variety of specifications, governorate-time trends, and falsification tests. This indicates that the effects of prenatal riot fatalities on child malnutrition are independent of previous trends or confounding factors. Moreover, I investigate whether the impacts of riot fatalities exposure on child malnutrition are driven by endogenous migration, fertility, and child mortality and find that they are not.

I also explore potential mechanisms behind the negative effects of prenatal riot exposure on WAZ by examining other indicators of health provided by the DHS. I find that children who are exposed to riot fatalities in utero are more likely to be sick and have illnesses like diarrhea and anemia. Moreover, I find a significant but small negative impact of prenatal riot fatalities on birth weight but even controlling for this decline in birth weight is unable to explain why children as old as 4 or 5 years are underweight in response to the in-utero exposure. Additionally, I find riot fatalities exposure skews the gender ratio towards boys. This is a surprising finding as previous research shows that negative shocks in utero result in a gender ratio distorted towards girls at birth (Catalano and Bruckner 2006; Torche and Kleinhaus 2012; Trivers and Willard 1973). The duration of breastfeeding falls with exposure to prenatal and early childhood riot fatalities exposure; however, the impact of prenatal and early childhood riot fatalities exposure on the dietary intake and diversity provided to children is negligible. It does not seem that vaccine provision is affected by riot fatalities exposure.

This paper builds on and contributes to the Fetal Origins hypothesis and human capital impacts of civil conflict literature. First, I find evidence that political uprising can have a hidden legacy on those who were not yet born. The Arab Spring is a recent political event, and the effects of political violence exposure in utero may have profound effects on health and human capital development for future generations. Second, I explore the impact of prenatal exposure over the whole period of pregnancy, disaggregated into trimesters, and exposure after birth and find evidence for the existence of critical windows of exposure. These findings are consistent with the Fetal Origins hypothesis. Third, my findings stress the importance of health improvement and development of policies for mothers (for instance, to support breastfeeding) in times of violence as a way of mitigating the damage to the health and human capital of future generations.

The remainder of the paper is organized as follows. In the following section I present a conceptual framework to model the impacts of prenatal adverse event exposure on human capital. Section 3 provides the background of the Egyptian

Revolution following the Arab Spring. Section 4 describes the data and summary statistics. Section 5 explains the identification strategy and empirical methodology. Section 6 presents the main results and Section 7 tests their robustness. Section 8 explores the potential channels behind the main results, Section 9 examines parental investment responses, and Section 10 elicits policy implications and conclusions.

2 Conceptual Framework

In this section I discuss a model, developed by Heckman (2007) and Cunha et al. (2010), that describes how human capital formation is dynamic and potentially impacted by early life shocks. The advantage of this model over the traditional static model, is that it captures the notion that there are critical periods during which investments and shocks can alter current and future human capital development. For example, an adults height is determined by the age of 2 while their cognitive development is still plastic to interventions until the end of early childhood (Brmswig et al. 1990; Knudsen et al. 2006). The two mechanisms through which shocks impact capital development are through the self-productivity of capital and changes in investment. In self-productivity, the development and stock of future human capital is determined by past capital; moreover, shocks in previous critical stages can result in decreases in current capital. Under the second mechanism, parents can invest more in their child to compensate for the shock. But, the shock can also endogenously determine parental investment by altering resource availability. For example, the shock may result in a parents income or wage being reduced. Parents may choose to divert resources away from the child in order to maintain current consumption, resulting in the reinforcement of the shock, or reduce consumption and invest more resources in the child. Therefore, parental investment may reinforce negative shocks through a reduction in investment, or if investment is maintained or increased it may not be enough to compensate for the negative shock.

I use a three period model where the function for health θ_t in period t is determined by the function of past health θ_{t-1}, previous shock π_{t-1}, parental investments I_{t-1}, and parental endowment h. In the model, θ_t presents nutritional status at time period t. Parental investments are captured in vector I and represents both material (e.g. books, clothes, shelter) and time (e.g. breastfeeding, caretaking) investments in children. h is parental capabilities and encompasses qualities like educational attainment, genes (for example, whether parents are tall), and income. The three periods are in-utero ($t = -1$), birth ($t = 0$) and childhood ($t = 1$). At birth θ_0, the technology of health production is as follows:

$$\theta_0 = (h, \theta_{-1}, I_{-1}, \pi_{-1}) \tag{1}$$

Where genetic endowment is captured by θ_{-1}, parental investments during pregnancy by I_{-1} , and in utero prenatal shocks by π_{-1}. Moreover, the shock can impact parental investments which are also determined in response to the childs current skill status θ_0 Therefore:

$$I_{-1} = q(\theta_{-1}, \mathrm{h}, \pi_{-1}) \tag{2}$$

Analogously, childhood ($t = 1$) skill production and parental investments are:

$$\theta_1 = (h, \theta_0, I_0, \pi_0) \text{ and } I_0 = q(\theta_0, h, \pi_0) \tag{3}$$

Where I_0 is the investment during infancy, and π_0 denotes the shocks received in infancy. In this paper, exposure to civil uprisings is the shock and is captured by π_{-1} and π_0. Using the framework of equation (2.1) and (2.2), we can observe the effect of prenatal shocks on human capital development at birth and in childhood. Given a prenatal shock, we can observe that its impact on capital development at birth is:

$$\frac{d\theta_0}{d\pi_{-1}} = \frac{\partial\theta_0}{\partial\pi_{-1}} + \frac{\partial\theta_{-1}}{\partial I_{-1}}\frac{\partial I_{-1}}{\partial\pi_{-1}} \tag{4}$$

The first term on the right hand side captures the biological impact of prenatal riot fatalities exposure on capital formation. For example, the fetus or the mother could undergo biochemical changes caused by stress adaptation to the prenatal shock which can result in irreversible damage during birth or later on in life (Barker 1995; deCatanzaro and Macniven 1992; Gluckman, Hanson, and Pinal 2005). Therefore, I expect the first term on the right to be negative. The second term on the right hand side captures the response of parental investments to the shock and could be positive or negative. The direct economic impact of the shocks could have led to increasing commodity prices and decreasing income. Mothers may stay at home due to the loss in work and wages which might have protective effects for the fetus as more time is now spent resting. Alternatively, parents may substitute away from prenatal care or reduce food consumption in response to lower purchasing power which negatively impacts the fetus. Similarly, the supply-side in health care markets may be disrupted leading to parents having to resort to lower quality maternal and neo-natal care. To sum up, the investment response channel captures both parental preferences and general equilibrium effects and therefore its sign is ambiguous. Consequently, the impact of prenatal shock on fetal health is ambiguous.

The latent impacts of prenatal exposure on human capital development in childhood ($t = 1$) is given by:

$$\frac{d\theta_1}{d\pi_{-1}} = \frac{\partial\theta_1}{\partial\theta_0}\frac{\partial\theta_0}{\partial\pi_{-1}} + \frac{\partial\theta_1}{\partial I_0}\frac{\partial I_0}{\partial\theta_0}\frac{\partial\theta_0}{\partial\pi_{-1}} \tag{5}$$

The first term on the right hand captures the self-productivity channel of prenatal exposure on human capital in childhood; the current stock of capital is determined by capital in the previous period which in turn is affected by prenatal shock exposure. Moreover, the effect of the prenatal shock is altered by the prior stock of capital. The second term on the right hand side represents parental investments in response to previous shocks and child human capital stock in the previous period. The sign of the investment term is ambiguous because parents may compensate for or reinforce the negative shock. For example, if a negative prenatal shock reduces birth weight, that could affect the child's health in a later stage through a biological mechanism and through parental investment reactions. Given that both terms have ambiguous signs, the net impact of prenatal riot fatalities exposure on human capital in childhood is ambiguous. Therefore, empirical assessment is needed.

The above framework allows me to posit five possible hypotheses on the impact of prenatal riot fatalities exposure: (i) it improves child WAZ as parents more than compensate for the effect of the negative prenatal shock (mechanism 2 dominates). (ii) it worsens child WAZ if parents do not compensate shortfall for health at birth with increased investment (mechanism 1 dominates). (iii) has no significant impact on WAZ as parents successfully compensate for the negative prenatal shock (both mechanisms cancel each other out). (iv) worsens birth weight, parents reduce their investments, and WAZ is reduced (both mechanisms reinforce each other). (v) has no impact on birth weight or parental investments (both mechanisms are insignificant).

3 The Arab Spring in Egypt

On the 17th of December, 2010, a Tunisian fruit vendor set himself on fire in protest of his mistreatment by police. This event sparked the Arab Spring, a wave of events that led to civil uprisings and toppled regimes across the Middle East from Morocco to the Gulf. The 2011 Egyptian Revolution began on the 25th of January in Tahrir square, 11 days after the ousting of the Tunisian president. The initial protest was organized against police brutality and widespread corruption and coincided with the Egyptian "police day" holiday. Egyptians from all socioeconomic backgrounds engaged in protests, demonstrations, marches, civil disobedience, and strikes (Sharp, 2012). Civil uprising events primarily took place in urban centers and Egypt's major cities. There were numerous violent clashes between the police and protesters with an estimate of at least 846 dead, 6,000 injured and 90 police stations burned during the first month (Hussein 2012; Rashwan 2011). Life during the uprisings was severely disrupted with nationwide shutdowns of the internet, mobile phone network, and banking system (Williams 2011). Multiple lootings across Cairo and clashes with police forces, resulted in the complete withdrawal of police from across Egypt (Washington Post 2011). At the same time, thousands of inmates from across Egypt's main prisons were released (Abouzeid 2011). The army became the sole source of state power and authority (Al Jazeera 2011). The 2011 Egyptian revolution culminated with the resignation of 30-year president Hosni Mubarak, the suspension of the Egyptian constitution, and the dissolution of the parliament. Following Mubarak's resignation, the Egyptian Supreme Council of Armed Forces (SCAF) stepped in to govern Egypt. Meanwhile, civil uprisings continued. In November 2011, a series of protests demanded the resignation and suspension of the cabinet sponsored by SCAF led to three days of violent demonstrations (BBC News 2011; Fahmy 2011; Kirkpatrick 2011). Soon after these protests the Muslim Brotherhood won the presidency and a parliamentary majority.

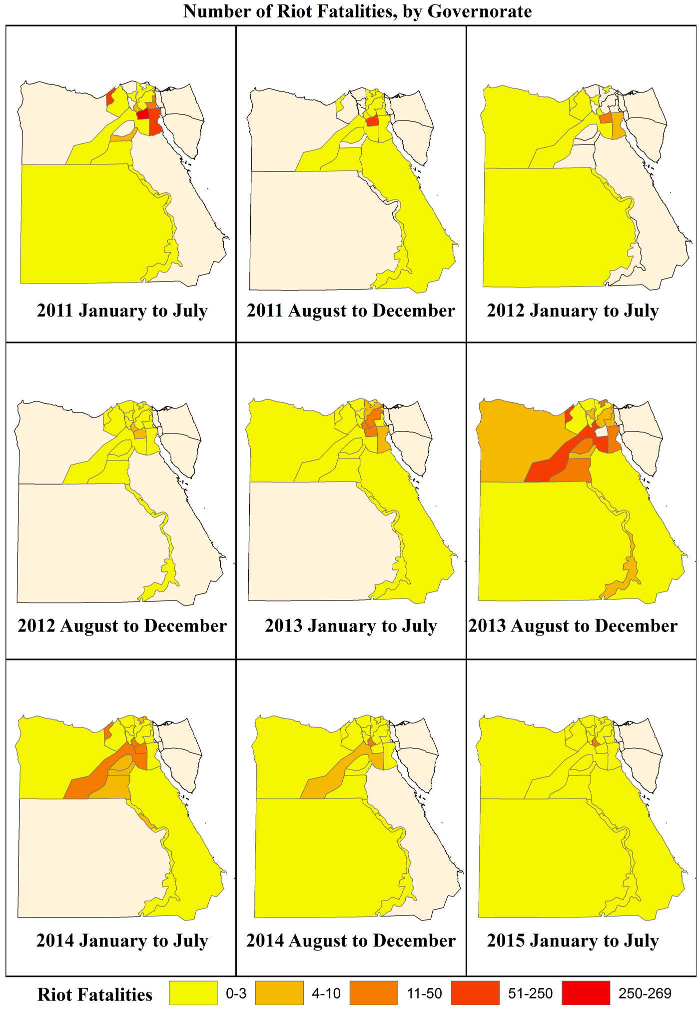
In June 2012, Mohammad Morsi, a leader of the Muslim Brotherhood, began a short-lived and divisive presidency. Angry over the drafting of the new constitution and President Morsi's decrees, protesters rallied multiple times during the course of his presidency. On the 30th of June, after millions of protesters take to the streets, Morsi was deposed via military coup. The army once again resumed control and violently suppressed pro-Muslim Brotherhood protests.

Women played a vital role in both revolutions. There are multiple accounts indicating that women took part equally in almost all tasks related to organizing and participating in protests; women helped hand out food, blankets, staff clinics, lead chants and even camped in Tahrir Square, the center of the Egyptian revolution (Wolf 2011; Hussein 2012; Taher 2012; The National 2017). Estimates report that in the days preceding Mubarak's ousting, women made up 40-50% of all protestors present (The National 2017).

The aftermath of the Arab spring in Egypt can be felt in the changes in economic circumstances. Between the 2011 and 2013 revolutions the healthcare price index increased sharply by 14.8% across Egypt (Bassiouni 2016). Additionally, the Egyptian Food Observatory survey (December 2011- September 2012) indicated that there was a 16% increase in the number of households who did not have sufficient income to meet their daily needs; moreover, after the 2011 uprisings there was an average of 12.83% yearly inflation in food prices (Egyptian Food Observatory 2012).

Figures 1 and 2 show the temporal and spatial change in civil uprising events over time. As shown, riot fatalities peak around the time of the 2011 January uprisings and the 2013 June uprisings. This paper's identification strategy exploits the non-monotonic variation in civil uprising events across time and governorates to identify the causal impact of in utero civil uprising exposure on child malnutrition.

Figure 1: Spatial Expansion of Civil Uprisings - Number of Riot Fatalities, by Governorate

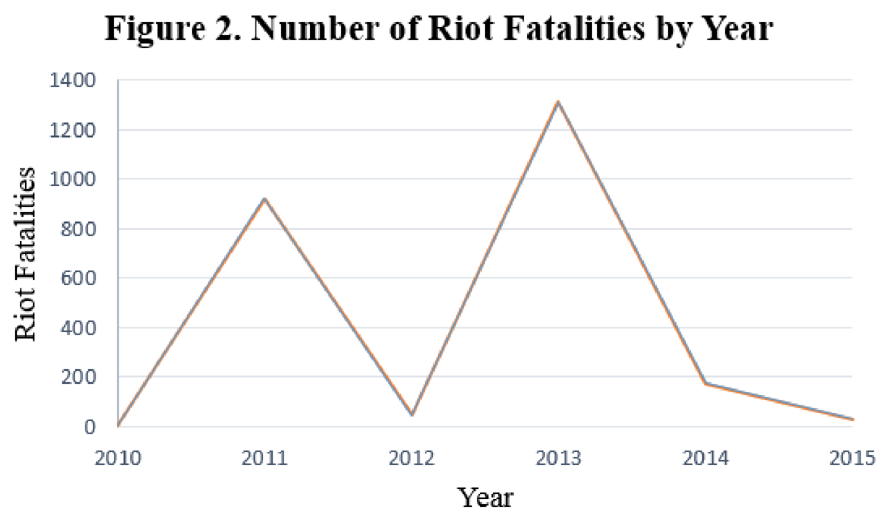


Source: Authors' own calculation from ACLED.

4 Data and Summary Statistics

4.1 ACLED

The Armed Conflict Location and Event Data Project (ACLED) contains the largest and most comprehensive publicly available account of conflict and civil uprising information for over 60 developing countries in Africa and Asia from 1997 till the present. ACLED primarily collects data through daily review of local, regional, national and continental media. Events are coded by date, exact geographic location,



Source: Authors' own calculation from ACLED.

event type, associated fatalities, and involved parties. Using ACLED data, I construct a measure of civil uprising intensity based on the number of fatalities due to riot events. ACLED defines riots as "group, public demonstration[s] against a government institution (Raleigh and Dowd 2015)." ACLED only records fatalities when they are reported by source materials. ACLED cannot independently verify the accuracy of the reported casualties beyond cross checking with multiple sources and reporting the most conservative estimate. I also construct an alternative estimate for civil uprising intensity based on the number of fatalities associated with government violence against unarmed civilians using the ACLED data.

4.2 Egypt Demographic and Health Survey

I merge the ACLED data with the 2008 and 2014 Egyptian Demographic and Health Surveys as they respectively precede and follow the start of the Egyptian revolution. The DHS are nationally representative and standardized surveys that gather data from randomly selected households, identified at the governorate level, from across Egypt's 27 governorates. 24,896 women, aged 14-49, were asked questions on education, demographics, employment, year and month of birth for all their children, health behaviors during and after pregnancy, and detailed questions on child health and nutrition. Additional information includes partner characteristics, number of household members, common household assets, fertility and health behavior. From the DHS, I obtain anthropometric data on 22,254 children under the age of 5. Out of these, 8,924 were surveyed in 2008 and the remaining in 2014. Children are identified at the governorate level. I utilize data on height-for-age z-scores (HAZ) and weight-for-age z-scores (WAZ).

Civil uprisings exposure is determined by the child's date of birth and current governorate residence. My main variable of interest, 'Prenatal Fatalities,' is a sum of the riot fatalities that occurred in a child's governorate of residence 9 months prior to their date of birth. The second variable I construct, 'Post-birth,' is the sum of the riot fatalities a child was exposed to in their governorate of residence between their date of birth and when the DHS was taken.

Table 4.1 presents the summary statistics for household characteristics, child characteristics, and civil uprising exposure. Average WAZ and HAZ are -0.16 and -0.68 respectively and indicate that Egyptian children lag behind the international reference population and are more underweight and stunted on average. The average age of a child is 28 months and 36% of children reside in urban areas.

4.3 Measurement Error

The advantage of using anthropometric z-scores is that their observed SD serves as a useful measure of data quality. According to the World Health Organization guidelines, the distributions of HAZ, WAZ, and WHZ should be relatively constant

Table 4.1: Summary Statistics

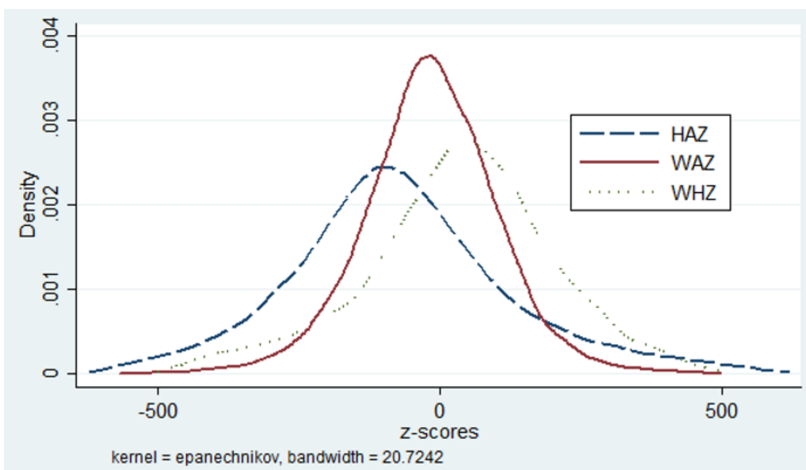
	Sample(n)	Mean	SD	Min	Max
Household Characteristics					
Mother Has Primary Education	24,896	0.8	0.4	0	1
Father Has Primary Education	29,890	0.87	0.34	0	1
Mother Has Secondary Education	24,896	0.71	0.46	0	1
Father Has Secondary Education	29,890	0.72	0.45	0	1
Mother Employed	24,894	0.13	0.33	0	1
Father Employed	24,713	0.99	0.12	0	1
Mother's Age	24,896	28.54	5.7	15	49
Partner's Age	24,896	34.91	7.4	14	95
Mother's Age at 1st Birth	24,896	21.66	3.87	8	45
Number of Household Members	24,896	5.75	2.94	2	31
Number of Children < 5 years	24,896	1.74	0.93	0	9
Maternal BMI	23,994	2.73	0.45	1	3
Urban Household	24,896	0.36	0.48	0	1
Poor Household	24,896	0.38	0.48	0	1
Child Characteristics					
Male Child	24,896	0.52	0.5	0	1
Age in Months	24,896	28.08	17.1	0	59
Birth Order	22,254	2.492	1.55	1	12
Number of Siblings	24,896	0.55	0.62	0	4
Ill	24,892	0.32	0.47	0	1
Diarrhea	24,881	0.12	0.32	0	1
Child Diet					
Duration of Breastfeeding	15,078	12.18	7.9	0	58
Dietary Diversity Index	14,441	3.6	2	0	9
Meat	14,516	0.39	0.49	0	1
Dairy	14,518	0.7	0.46	0	1
Child < 5 Anthropometrics(*100)					
Height-for-age z-score	22,254	-68.35	199.4	-600	600
Weight-for-age z-score	22,254	-15.77	120.05	-568	499
Weight-for-age z-score	22,254	34.54	168.56	-499	498

Notes: Primary and Secondary Education are dummy variables indicating the level of educational attainment. Maternal BMI is the mother's weight divided by the square of height. Urban household is a dummy indicating whether a household is in an urban area. Poor household is a dummy variable based on a wealth index which is created from the ownership of durable goods (car, refrigerator, stove, etc.), home material construction, and access to water and electricity. Duration of breastfeeding is the number of months a child has breastfed. Dietary diversity index is composed of how many different food groups a child has eaten in the past 24 hours at the time of the survey. Meat and dairy are dummy variables indicating whether child has consumed those items in the past 24 hours. Data sources: 2008 and 2014 Egyptian Demographic Health Survey.

with a SD close to 1 with respect to the reference population. In addition, a standard deviation above 1.3 implies that there is a large amount of measurement error and incorrect age reporting resulting in inaccurate data. The WHO reports the expected ranges of the anthropometric indicators to be 1.10 to 1.30 for HAZ, 1.00 to 1.20 for WAZ, and 0.85 to 1.10 for WHZ (WHO 2017). From the summary statistics reported in Table 1, the SD of HAZ, WAZ, and WHZ are 1.99, 1.2, and 1.68 respectively.

For the analysis, I have kept z-score measurements scaled by a 100, as they are recorded in the data. Therefore, regression results should be interpreted after dividing by 100; for example, a coefficient that suggests a 10 unit change in z-score should be interpreted as a 0.1 SD change. As illustrated by Figure 3, the data on HAZ and

Figure 3. Kernel Density Estimate of Anthrompometric Indicators



Source: Authors' own calculation from 2008 and 2014 Egypt DHS.

WHZ are more imprecise with greater measurement error relative to WAZ. Therefore, I expect WAZ to be a more accurate indicator of child nutritional status relative to the other measurements.

5 Identification Strategy and Empirical Methods

I estimate the causal impact of in utero civil uprising exposure on child nutritional status, using the following specification:

$$\begin{aligned} WAZ_{ijt} &= \beta PrenatalRiotFatalities + \theta PostbirthRiotFatalities \\ &\quad + X_{ijt} + \alpha_j + \delta_t + \tau(\alpha_j * t) + \epsilon_{ijt} \end{aligned} \tag{6}$$

Where WAZ_{ijt} is the weight-for-age z-score for a child i residing in governorate j and born at time t; $PrenatalRiotFatalities_{jt}$ is the total number of riot fatalities a child was exposed to in utero based on their date and governorate of birth; $PostbirthRiotFatalities_{jt}$ is the total number of riot fatalities a child was exposed to from their date of birth and when their anthropometric measurements were taken; X_{ijt} is a vector of individual characteristics and includes age of child, number of siblings, birth order and dummies for the childs gender, parental education and employment status, household wealth, and mothers age at birth; α_j is governorate fixed effects; δ_t is birth year fixed effects; τ captures governorate-year trends as the interaction of governorate fixed effects and years; and ϵ_{ijt} is an idiosyncratic error term.

Figure 1 is a map of riot fatalities across Egypt which shows that exposure was not monotonic and varied considerably over time. The fixed effects specification I use mimics a Difference-in-Differences model in which I estimate the impact of prenatal riot exposure on child malnutrition. Including governorate fixed effects provides a control for any persistent differences in outcomes between children due to time invariant governorate characteristics correlated with conflict onset and intensity. For example, certain governorates may historically have a lack of health services that would be negatively correlated with child nutrition and likely positively correlated with civil uprising incidence. Including birth year fixed effects controls for shocks that affect all children in that birth cohort, and $Postbirth_{jt}$ isolates the effect of in utero civil uprising exposure from exposure after birth. Additionally, I control for possible sources of omitted variable bias by including household wealth, parental education and employment, and mothers nutritional status (BMI) that could be correlated with the incidence of civil uprisings and child WAZ. Using a fixed effects model assumes that there are no underlying trends correlated with child health and riots within units smaller than governorates (districts) and years.[1] For the former, suppose that some districts in a governorate were less developed and therefore were also areas that simultaneously were more likely to have civil uprisings and have worse child nutritional outcomes. Therefore, my estimates of civil uprisings on child nutrition would be biased downward. To address that concern I include an imperfect proxy of governorate-birth year time trends to account for governorate specific cohort trends that could be correlated with violence.

6 Results

6.1 Weight-for-age z-score and Prenatal Riot Fatalities

Table 6.1 presents the results from the fixed effects model of equation (1) of the impact of prenatal riot fatalities exposure on child WAZ. The coefficient on prenatal riot fatalities exposure remains negative and statistically significant across the different levels of controls and fixed effects. The results indicate that prenatal exposure to riot fatalities has a negative effect on child WAZ. Moreover, riot fatalities exposure after birth does not appear to have a negative effect on WAZ. This is consistent with

[1]For the latter, I do test for seasonality effects within a year – results are available upon request.

Table 6.1: Prenatal Riot Fatalities Exposure and Weight-for-Age z-score

	(1) waz	(2) waz	(3) waz	(4) waz	(5) waz	(6) waz
Prenatal Fatalities	-0.0385*	-0.0614***	-0.0635***	-0.0516**	-0.0550***	-0.0439***
	(0.0162)	(0.0139)	(0.00814)	(0.0158)	(0.0101)	(0.0116)
Post-birth	0.0694	0.0563	0.0529	0.0208	0.0167	0.0608
	(0.0591)	(0.0739)	(0.0473)	(0.0940)	(0.0734)	(0.0618)
Girl		15.02***	15.14***	15.13***	15.26***	15.52***
		(1.932)	(1.945)	(1.936)	(1.944)	(1.925)
Birth Order		-2.331*	-1.317	-2.175*	-1.187	-1.344
		(1.026)	(0.777)	(0.986)	(0.706)	(0.730)
Poor Household		-5.540	-3.658	-5.367	-3.749	-2.692
		(5.319)	(2.413)	(5.227)	(2.373)	(2.276)
Maternal BMI		15.32***	15.64***	14.74***	14.94***	16.03***
		(3.212)	(2.951)	(3.371)	(3.222)	(2.996)
Controls		X	X	X	X	X
Governorate FE			X		X	X
Birth Year FE				X	X	X
Governorate Time Trends						X
N	22252	21347	21347	21347	21347	21347
R squared	0.000411	0.0190	0.0621	0.0225	0.0649	0.0876

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is child's weight-for-age z-score (WAZ) which ranges from -600 to 600; Prenatal fatalities exposure is the number of riot fatalities a child was exposed to prenatally. Postbirth fatalities is the number of riot fatalities a child is exposed to after birth. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends refers to governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

other studies that document significant negative effects of conflict exposure in early childhood on child malnutrition that do not include prenatal exposure (Bundervoet and Verwimp 2005; Akresh, Verwimp, and Bundervoet 2011; Bundervoet, Verwimp, and Akresh 2009; Akresh, Lucchetti, and Thirumurthy 2012). The results suggest that exposure to violence in the prenatal period has more critical effects on health than exposure after birth. The coefficient on prenatal riot fatalities exposure increases in significance and magnitude upon including demographic controls and governorate fixed effects as seen in column (2). With the additional inclusion of birth year fixed effects in column (4), the coefficient remains significant at the 1% level. Upon the inclusion of both fixed effects in column (5) the coefficient remains statistically significant at the 1% level. In column (6), with the inclusion of governorate year trends, I find that the coefficient on prenatal riot fatalities exposure remains significant at the 1% level though its magnitude decreases slightly from column (5) to column (6). The coefficient in column (6) estimates that prenatal exposure to a fatality reduces WAZ by an additional 0.000439 standard deviation (SD). Given 1 SD in prenatal riot fatalities exposure of 65.3, WAZ is reduced by approximately 2.8%.

After controlling for a host of characteristics, being part of a poor household is not significantly correlated with WAZ. In the other controls included in the regression, but not shown, neither parental education or employment are significantly correlated with WAZ. But, maternal BMI, a measure of the mothers short term nutritional status, is positively correlated with the childs WAZ. This indicates that WAZ is intergenerational. Consequently, this supports the argument that WAZ is a comprehensive indicator of long-term and short-term nutritional status that is sensitive to current nutritional circumstances (Deaton and Dréze 2009).[2]

[2] Additional results on the impact of prenatal riot fatalities exposure on height-for-age z-scores are available upon request.

6.2 Weight-for-age z-score and Prenatal Riot Fatalities Exposure by Trimester

Table 6.2 investigates whether there are critical periods during the mother's pregnancy where riot fatalities exposure has more of a negative impact on later child health. In this specification, prenatal riot fatalities exposure is disaggregated into pregnancy trimesters. Based on previous research in fetal sensitivity to shocks in different trimesters, I had predicted that the effects of violence exposure would vary across trimester (Almond and Mazumder 2011; Almond, Mazumder, and van Ewijk 2015). The coefficients on the effects of different trimester exposure on WAZ are negative and are therefore consistent with my previous results in Table 2. I find that prenatal riot fatalities exposure in the second trimester has the largest impact on reducing WAZ and is consistently significant at the 1% level across the different controls of the specification. Additionally, the impact of exposure in the second trimester is greater than in the other two trimesters. Exposure in the third trimester is also significant at the 10% level in column (6), the most conservative estimation. According to the medical literature, the first and third trimester are the most critical for development and growth respectively (Harding and Bocking 2001). My findings that second trimester riot fatalities exposure reduces WAZ indicates that the second trimester is also a critical period. Moreover, these findings are consistent with the medical literature. Maternal stress has been shown to have negative impacts on birth weight and later life outcomes (Beydoun and Saftlas 2008).

Consider the possibility that the most vulnerable children die upon being exposed to high levels of violence exposure in either the first or third trimester. Prenatal violence exposure could therefore select for healthier children. If that was the case, then I would expect there to be a positive correlation of first and third trimester

Table 6.2: Prenatal Riot Fatalities Exposure by Trimester and Weight-for-Age z-score

	(1)	(2)	(3)	(4)	(5)	(6)
	waz	waz	waz	waz	waz	waz
1st Trim Fatalities	-0.0230	-0.0452	-0.0424**	-0.0240	-0.0235	-0.0144
	(0.0320)	(0.0271)	(0.0140)	(0.0322)	(0.0187)	(0.0212)
2nd Trim Fatalities	-0.0840***	-0.109***	-0.114***	-0.0954***	-0.102***	-0.0908***
	(0.0151)	(0.0166)	(0.0172)	(0.0159)	(0.0175)	(0.0191)
3rd Trim Fatalities	-0.00482	-0.0258	-0.0297***	-0.0320	-0.0355**	-0.0252*
	(0.0158)	(0.0152)	(0.00757)	(0.0178)	(0.0109)	(0.00940)
Post-birth	0.0467	0.0347	0.0275	0.00461	-0.00371	0.0379
	(0.0631)	(0.0783)	(0.0515)	(0.0973)	(0.0764)	(0.0663)
Girl		14.99***	15.11***	15.13***	15.27***	15.49***
		(1.970)	(1.981)	(1.972)	(1.978)	(1.960)
Maternal BMI		15.08***	15.36***	14.57***	14.73***	15.80***
		(3.283)	(2.990)	(3.426)	(3.245)	(3.001)
p value Trim 1 = Trim 2	0.0921	0.0708	0.0048	0.0646	0.0048	0.0069
p value Trim 2 = Trim 3	0.0003	0.0007	0.0007	0.0103	0.0092	0.0102
p value Trim 1 = Trim 3	0.3152	0.1972	0.2262	0.6952	0.4153	0.4693
Controls		X	X	X	X	X
Governorate FE			X		X	X
Birth Year FE				X	X	X
Governorate Time Trends						X
N	21973	21076	21076	21076	21076	21076
R squared	0.000742	0.0184	0.0624	0.0218	0.0650	0.0866

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is child's weight-for-age z-score (WAZ) which ranges from -600 to 600; Prenatal fatalities exposure is the number of riot fatalities a child was exposed to prenatally and is disaggregated into trimester exposure. Postbirth fatalities is the number of riot fatalities a child is exposed to after birth. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends refers to governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

violence exposure with WAZ. Since the coefficients for prenatal riot fatalities exposure are negative with each trimester selection effects do not appear to dominate scarring.

7 Robustness

7.1 Placebo Check

To investigate whether pre-existing violence exposure prior to conception impacts WAZ, I run a falsification test where the results are presented in Table 7.1. The specification is identical to those run in Table 6.2; but, riot fatalities exposure is calculated based on 9 months before conception. Therefore, the coefficients on the different placebo trimester measures in Table 7.1 capture the impact of riot fatalities exposure corresponding to three month intervals in the 9 months preceding conception on WAZ. As the coefficients on prenatal riot fatalities exposure in Table 7.1 are not statistically significant, this indicates that the results in Tables 6.1 and 6.2 are not driven by model misspecifications such as residual health effects that could be correlated with timing of violence exposure. The placebo check also shows no trends in riot fatalities and health that could be leading to spurious correlations.

7.2 Exclusion of Governorates and Birth Year Cohorts

I examine the possibility that children from certain governorates or a specific birth cohort are driving the negative impacts of prenatal riot fatalities on child WAZ. I estimate equation (1), but I exclude governorates which had the highest number of riot fatalities, like Cairo and Alexandria. Additionally, I exclude certain birth years that correspond to the years after 2011 that had the highest escalation of violence, specifically 2013 and 2014. I present the results in Table 7.2 and find that upon

Table 7.1: Placebo Check Prenatal Riot Fatalities Exposure by Trimester and Weight-for-Age z-score

	(1) waz	(2) waz	(3) waz	(4) waz	(5) waz	(6) waz
1st Trim Placebo Fatalities	0.0345 (0.120)	-0.00540 (0.109)	0.0201 (0.0680)	0.0152 (0.119)	0.0367 (0.0725)	0.0560 (0.0537)
2nd Trim Placebo Fatalities	0.0573 (0.0359)	0.0277 (0.0326)	0.0472 (0.0762)	0.0470 (0.0451)	0.0618 (0.0785)	0.0817 (0.0788)
3rd Trim Placebo Fatalities	0.0286 (0.147)	0.0178 (0.146)	0.0409 (0.104)	0.0365 (0.103)	0.0558 (0.150)	0.0737 (0.0915)
Post-birth	-0.0510 (0.0813)	-0.0730 (0.0981)	-0.00621 (0.0440)	-0.0936 (0.104)	-0.0309 (0.0646)	0.0734 (0.0616)
Girl		16.29*** (2.169)	16.45*** (2.186)	16.39*** (2.154)	16.55*** (2.168)	16.93*** (2.155)
Birth Order		-2.324* (1.082)	-1.337 (0.852)	-2.187* (1.041)	-1.232 (0.783)	-1.472 (0.785)
Poor Household		-4.114 (5.393)	-3.452 (2.424)	-3.942 (5.333)	-3.522 (2.386)	-2.863 (2.309)
Maternal BMI		14.62*** (3.286)	15.23*** (3.042)	14.23*** (3.422)	14.75*** (3.281)	15.65*** (3.126)
Controls		X	X	X	X	X
Governorate FE			X		X	X
Birth Year FE				X	X	X
Governorate Time Trends						X
N	20745	19902	19902	19902	19902	19902
R squared	0.0000960	0.0159	0.0611	0.0200	0.0643	0.0849

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is child's weight-for-age z-score (WAZ) which ranges from -600 to 600; Placebo prenatal fatalities exposure is the number of riot fatalities, disaggregated into trimesters, a child's mother was exposed to 9 months before the child was conceived. Postbirth fatalities is the number of riot fatalities a child is exposed to between birth and the time their anthropometric measurements are taken. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends are governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

Table 7.2: Prenatal Riot Fatalities Exposure and WAZ, Excluding Those Born in Certain Governorates and Years

	(1) Exc Cairo waz	(2) Exc Alexandria waz	(3) Exc 2013 waz	(4) Exc 2014 waz
Prenatal Fatalities	-0.00974	-0.0477***	-0.0389*	-0.0337**
	(0.0433)	(0.0104)	(0.0166)	(0.00912)
Post-birth	1.224	0.0619	0.0775	0.0619
	(1.329)	(0.0612)	(0.0693)	(0.0670)
Girl	14.79***	15.54***	12.83***	14.75***
	(1.864)	(1.992)	(1.798)	(1.926)
Mother Completed Primary School	-2.268	-1.772	-1.093	-2.687
	(4.496)	(4.462)	(4.291)	(4.596)
Birth Order	-1.634*	-1.217	-1.387	-1.665*
	(0.714)	(0.739)	(0.814)	(0.711)
Maternal BMI	17.43***	15.69***	17.06***	16.50***
	(2.797)	(3.078)	(3.143)	(3.109)
Poor Household	-2.324	-2.666	-2.598	-3.089
	(2.282)	(2.301)	(2.715)	(2.181)
Controls	X	X	X	X
Governorate FE	X	X	X	X
Birth Year FE	X	X	X	X
Governorate Time Trends	X	X	X	X
N	20358	20679	18524	20410
R squared	0.0910	0.0833	0.0896	0.0979

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is child's weight-for-age z-score (WAZ) which ranges from -600 to 600. Prenatal fatalities exposure is the number of riot fatalities a child was exposed to prenatally. Postbirth fatalities is the number of riot fatalities a child is exposed to after birth. **Column (1)** excludes the governorate of Cairo; **Column (2)** excludes the governorate of Alexandria; **Column (3)** excludes those born in 2013; **Column (4)** excludes those born in 2014; Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends refers to governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

excluding Cairo, the governorate with the highest number of conflict events and fatalities, the impact of prenatal riot fatalities on WAZ is reduced and is no longer significant. This suggests that Cairo is an important region to consider and is driving my results. Cairo was at the center of the Egyptian revolution and most of the riots and fatalities took place in the capital.

7.3 Migration

One potential threat to my identification strategy is that there is a systematic change in behavior in response to violence; such as migration. My estimates on the impact of prenatal riot fatalities exposure on child nutrition would be biased if people choose to leave areas with a high number of riot fatalities. If richer and more educated families choose to leave areas where there is greater uprising violence, then the areas with higher levels of riot fatalities would have a disproportionate number of poorer, less educated families, who may be more likely to have children with low WAZ. Accordingly, I would overestimate the negative impact of prenatal exposure to riot fatalities on health. Ideally, I would be able to restrict my analysis to non-migrants. The 2008 DHS asks respondents how long they have lived in their current place of residence. I classify migrants as those who have lived less than 5 years in their current residence. It is important to note that this measure does not distinguish between those who migrate across or within governorates. Unfortunately, I only have information on migration for respondents from the 2008 DHS. The questions pertaining to migration were dropped from the survey in 2014. Therefore, to account for the probability of migration in the 2014 DHS data, I explore which household characteristics are strongly correlated with the likelihood of migration in the 2008 DHS dataset.[3] I

[3]Upon examining the summary statistics for migrants and non-migrants in 2008, I find that migrants are on average, slightly more likely to have completed secondary education, but on other

estimate the following equation to investigate the association of different household and individual characteristics with migration:

$$\text{Migrated}_{ij} = \beta X_{ij} + \alpha_j + \epsilon_{ijt} \tag{7}$$

Where $Migrated_{ij}$ is a dummy variable indicating whether a child i residing in district j is a migrant; X_{ij} is a vector of individual and household characteristics that include controls for education, employment, and household wealth; α_j is governorate fixed effects. The results are presented in Table 7.3. Of all the controls used, only the childs age and birth order were significantly associated with the likelihood of being part of a migrant household. The results indicate that as a child ages, their families are less likely to migrate. Moreover, birth order is negatively associated with migrating. This indicates that families with younger, higher birth order children are less likely to migrate. As birth order and child age are the most significant correlates of migration, I investigate their interaction with prenatal riot fatalities exposure. The regression equation is as follows:

$$\begin{aligned} WAZ_{ijt} = \; & \beta PrenatalRiotFatalities_{jt} + \theta PostbirthRiotFatalities_{jt} + \\ & \mu Age_i + \rho Birthorder_i + \lambda(PrenatalRiotFatalities_{jt} * Age_i) + \\ & \gamma(PrenatalRiotFatalities_{jt} * Birthorder_i) + \\ & X_{ijt} + \alpha_j + \delta_t + \tau(\alpha_j * t) + \epsilon_{ijt} \end{aligned} \tag{8}$$

Where λ and γ are the interaction terms of interest and indicate the different effects of prenatal riot fatalities exposure on different ages and birth orders respectively. In Table 7.4 find that the interaction term between birth order and prenatal riot

characteristics they appear to be quite similar. Summary table is available upon request.

Table 7.3: Correlates of Migration

	(1) migrated	(2) migrated
Child's Age in Months	-0.00147***	-0.00140***
	(0.000153)	(0.000152)
Birth Order	-0.0328***	-0.0301***
	(0.00442)	(0.00433)
Girl	0.00586	0.00615
	(0.00803)	(0.00836)
Ratio of Girls/Boys	0.0112	0.0110
	(0.00860)	(0.00885)
Father Employed	0.0328	0.0404
	(0.0217)	(0.0237)
Mother Employed	0.00631	0.00855
	(0.0132)	(0.0130)
Mother Completed Primary School	-0.0186	-0.0276
	(0.0166)	(0.0174)
Mother Completed Secondary School	0.00384	0.0187
	(0.0145)	(0.0159)
Partner Completed Primary School	-0.0219	-0.0260
	(0.0138)	(0.0126)
Partner Completed Secondary School	0.0157	0.0152
	(0.0118)	(0.0101)
No. of Siblings	0.00591	0.00947
	(0.00641)	(0.00693)
Poor Household	-0.0380*	-0.0235
	(0.0159)	(0.0125)
Governorate FE		X
N	9514	9514
R squared	0.0477	0.0819

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is a dummy indicating whether a household had migrated and is drawn only from the 2008 DHS; survey respondents who report living in the current place of residence for less than 5 years are classified as migrants. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

fatalities exposure is consistently positive and significant at the 1% level across the varying level of controls. I find that the interaction term between birth order and prenatal riot fatalities exposure is consistently positive and significant at the 1% level across the level of controls. The average child in the sample has a birth order of 2.44 and in the most conservative estimation in column (6), the interaction term of birth order with riot fatalities is 0.019 and the coefficient on prenatal fatalities exposure is -0.0833; therefore, for a child above a birth order of 4.4 the effects of prenatal riot fatalities on WAZ are reduced to zero. As birth order is negatively corrlated with migration and positively correlated with WAZ this implies that migration attenuates the impact of prenatal riot fatalities to zero. I had previously predicted that families with children who would have higher WAZ would be the most likely to migrate. However, the results suggest that families with children who have lower WAZ are the ones most likely to migrate. 88.45% of the children in the sample are of birth order 4 and below and the average birth order is 2.45. Therefore, even within 1 SD of birth order (1.64) the impact of prenatal riot fatalities exposure on WAZ is negative.

7.4 Fertility

Women may change their decisions to have children upon exposure to civil uprisings. For example, women may delay having a baby due to an uncertain future and fear of decline in economic circumstances and (ii) there may be an increase in fetal mortality due to the stress caused by the civil uprisings. If fertility rates are endogenous to civil uprisings that could bias the estimates of the effect of civil uprisings on child malnutrition.

To address the issue of selection due to fertility I examine the impact of prenatal riot fatalities exposure on WAZ for children who were *in utero* at the time of the start

Table 7.4: Interaction of Prenatal Riot Exposure and Migration Predictor Variables

	(1)	(2)	(3)	(4)	(5)	(6)
	waz	waz	waz	waz	waz	waz
Prenatal Fatalities	-0.0385*	-0.117***	-0.117***	-0.0924***	-0.0950***	-0.0833***
	(0.0162)	(0.0155)	(0.00688)	(0.0162)	(0.0116)	(0.0157)
Post-birth	0.0694	0.0363	0.0366	0.0192	0.0132	0.0581
	(0.0591)	(0.0908)	(0.0512)	(0.103)	(0.0703)	(0.0606)
Birth Order		-2.438*	-1.437	-2.284*	-1.294	-1.451
		(1.021)	(0.763)	(0.985)	(0.693)	(0.718)
Prenatal Fatalities × Birth Order		0.0183***	0.0169***	0.0202***	0.0186***	0.0190***
		(0.00336)	(0.00304)	(0.00297)	(0.00270)	(0.00278)
Prenatal Fatalities × Child's Age in Months		0.00171	0.00186*	-0.000184	0.0000794	-0.0000686
		(0.00264)	(0.000899)	(0.00286)	(0.00112)	(0.00104)
Controls		X	X	X	X	X
Governorate FE			X		X	X
Birth Year FE				X	X	X
Governorate Time Trends						X
N	22252	21347	21347	21347	21347	21347
R squared	0.000411	0.0192	0.0624	0.0227	0.0650	0.0878

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is child's weight-for-age z-score (WAZ) which ranges from -600 to 600. Prenatal fatalities exposure is the number of riot fatalities a child was exposed to prenatally. Postbirth fatalities is the number of riot fatalities a child is exposed to after birth. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends refers to governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

Table 7.5: Anticipation and the Impact of Prenatal Riot Fatalities on WAZ

	(1)	(2)	(3)	(4)	(5)	(6)
	waz	waz	waz	waz	waz	waz
Prenatal Fatalities	0.00624	-0.0374	-0.0286	-0.0380	-0.0298	-0.0319
	(0.0919)	(0.0967)	(0.0334)	(0.100)	(0.0359)	(0.0449)
Post-birth	0.121	0.120	0.232***	0.116	0.232***	0.231***
	(0.124)	(0.141)	(0.0567)	(0.142)	(0.0568)	(0.0610)
Girl		-1.780	-0.868	-1.875	-0.954	-1.175
		(3.008)	(2.820)	(2.995)	(2.815)	(2.897)
Birth Order		-8.187**	-5.829*	-7.876**	-5.604*	-5.291*
		(2.607)	(2.414)	(2.565)	(2.376)	(2.294)
Poor Household		-0.403	2.457	-0.0407	2.642	2.505
		(7.030)	(3.659)	(6.999)	(3.659)	(3.675)
Maternal BMI		25.15**	25.58***	24.95**	25.45***	25.40***
		(6.940)	(6.340)	(6.963)	(6.376)	(6.596)
Controls		X	X	X	X	X
Governorate FE			X		X	X
Birth Year FE				X	X	X
Governorate Time Trends						X
N	6288	5989	5989	5989	5989	5989
R squared	0.000135	0.0167	0.120	0.0159	0.119	0.129

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Sample is restricted to those who were already in utero at the start of the January 25 Egyptian revolution of 2011. This table investigates the extent to which people changed their reproductive decisions in response to the start of the uprisings. The dependent variable is child's weight-for-age z-score (WAZ) which ranges from -600 to 600; Prenatal fatalities exposure is the number of riot fatalities a child was exposed to prenatally. Postbirth fatalities is the number of riot fatalities a child is exposed to after birth. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends refers to governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

of the Egyptian revolution. This sample contains families who could not have known about the onset, intensity, or duration of the uprisings and therefore could not have changed their fertility behavior in anticipation. The results are presented in Table 7.5. The estimates on the impact of riot fatalities is negative in the most conservative estimate with similar sized effects yet it is not statistically significant. Due to the imposed restriction, the sample size maybe too small to detect significant effects. I also find that riot fatalities exposure after birth has a positive impact on child WAZ. I find my results are still robust when running additional checks on reported stillbirths and gender ratios.[4]

8 Channels

8.1 Birth weight

In the model of child human capital development I discuss, birth weight serves as an important proxy for health endowment at birth. Previous studies show that negative shocks in the environment during in utero development can lead to worse birth outcomes And lower birthweight children (<2,500 grams) are at much greater risk of dying (Currie and Vogl 2013; Katz et al. 2013). Moreover, Behrman and Rosenzweig (2004) find that an increase in birthweight is correlated with better labor market outcomes and higher height. I investigate the impact of prenatal riot exposure on birthweight. The DHS collects birthweight and size at birth data primarily through mothers self-reporting. I estimate equation (6), with birthweight as the outcome variable.

The results are shown in Table 8.1 , and indicate that prenatal exposure to

[4]Result tables are readily available upon request.

riot fatalities reduces birthweight. The impact is robust across all controls of the fixed effects model. Though this effect is significant, it appears to be economically insignificant. Using the most conservative estimate of the effect given in column (6), 1 SD in prenatal riot fatalities exposure reduces birthweight by 0.3% from the mean birthweight.

I also include birthweight as a control variable in the estimation of the impact of prenatal riot fatalities on WAZ and find there is no change in significance or magnitude of the impact of prenatal riot fatalities exposure on WAZ.[5] This indicates that parents are not reacting to or treating children with lower birthweight differently when exposed to the shock.

8.2 Illness

In utero exposure to violence may have a negative impact on immunity in the short and long term. Previous studies have shown that exposure to adverse events in utero have resulted in an increase in the likelihood of disability, heart disease, and obesity later on in life (Gillman 2005; Almond, Currie, and Herrmann 2012; Almond 2006). I explore the impact of prenatal and post birth riot fatalities exposure on the likelihood of a child falling ill and developing illnesses like diarrhea or anemia. The DHS collects data on illness by asking mothers if their child was sick or displayed illness symptoms in the past two weeks. Table 8.2 presents the results and indicates that prenatal riot fatalities exposure increases the likelihood of falling ill. This is consistent with the main estimates of a decline in WAZ for children but perhaps, worryingly also shows a decline in the immunity levels of children who were exposed to greater riot fatalities in-utero.

[5] Summary of results can be made available upon request.

Table 8.1: Effect of Prenatal Riot Fatalities Exposure on Birthweight

	(1) Birthweight	(2) Birthweight	(3) Birthweight	(4) Birthweight	(5) Birthweight	(6) Birthweight
Prenatal Fatalities	-0.0961***	-0.0916***	-0.122***	-0.0726***	-0.0901***	-0.168***
	(0.0144)	(0.0155)	(0.0171)	(0.0159)	(0.0213)	(0.0222)
Post-birth	0.0859	0.0228	-0.208	0.257	0.121	0.0166
	(0.122)	(0.155)	(0.153)	(0.141)	(0.120)	(0.142)
Girl		-45.57***	-44.50***	-45.53***	-44.34***	-43.33***
		(9.789)	(9.924)	(9.999)	(10.12)	(10.13)
Birth Order		6.249	5.875	5.915	5.575	5.691
		(7.626)	(7.223)	(7.455)	(7.144)	(7.814)
Maternal BMI		-21.29	-14.82	-13.73	-8.691	-6.150
		(12.34)	(13.45)	(12.76)	(14.00)	(15.39)
Controls		X	X	X	X	X
Governorate FE			X		X	X
Birth Year FE				X	X	X
Governorate Time Trends						X
N	13119	12479	12479	12479	12479	11085
R squared	0.000182	0.00779	0.0147	0.0117	0.0182	0.0216

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is child's weight at birth taken from a birth certificate or health card and is measured in grams. Prenatal fatalities exposure is the number of government violence against civilians fatalities a child was exposed to prenatally. Postbirth fatalities is the number of government violence against civilians fatalities a child is exposed to after birth. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends refers to governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

Table 8.2: Impact of Prenatal Riot Fatalities Exposure on Illness

	(1) ill	(2) diarrhea	(3) fever	(4) cough	(5) anemia
Prenatal Fatalities	0.00015***	0.000057*	0.00012***	0.00014***	0.00014**
	(0.00002)	(0.000024)	(0.000022)	(0.000016)	(0.000046)
Post-birth	-0.00121***	-0.00025	-0.00093***	-0.0011***	-0.00089***
	(0.000232)	(0.00021)	(0.00013)	(0.000081)	(0.00022)
Girl	-0.0230***	-0.00692	-0.0123*	-0.0214***	-0.00599
	(0.00539)	(0.00510)	(0.00460)	(0.00570)	(0.0119)
Birth Order	0.0230***	0.0140***	0.0161**	0.0141*	0.0212*
	(0.00546)	(0.00276)	(0.00489)	(0.00520)	(0.00961)
Poor Household	0.0110	0.00758	0.00572	0.00731	0.0827***
	(0.00988)	(0.00491)	(0.00735)	(0.00965)	(0.0218)
Maternal BMI	0.00544	0.000516	0.00349	0.00755	-0.0220
	(0.00917)	(0.00569)	(0.00650)	(0.00886)	(0.0154)
Controls	X	X	X	X	X
Governorate FE	X	X	X	X	X
Birth Year FE	X	X	X	X	X
Governorate Time Trends	X	X	X	X	X
N	21346	21339	21332	21331	3912
R squared	0.114	0.0780	0.0719	0.0815	0.148

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. **Column (1)** dependent variable is a dummy variable indicating if the child is ill with recent diarrhea, recent fever, repiratory illness in the past 2 weeks, or anemia; **Column (2)** dependent variable is a dummy indicating whether child had diarrhea recently; **Column (3)** dependent variable is a dummy indicating whether child had a recent fever; **Column (4)** dummy variable indicating whether child had respiratory illness in the past two weeks; **Column (5)** dummy indicating whether child has anemia (classified by a direct measurement of hemoglobin levels in a subsample of one-third of the 2014 DHS households). Prenatal fatalities exposure is the number of riot fatalities a child was exposed to prenatally. Postbirth fatalities is the number of riot fatalities a child is exposed to after birth. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends refers to governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

9 Investments in Children

This section explores whether mothers are changing their investments in children in response to prenatal riot fatalities exposure in their children. In response to a negative health shock, mothers may change their behavior and either compensate or reinforce the shortfall in health. Therefore, I analyze if there are changes in breastfeeding, vaccination, child diet diversity, and food provision.[6] The Egypt DHS provides detailed information on duration of breastfeeding, vaccination history, and the food a child has recently eaten at the time the survey was taken.

9.1 Breastfeeding

Breastfeeding has been shown to have significant positive impacts on the mother and child; similarly, the absence, or reduction in duration, of breastfeeding has been linked to adverse economics and health outcomes (M. C. Bartick et al. 2013; M. Bartick and Reinhold 2010). For example, a study by Walters et al. in 2016 finds that inadequate breastfeeding leads to over 124,000 deaths, equivalent to a 1% reduction in GDP, for 7 South Asian countries. Moreover, multiple studies point to the significance of breastfeeding as a vital determinant of child health and human capital development (Victora et al. 2015; Kramer et al. 2008; Lucas et al. 1992; Reading 2000).

Prenatal riot fatalities exposure could impact maternal breastfeeding practices in several ways. For one, an increase in maternal stress can directly reduce milk production (Chaudhury, Chaudhury, and Lu 1961; Cross 1955). Or, mothers may choose to increase the duration of breastfeeding to compensate for their childs poor health due to prenatal shocks. Alternatively, exposure to civil uprisings may have a direct negative impact on the mother and reduce the resources she has, such as

[6] Impact of prenatal riot fatality exposure on vaccine usage available upon request

food or time availability, to breastfeed.[7] Since breastfeeding requires a significant time investment from the mother, she may reduce the duration they breastfeed their children in order to work. Alternatively, reduced employment may mean the mother has more time has to care for the child and breastfeeding is relatively cheaper. Moreover, the impacts of exposure to violence may be different based on the households socioeconomic status.[8] I investigate the impact of prenatal riot fatalities exposure on the duration of breastfeeding for the whole sample, and those of high and low socioeconomic status (SES). I estimate the following equation:

$$\begin{aligned} Breastfeed_{ijt} &= \beta PrenatalRiotFatalities + \theta PostbirthRiotFatalities \\ &\quad + X_{ijt} + \alpha_j + \delta_t + \tau_{\alpha_j * t} + \epsilon_{ijt} \end{aligned} \tag{9}$$

Where $Breastfeed_{ijt}$ is the duration of breastfeeding for a child i residing in governorate j and born at time t. The results are presented in Table 9.1, column (1). According to the fixed effects model, both prenatal and after birth exposure to riot fatalities reduces the duration of breastfeeding. This suggests that mothers are substituting away from breastfeeding towards something else and in effect, reinforcing the negative shock. I also compare the impacts of prenatal riot exposure by household socioeconomic status(SES) as proxied by wealth. I find that the negative impacts of prenatal and after birth riot fatalities exposure is greater for households of higher SES. Additionally, I find a positive, though insignificant, coefficient on post-birth riot fatalities for lower SES households. This suggests that mothers in poorer households increase the duration of breastfeeding for their child when they are exposed to greater

[7]The Egyptian revolution was accompanied with rising commodity prices, increased unemployment, and shortages in fuel and electricity (Brookings Institution 2001).

[8]It has been well documented that in developing nations, richer and more educated women are more likely to cease breastfeeding sooner than less educated and poorer women (Bollen, Glanville, and Stecklov 2001).

amounts of riot fatalities.

Table 9.1: Impact of Riot Fatalities Exposure on Duration of Breastfeeding

	(1) Full Sample BreastfeedDuration	(2) High SES BreastfeedDuration	(3) Low SES BreastfeedDuration
Prenatal Fatalities	-0.0042**	-0.0042***	-0.015
	(0.0013)	(0.00076)	(0.0095)
Post-birth	-0.0193***	-0.0169***	0.133
	(0.00302)	(0.00159)	(0.121)
Girl	-0.387**	-0.364	-0.432**
	(0.110)	(0.189)	(0.120)
Birth Order	1.197***	1.550***	1.069***
	(0.0862)	(0.205)	(0.110)
Maternal BMI	-0.290*	-0.437	-0.187
	(0.111)	(0.236)	(0.119)
Controls	X	X	X
Governorate FE	X	X	X
Birth Year FE	X	X	X
Governorate Time Trends	X	X	X
N	12906	4852	8054
R squared	0.503	0.452	0.535

Notes: Robust standard errors in brackets and clustered at the governorate level (n=25). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Dependent variable is duration of breastfeeding in months; **Column (1)** Full Sample; **Column (3)** Sample restricted to those who are of higher SES and are rich; **Column (4)** Sample restricted to those of lower SES and are poor; Prenatal fatalities exposure is the number of riot fatalities a child was exposed to prenatally. Postbirth fatalities is the number of riot fatalities a child is exposed to after birth. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, and whether the mother completed secondary education. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends refers to governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

9.2 Child's Diet

Previous research has found that dietary diversity has a positive impact on child nutrition and can serve as an indicator of dietary quality (Arimond and Ruel 2004). I investigate the impact of prenatal and early childhood riot fatalities exposure on the dietary diversity of a child and the likelihood of consuming different food items. The dietary index is a count of the different food type groups, such as meat or grains, a child has consumed recently at the time the DHS survey was taken. Dietary diversity increases rapidly with age as children are weaned off of breastfeeding. Moreover, at very young ages, less than 12 months, dietary diversity is not a good indicator of child nutrition as breastfeeding is more nutritionally sound for that stage according to the medical literature; indeed, introduction of complementary food to a child less than 6 months in age is detrimental to their health (Wright et al. 2015). Therefore, I restrict my analysis to children 12 months and older, when dietary diversity is a better measure for dietary quality. In Table 9.2 I find that the prenatal riot fatalities exposure has a significant positive impact on increasing dietary diversity.

10 Conclusion and Policy Implications

This paper is the first to assess the effect of the in-utero exposure to Arab Spring on child health. I exploit the temporal and spatial variation in civil uprisings as a natural experiment to test the Fetal Origins hypothesis. I find that prenatal exposure to violent civil uprisings reduces child weight-for-age z-score (WAZ). Additionally, in I find that there is a 1.2% increase in malnutrition for every 100 riot fatalities.[9] The WHO categorizes malnutrition as weight-for-age z-scores below -2 SD and mortality

[9]Result table of the impact of prenatal riot fatality exposure on malnutrition is available upon request.

Table 9.2: Impact of Prenatal Riot Fatalities Exposure on Nutritional Diversity for Children Older Than 12 Months

	(1) dietsum	(2) dairy	(3) meat	(4) legumes	(5) grains	(6) fortifiedcereal
Prenatal Fatalities	0.000952*	0.000105	-0.0000101	0.000190	0.000205**	0.0000197
	(0.000386)	(0.0000964)	(0.0000809)	(0.000145)	(0.0000654)	(0.0000805)
Post-birth	-0.000845	-0.000954***	-0.000707**	0.000244*	-0.000628**	0.000255
	(0.000631)	(0.000213)	(0.000241)	(0.000106)	(0.000204)	(0.000149)
Girl	-0.0492	-0.0115	-0.0116	-0.00642	-0.0168*	-0.000162
	(0.0253)	(0.00839)	(0.00567)	(0.00886)	(0.00631)	(0.00394)
Birth Order	0.841***	0.109***	0.113***	0.100***	0.184***	-0.0129**
	(0.0497)	(0.0104)	(0.00947)	(0.0106)	(0.0104)	(0.00356)
Poor Household	-0.0638	-0.0318**	-0.0468**	0.0175	-0.0181	-0.0139***
	(0.0578)	(0.0105)	(0.0133)	(0.0114)	(0.0110)	(0.00348)
Maternal BMI	-0.0529	0.00357	-0.00122	0.00168	-0.0157	-0.000469
	(0.0474)	(0.00865)	(0.0108)	(0.0110)	(0.0106)	(0.00363)
Controls	X	X	X	X	X	X
Governorate FE	X	X	X	X	X	X
Birth Year FE	X	X	X	X	X	X
Governorate Time Trends	X	X	X	X	X	X
N	12621	12684	12682	12679	12683	12642
R squared	0.152	0.0974	0.0688	0.0809	0.119	0.0371

Notes: Robust standard errors in brackets and clustered at the governorate level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All results are restricted to children aged 1 or older, when most children are being fed a solid or semi-solid diet. Women who had at least one child under the age of two were asked questions about the types of foods they and their youngest child had consumed. **Column (1)** dependent variable is a nutritional diversity index with a score of 1 being awarded to every different food type consumed (dairy, meat, eggs, fish, grains, fortified cereal, tubers, and legumes) ; **Column (2)** dummy indicating whether a child had recently consumed dairy products; **Column (3)** dummy variable indicating whether a child had recently consumed meat products; **Column (4)** dummy indicating whether a child had recently consumed legumes; **Column (5)** dummy indicating whether a child had recently consumed grains; **Column (6)** dummy indicating whether a child had recently consumed fortified cereals; Prenatal fatalities exposure is the number of riot fatalities a child was exposed to prenatally. Postbirth fatalities is the number of riot fatalities a child is exposed to after birth. Controls include mother's age at child's birth, child's age in months, mother's BMI, number of siblings, child's birth order, and dummies for father being employed, mother being employed, father completed primary education, mother completed primary education, mother completed secondary education, and whether a household is poor. Fixed effects include governorate (25) and birth year cohort (13) dummies. Trends refers to governorate-specific time trends (governorate*year). Data sources: 2008 and 2014 Egyptian Demographic Health Survey and the Armed Conflict Location and Event Data project.

risk is much greater for those who are malnourished (Pelletier, Frongillo, and Habicht 1993). Moreover, prenatal, and not early childhood exposure, is significantly linked with worse nutritional outcomes. This finding is consistent with the literature on the Fetal Origins hypothesis and conflict economics.

I explore whether the negative impact of prenatal riot fatalities can be explained through changes in parental investment. I find that parents do not seem to alter their investments in dietary diversity or vaccinations in response to civil uprisings exposure. But, breastfeeding duration is reduced for children who are prenatally exposed to riot fatalities. Breastfeeding has been shown to confer increased immunity to children and therefore the increase in likelihood of illness for children prenatally exposed to riot fatalities is consistent with the reduction in breastfeeding (Hanson 1998). Therefore, the reduction in WAZ and increase in malnutrition is likely being driven by the fall in the duration of breastfeeding. I find that the negative impacts of prenatal riot fatalities exposure does not change when I control for birthweight. This indicates that parents are not fully compensating for shortfalls in health at birth. Consequently, the reduction in WAZ is driven by a reduction in investment that reinforces the negative impact of the prenatal shock.

I examine whether there are certain sub-populations that are driving these reductions in breastfeeding who would benefit the most from interventions aimed at increasing breastfeeding duration. It turns out that, in response to prenatal riot fatality exposure, breastfeeding duration falls across the board. But, the impacts of prenatal shock seem to be more pronounced for mothers who reside in rural regions, are employed, and who lack primary education. From Table 9.1 I find that children from high socioeconomic status households have a greater reduction in their breastfeeding duration in response to riot fatalities exposure relative to children from low SES. There could be multiple sociocultural, biological, economic and personal reasons behind the fall in length of breastfeeding. For example, previous studies in developing nations found that employment, increased marketing of breast milk substitutes, or low health were significant barriers to the duration and exclusivity of breastfeeding in infants (Balogun et al. 2015; WHO 2017). Alternatively, stress exposure could be directly affecting the amount of breast milk produced (Chaudhury, Chaudhury, and Lu 1961; Cross 1955). Consequently, there should be further research into the barriers to breastfeeding in Egyptian society and how they interact with the aftermath of the Arab Spring. A successful increase in breastfeeding duration would offer important nutrition and immune benefits that would help guard children against negative *in utero* shocks.

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