Vitamin A and Resilience to Early Life Shocks

Evidence From the Interaction of a Natural Experiment and a Randomized Control Trial*

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Abstract

We know that trauma in early life can have large and sometimes lasting effects. Little is known, however, about how to protect children against these negative impacts. The protective effect of investments is difficult to identify empirically, because these investments are endogenous choices correlated with the probability of trauma. We resolve this difficulty by leveraging a unique combination of events, in which a tornado tore through an area of northwest Bangladesh involved in a randomized controlled trial (RCT) of vitamin A supplementation at birth. Using detailed birth and mortality records and anthropometric measurements at 0-6 months, we test whether vitamin A supplementation at birth protects against the deleterious effects of experiencing a natural disaster in early life. Tornado exposure in early infancy negatively affected infants' anthropometric outcomes and increased the frequency of severe fevers. But infants dosed with vitamin A at birth through the RCT were largely shielded from these effects. Tornado impacts, as well as the protective effects of vitamin A, are substantially larger for boys; girls experience no significant negative impacts or protection. Our results suggest that simple health interventions can protect effectively against trauma in early life, and that more research on the role of micronutrients in engendering resilience to shocks in infants is likely valuable.

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1 Introduction

Recent studies from around the world have demonstrated that trauma in early life can have large impacts on the survival and wellbeing of infants and children. Much of this literature has focused on air and water pollution (Adhvaryu et al., 2014; Chay and Greenstone, 2003a,b; Currie and Neidell, 2005; Currie and Walker, 2011; Currie et al., 2009, 2011; Greenstone and Hanna, 2011); the effects of income shocks (Baird et al., 2011; Bhalotra, 2010), nutrient availability (Almond et al., 2011), clinical intervention at birth (Almond et al., 2010; Bharadwaj et al., 2013), sanitation (Watson, 2006), and access to health care (Almond et al., 2006) have also been documented.

This mounting evidence begs the question: how do we protect vulnerable children? In other words, is it possible to engender resilience to early life shocks? This question is not answered easily. While it is plausible that exposure to many types of early-life shocks is effectively random, measures taken to prevent negative impacts–and measures to mitigate impacts once a shock has occurred–are likely not random at all; they are rather deliberate choices. The extent to which parents invest in restoring their child's wellbeing after a shock is likely correlated with unobserved characteristics that also determine the child's outcomes. Assessing outcomes after these endogenous choices thus cannot produce a rigorous answer regarding how much a particular investment actually contributes to resilience.

In this study, we exploit data from a unique situation that by chance combined an exogenous negative shock with a randomized health intervention in early life. On March 20, 2005, a tornado struck several areas of northwest Bangladesh that were involved in a double-blind cluster randomized controlled trial (RCT) of maternal and newborn vitamin A supplementation. The tornado killed 56 people and injured almost 4000, and generated significant property damage in about 7 percent of the villages under study (Klemm et al., 2008). Both treatment and control villages were affected. We leverage this rare combination of events, along with detailed birth and mortality records and anthropometric measurements at 0, 3, and 6 months, to test whether vitamin A supplementation mitigates the deleterious effects of experiencing a natural disaster in early life.[1]

Our empirical strategy exploits the contemporaneous combination of an RCT and a natural experiment. To estimate the effects of the tornado, we compare the health of infant cohorts exposed to

[1]The protective role of vitamin A has a well charted physiological basis. Vitamin A promotes the functioning of neutrophils, macrophages, and natural killer cells – vital components of the body's immune system. It also helps restore innate immunity after infection by promoting the normal regeneration of mucosal barriers (Stephensen, 2001).

the tornado *in utero* and at 0-3 months to unexposed cohorts, across villages (also called sectors) falling within and outside the tornado's path. Then, to identify the potential protective effects of vitamin A supplementation, we add a third difference, across treatment and control sectors.

We show that exposure to the tornado in early life (at 0-3 months) had a substantial negative impact on key anthropometric measures of infant health–namely mid-upper arm circumference (MUAC) and chest circumference (CC), and increased the frequency of severe fevers in infancy. However, those treated with vitamin A at birth through the RCT were effectively protected from these deleterious effects. For example, a standardized anthropometric index at 3 months, constructed for mean effects analysis (Kling et al., 2007), dropped by .32 SD if the child was exposed to the tornado at 0-3 months in a placebo (control) sector. That difference all but vanishes for the same exposed cohort in treatment sectors. This pattern is consistent for anthropometrics at 6 months. Results on the incidence of fevers between 0 and 3 months reinforce the results on anthropometric outcomes: exposure to the tornado in the first three months of life increases the incidence of severe fevers, but this impact is wholly blunted in treatment sectors. These impacts, and the protective effects of vitamin A, are particularly strong for boys compared to girls; indeed, our estimates suggest that boys bear the entire brunt of the tornado's impacts (experiencing a decline of half a standard deviation in anthropometric measures), while girls are not significantly effected (standardized point estimate is -0.02).

To our knowledge, our study is the first to rigorously demonstrate that it is possible to protect against the deleterious effects of early life trauma. We show that health investments in early life can engender nearly complete resilience to negative shocks. This result relates to recent studies suggesting that intervention at birth can correct for health-related or economic disadvantage (Almond et al., 2011, 2010, 2006; Bharadwaj et al., 2013). These studies show that intervention in early life can improve survival and health outcomes for children with low baseline health or economic status. Our findings add to this literature in two ways. First, we measure a preventative (as opposed to a corrective) effect of investments at birth. Taken together, then, the evidence to date demonstrates that investments at birth work toward both improving outcomes after fetal disadvantage as well as protecting against trauma in early infancy.

Second, previous work has stopped short of showing what outcomes *would have been* if the child had been born without trauma. That is, how close does one get to coming to par with healthy babies' outcomes if one intervenes on low birth weight babies at birth? This question can only be answered well if the shock to the endowment is also plausibly random. We leverage the unique combination of an RCT and a natural experiment to show that not only are babies who receive vitamin A more robust after the tornado, as compared to exposed babies who did not receive vitamin A, but there is also full catch up. Babies exposed to the tornado who received vitamin A are no worse off than babies who were not exposed to the tornado.

We also add to the understanding of the "fetal origins" hypothesis–that early life factors have long-lasting effects on health and economic well-being (Almond and Currie, 2011; Currie and Vogl, 2012; Heckman, 2006, 2007). Recent work in this literature has emphasized the need to look at the long-term effects of investments, asking the question: do early investments serve as complements or substitutes to initial endowments (Almond and Mazumder, 2012; Bhalotra and Venkataramani, 2011; Cunha et al., 2010). Our findings make some inroads toward answering this question. Our result–that outcomes for exposed infants who received supplementation are no worse than for unaffected infants–supports the hypothesis that, at least in the short term, endowments and investments are substitutes. Since the RCT did not track infants beyond 6 months, we cannot determine whether this substitutability persists for longer-term outcomes. Though much more work is needed in this area, our results suggest that it is perhaps possible to protect young children from the lifelong disadvantage that can result from early life trauma.

Finally, we provide evidence in support of policies encouraging vitamin A supplementation at birth in low-income contexts. Our results suggest that much of the impact of supplementation, at least on infant mortality, can be attributed to the large benefits accruing to the most distressed infants (in this case, to tornado-affected infants, and more suggestively, to low birth weight babies). To enhance their impact, supplementation policies should thus target distressed infants, particularly those living through traumatic experiences – natural disasters, disease outbreaks, war, and the like – in the first few months of life. Infant boys may be particularly vulnerable, given that their immune systems are much less developed than similarly aged girls.

The remainder of the paper is organized as follows. Section 2 provides contextual details regarding the vitamin A supplementation RCT and the tornado event. Section 3 describes our data, and section 4 provides details on our empirical strategy. Section 6 describes the results, and section 7 concludes.

2 Context

2.1 The RCT

The two randomized field experiments we study were nested double-blind placebo-controlled cluster randomized trials of maternal and newborn vitamin A (and in the maternal trial, β-carotene) supplementation in Bangladesh, conducted from 2001 to 2007.[2] These trials are part of the JiVitA Bangladesh international nutrition research project on maternal and child health. Both trials were conducted in a contiguous 435 square kilometer area in northwest Bangladesh, in Rangpur Division, with an estimated population of about 600,000. The study site is typical of rural Bangladesh, lying at approximately the 35th percentile of the distribution of economic and quality of life indicators among rural areas in Bangladesh (see Labrique et al. (2011) for more details on representativeness of the study area).

The study area was subdivided into 596 sectors, each of which was populated with 107 to 377 households at baseline. These sectors were randomized using a 3x2 cluster randomized factorial design with three different groups for pregnant women and 2 groups for their newborn children. The 3-group randomization (maternal trial) used a geographic block randomization, which is described in detail in West et al. (2011). The 2-group randomization (infant trial) was done by geographic block randomization, where each block was defined within one of the three earlier groups, as described in Klemm et al. (2008).

All married women in the study area in 2001 (totaling 102,769) and newlywed women (during the study, totaling 27,711), ages 13-45, were surveilled for pregnancy. In total, 60,294 pregnancies were identified and, if consent was given (>99% of cases), the pregnant woman was enrolled in the maternal supplementation study. The infant trial was nested within the maternal trial and was conducted during part of the maternal trial, or between January 2004 and December 2006. A total of 15,937 infants received supplementation (or placebo) directly at birth or shortly thereafter (79% within 24 hours; 90% within 1 week) and were followed until 6 months after birth.

The two treatment groups in the maternal trial received the recommended weekly allowance of vitamin A, either in the form of vitamin A or β-carotene (which the body converts into vitamin A), as weekly supplements from first trimester through 12 weeks post partum, while the control group received

[2]These trials and the tornado survey referred to below were all approved by the Institutional Review Board of the Bloomberg School of Public Health, Johns Hopkins University, and the Ethics Committee of the Bangladesh Medical Research Council. Each of the trials was pre-registered at clinicaltrials.gov; Identifiers: NCT00198822 (maternal trial) and NCT00128557 (infant trial).

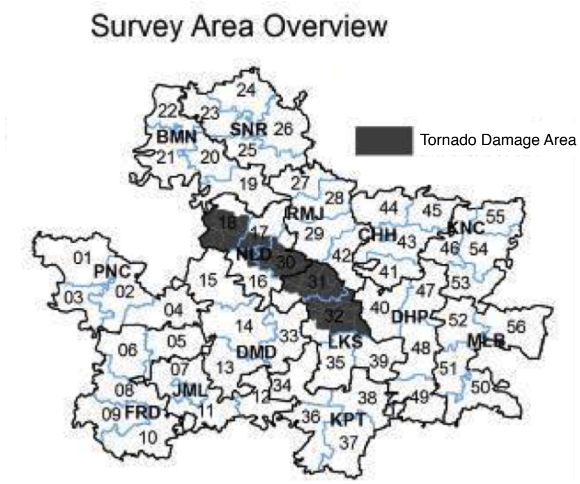

Figure 1: Area damaged by the tornado. The figure was produced by the JiVitA GIS Unit.

a placebo supplement. Life born infants in each sector were randomized to receive either 50,000 IU[3] of vitamin A once at birth or to receive placebo once at the same time.

Further information on field procedures and other details can be found in Labrique et al. (2011), West et al. (2011) and Klemm et al. (2008).

2.2 The Tornado

On the night of March 20th, 2005, a tornado swept through Gaibandha District, affecting about 7% of the study area (Sugimoto et al., 2011) (see Figure 1). Between August and October 2005 each household in affected areas was visited by a survey enumerator, who asked questions on mortality and morbidity of household members as well as damage to homes as a result of the tornado. Based on this survey, the tornado resulted in 56 deaths, injured 3,710 people and destroyed 3,540 houses(Sugimoto et al., 2011). Out of 596 study sectors, 41 sector had some houses destroyed and in 24 sectors more than 20% of houses were destroyed. Our evidence suggests that the tornado had no effect on the timing of supplementation or anthropometric and survey measurements. For instance, among infants in their second or third trimesters in-utero during the tornado those in the tornado area were supplemented within 24 hours at the rate of 80% while those outside of this area were dosed at the rate of 79.2%. Birth anthropometry for this same population was obtain within 7 days in the tornado area at the rate

[3] International Units

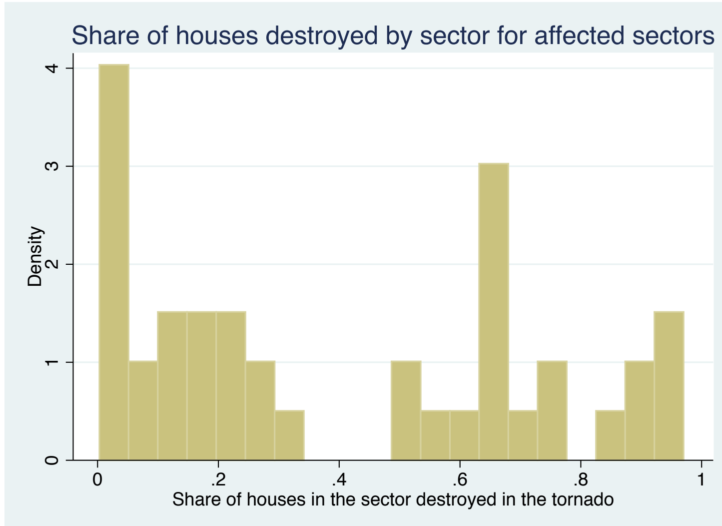

Figure 2: Histogram of the share of houses destroyed by sector (only for the 41 sectors with some damage).

of 88.2% and outside this area at the rate of 89.5%.

3 Data

3.1 Sample

In defining the sample we follow Klemm et al. (2008) and include infants who were met and dosed with vitamin A or placebo within 30 days of birth, and for which vital status at 24 weeks is known. The randomized study was discontinued after December 31st, 2006, and all infants born after that date were supplemented with vitamin A (regardless of randomization status). We therefore exclude the 3721 infants born after this date. We also exclude non-singleton births (298 infants) and those that we can not assign to a cohort (63 infants). This leaves us with a final core analysis sample of 18767 infants.

3.2 Summary Statistics

Table 1 reports means and standard deviations of important outcomes and control variables. We code as missing birth measures taken after 7 days and 3 and 6 month measures taken more than 8 weeks after the target date (in our regressions we also control for the date of measurement). We report means for the whole sample, as well as within and outside of tornado-affected sectors, and across treatment and control sectors within the tornado area. We also report differences in means across these sub-samples. Differences noted with asterisks denote statistically significant differences.

Babies in this area of Bangladesh are small relative to reference populations. The mean weight is 2.5 kg, exactly at the threshold for classification as low birth weight. Average length at birth in cm is approximately 46.7, a full 3 cm less than the reference US population. Head circumference is 32.7 cm at birth, which is 3 cm less than the same measurement for the reference US population. This difference (with respect to the reference population) shrinks slightly by 6 months: head circumference at 6 months is 40.89 cm as compared to 43.5 cm for reference infants.[4]

3.2.1 Comparisons across affected and unaffected areas and across study arms within tornado sectors

Means of health outcomes at birth and at 3 and 6 months are balanced across the tornado and non-tornado areas for pre-tornado cohorts. There is some evidence that infants in tornado-affected sectors were slightly healthier, particularly by 6 months: 9 out of the 11 anthropometric measurements recorded are larger in the tornado area; three of these differences–MUAC, CC, and AI, all at 6 months–are statistically significant, though the differences are small in magnitude.

Next, we compare means across treatment sectors (infants who received vitamin A supplementation at birth) and control (placebo) sectors within the tornado-affected area. Reassuringly, most birth outcomes (weight and anthropometry) and maternal characteristics are balanced across the treatment arms within the tornado area. Finally, anthropometric measures at 3 and 6 months are not significantly different across the two groups.

3.2.2 Dosing

Infants were dosed within hours of birth with either treatment (vitamin A) or placebo. The trial was double blind, so the implementation teams did not know whether they were dosing infants with treatment or placebo. In Table A1, we report dummies reflecting the distribution of time to dosing (in hours after birth) across key groups.

48 percent of infants were dosed within 6 hours of birth. 62 percent were dosed within 12 hours,

[4] Data for reference populations are from the Centers for Disease Control and Prevention Growth Charts for the United States (Kuczmarski et al., 2000).

and 74 percent by 24 hours. The dose timing distribution has a long right tail: 16 percent of infants were dosed more than 7 days after birth. Overall, the distribution of dosing timing was fairly similar across tornado and non-tornado sectors, and within the tornado area across vitamin A and placebo groups. We do see small significant differences in dosing less than 6 and 12 hours (note that this is prior to the tornado). Tornado areas were dosed slightly *earlier* than non-tornado areas.

In Table A21, we verify that for exposed infant cohorts, dosing was actually more equal across tornado and non-tornado areas, and, within the tornado area, across vitamin A and placebo sectors.

4 Empirical Strategy

4.1 Sources of variation

We leverage three sources of variation to identify the protective effect of vitamin A: 1) spatial variation in tornado exposure; 2) temporal overlap between the tornado event and key early life periods; and 3) the randomized allocation of vitamin A to newborns.

With regard to spatial variation, we compare infants born in sectors that were in the tornado's path with those born in sectors outside this path. Our baseline definition of spatial exposure classifies a particular sector as exposed if there was any tornado damage in the sector. Under this definition, 41 sectors, or 7 percent of all sectors involved in the RCT, were exposed. Since several sectors experienced a low degree of damage (less than 20 percent of homes were destroyed in 17 sectors), we may be misclassifying these sectors as "exposed" according to the baseline definition. We can thus define an alternative that includes only sectors affected to a greater degree – for example, sectors in which greater than 20 percent of homes were destroyed. Results are qualitatively unchanged when we use the alternative definition of spatial exposure. The caveat to using this alternative is that as we increase the cutoff, the number of exposed sectors shrinks, leading to imbalance in the sample across the exposed and unexposed groups, thus power goes down.

Second, we construct dummies for two main time periods of early exposure: the prenatal period (i.e., the infant was *in utero* during the tornado event) and early life (i.e., the infant was either 0-10 weeks or 0-22 during the tornado event, depending on the timing of the measurement of the outcome variable). Throughout the paper we define the *in utero* period as the time between our best guess of the date of conception (based on the last menstrual period) and birth. This definition has the advantage of being the normal definition of the *in utero* period but the disadvantage that it induces a mechanical correlation between exposure to shocks *in utero* and gestational length(Currie and Rossin-Slater, 2013). We discuss what effect this has on our results in Section 6.6.3 based on re-estimation of our models using a definition of the *in-utero* period as the 9 months before birth. For the postpartum period, we use 2 main periods to define early life exposure: 0-3 months and 0-6 months.

Third, we use randomized variation in the allocation of vitamin A to newborns by sector. Accordingly, we construct a dummy for whether the infant was born in a treatment sector, meaning he was dosed with vitamin A at birth. As explained earlier, supplementation at birth in the RCT was cross-randomized with prenatal supplementation. We focus on supplementation at birth in the body of the paper, and describe the prenatal supplementation results in the appendix.

5 Estimation

Perhaps the most intuitive candidate strategy for identification of a protective effect for vitamin A is to compare infants born in some window of time around the tornado event, inside and outside the tornado area, and across treatment (vitamin A supplementation) versus control (placebo) sectors–a difference in differences strategy. This would, however, require two fairly strong assumptions for identification. First, we would have to assume that the tornado hit a random subset of sectors. This is clearly violated, as the tornado affected a spatially contiguous area. Second, we would need that the randomization was balanced both inside and outside the tornado-affected area. Due to the small number of sectors inside the tornado area, this assumption may not hold.

Our strategy, which leverages the timing of births using a triple difference specification, allows for much weaker assumptions. In particular, in the difference in differences strategy above, we would rely on a single (spatial) difference across tornado and non-tornado areas to identify the effects of the tornado. In contrast, here we can rely on both spatial and temporal variation (around the tornado window) to identify the tornado effect. That is, we can compare babies born at different times (within and outside of a window around the tornado event), across sectors affected by and unaffected by the tornado. Then, we can essentially compare the size of this effect across vitamin A treatment sectors and placebo sectors. This strategy also lowers concern about imbalance between the vitamin A and placebo sectors as we estimate how birth outcomes change over time rather than comparing main effects across sectors.

Finally, we must also assume that the tornado hit vitamin A and placebo sectors equally hard. This can be checked in the data. In fact, the average number of houses destroyed in the tornado hit vitamin A sectors was 33.7% compared to 47.6% in the tornado hit control sections. This is in part because the 6 sectors hit hardest (by this measure) were all control sectors. Excluding those sectors the average damage in tornado hit vitamin A sectors is 33.5% compared to 28.7% in the tornado hit control sectors. However, as discussed below and displayed in Table A14, our findings are unchanged (and in fact statistically stronger) if we exclude those sectors.

We thus estimate a triple difference across the three dimensions described above to identify the protective effect of vitamin A. We assess the impact of the tornado by comparing outcomes for infants across sectors affected by the tornado v. unaffected sectors and for those whose prenatal and early life periods coincided with the tornado timing v. those for whom these periods did not. We then take a third difference across treatment v. control sectors, to estimate the protective effect of vitamin A supplementation at birth.

We estimate the following triple difference specification via ordinary least squares (OLS):

$$\begin{aligned} O_{ij} = \quad & \alpha + VitA_j\left(\beta_1 + \beta_2 T_j + \beta_3 U_i + \beta_4 E_i + \beta_5 T_j U_i + \beta_6 T_j E_i\right) \\ & + \gamma_1 T_j + \gamma_2 U_i + \gamma_3 E_i + \gamma_4 T_j U_i + \gamma_5 T_j E_i + X'_{ij}\delta + \varepsilon_{ij}. \end{aligned} \tag{1}$$

Here, i denotes infant and j denotes sector. O_{ij} is a health outcome measure. T_j is a dummy for tornado-exposed sector. U_i is a dummy that is 1 if the infant was *in utero* during the tornado event, and E_i is a dummy that is 1 if the infant was 0-10 weeks during the tornado. $VitA_j$ is a dummy for treatment sector in the RCT. X_{ij} is a vector of determinants of child health used as controls. Standard errors are clustered at the sector level. We also cluster errors using multi-level clustering to correct for spatial auto-correlation and find little qualitative change in the precision of the results.

6 Results

6.1 Attrition

We begin with a discussion of attrition. While tracking of infants over the 6 month period of the study was fairly intensive, a non-trivial fraction of anthropometric measurements at 3 and 6 months are missing. A smaller fraction of measurements were done substantially late (we define this arbitrarily to be more than 8 weeks after the exact date on which the infant turned 3 or 6 months old).

This attrition arises from multiple sources. First, the infants may have died. Second, while migration outside of the study area was uncommon, in some cases neighbors reported that the respondent mother and infant child had migrated. Third, adverse conditions (for example, heavy rainfall during monsoon) may have made timely household visits difficult or impossible.

We have detailed information on the timing of death if the infant died, on migratory status, and also on the timing of enumerator visits. This allows us to break down the extent of attrition due to these causes separately as well as on the whole. We present a summary analysis here in Table 2 by looking at overall attrition – breaking this analysis up by the causes of attrition mentioned above results in similar findings.

In this analysis, we regress a dummy for 3 or 6 month anthropometric measures missing on cohort, tornado area, and vitamin A sector dummies and their interactions. This allows us to investigate the extent to which attrition was differential across time and space. In particular, we are interested in understanding whether tornado exposure might have increased attrition rates, and whether this effect was different across vitamin A treatment and placebo sectors.

Table 2 presents these results. We find no significant evidence that exposure to the tornado changed attrition rates. The coefficient on the interaction between tornado area and 0-3 month cohort shows a small and insignificant impact of the tornado on the probability that anthropometric measures were missing at both 3 and 6 months. A similar story holds for infants in the vitamin A sectors who were exposed to the tornado, but with less precision: the coefficient on the triple interaction is slightly larger and imprecisely estimated at 3 months, but very small at 6 months. Overall, there is little evidence that tornado exposure changed attrition, both in vitamin A and placebo sectors.

6.2 Anthropometry at 3 and 6 months

Next, we estimate tornado impacts for infants exposed in early life, as well as the protective effects of vitamin A supplementation at birth, using linear regression models of the form shown in equation 1. The main outcomes reported here are 1) anthropometric index, which is composed of mid-upper arm circumference (MUAC), chest circumference (CC) and head circumference (HC), all measured in centimeters, and 2) MUAC itself (since this component is most responsive to short term shocks).

We report results for the pooled sample, as well as broken down into male and female sub-samples. We control in all specifications for the best-guess length of gestation in weeks; age at measurement; maternal MUAC; maternal height; and a living standards index, which is a principal components analysis of household assets data.

The results for 3 month outcomes are reported in Table 3. The interaction of birth in tornado area with early life exposure has a large and negative coefficient in the pooled sample (column 5) (-.29, p<.1). By 3 months, infants exposed in early life to the tornado were .3 SD smaller than non-exposed infants.

This effect shows significant heterogeneity across infant boys and girls. Boys experience a decrease of nearly half a standard deviation in AI (column 1), while girls see almost no decrease at all (column 3). This remarkable difference essentially means that the overall impact on anthropometry is driven *entirely* by the impact on boys.

The triple interaction coefficients suggest that vitamin A has a substantial protective effect, dampening the impact of tornado exposure substantially, particularly for boys. The coefficient on the triple interaction with early life exposure in the pooled sample (column 5) is .29, indicating that infants' AI in vitamin A sectors was not significantly affected by the tornado, while those in placebo sectors experienced large negative impacts. Again, this is driven entirely by boys, for whom the protective effects are large and significant; for girls, neither an initial impact nor a protective effect is observed.

The patterns for MUAC, CC and HC are similar; we report only MUAC here because it drives the impacts we see on AI. Length of gestation, maternal MUAC and height, as well as living standards, are all positively associated with anthropometry.

In Table 4, we show the negative impacts of the tornado and the protective effect of vitamin A both continue to be salient for anthropometry at 6 months. Indeed, the estimates of the tornado impact on AI and MUAC are both larger at 6 months compared to 3 months, as are the protective effects (read off the triple interactions). Again, we only find significant effects boys; impacts on girls are small and insignificant (though there may be a slightly positive effect of vitamin A by 6 months in the infant girl sample, but this is not precisely estimated).

6.3 Results on Fever Episodes

Here we present evidence on fever episodes, one mechanism underlying the impacts on anthropometric outcomes. Since vitamin A's primary role in infancy is to strengthen the immune system, we would expect that infants dosed with vitamin A at birth are less prone to fevers occurring because of poor nutrition, sanitation, and the like following tornado exposure. We test this hypothesis using data on infant fever episodes reported by mothers at 3 and 6 months.

Table 5 reports these results. The double interactions between tornado area and tornado time windows show that exposure to the natural disaster increased the incidence of fever for most types of exposure–*in utero* (in some specifications), at 0-3 months, and at 4-6 months. However, vitamin A had a protective effect for early life exposure (0-3 months), though this coefficient becomes insignificant when the triple interaction for 4-6 month exposure is added to the specification. Again, effects in the pooled sample are driven entirely by the sub-sample of infant boys at 3 months. By 6 months we begin to see some suggestive evidence of effects for girls, yet still the coefficients are insignificantly different from 0; the impact is larger and precisely estimated for boys at both 3 and 6 months.

6.4 Gender Differences

The fact that tornado effects as well as the protective effects of vitamin A are driven entirely by boys is striking. This difference helps speak to the mechanisms through which tornados affected health in this context.

We begin exploring these mechanisms by examining the raw differences across genders in health (as measured by anthropometry and self-reported fever episodes) as well as supplementary feeding behavior in early life. We focus on supplementary feeding because nearly all babies are breastfed from 0 to 6 months, but it is not uncommon for some babies to receive supplemental resources, mostly sugary water or a water-based porridge substance common in this area of Bangladesh. Supplemental feeding could mean greater nutritional intake, particularly when mothers are malnutritioned and do not produce enough milk to sustain the infant on breastmilk alone, but may also be dangerous for the infant, given that water is often not treated properly and may contain infection-causing bacteria that are the progenitors of disease in infants.

The results in Table 6 show that males are indeed larger at both 3 and 6 months by .6-.7 SDs compared to girls, but yet are more prone to fever episodes and are 8 percentage points more likely at 3 months and 14 points more likely at 6 months to be engaging in supplementary feeding. This indicates that infant boys, though larger in size, may be exposed to the deleterious effects of environmental shocks than infant girls.

6.5 Destruction of Toilet Facilities

Sanitation is directly related to the "environmental" mechanism that may be driving the gender differences we see. In particular, when toilet facilities are not available, in this context open defecation is widely used. In Table 7 we confirm that the tornado indeed destroyed households' toilet facilities to a substantial extent. Households surveyed after the tornado in tornado-exposed sectors were 21 percentage points less likely to have a toilet facility than similar households surveyed before the tornado.

This drastic change in sanitary facilities likely led to a sharp increase in open defecation after the tornado in affected areas. Unfortunately, we do not have water quality data to support the idea that this led to an increase in, for example, fecal bacteria in the groundwater supply in these areas, so we cannot conclude for sure that this decline in sanitation led to increased infections for those infants who were consuming water, but the available evidence is consistent with this hypothesis. We therefore suggest that one driver of the stark differences between infant boys and girls is that boys were exposed to groundwater contamination through the fact that they were more likely to be engaged in supplemental feeding at very early ages.

6.6 Robustness Checks

6.6.1 Restricting Control Group to Pre-Tornado Cohorts

In our main analysis, infants conceived after the tornado are considered part of the (temporal) control group. It is possible that these infants were affected by the aftermath of the tornado; for example, sanitation and health infrastructure likely took time to rebuild in affected areas, so infants born in some window well after the tornado could still have been exposed to its negative impacts.

To account for this possibility, we include additional interaction terms that effectively remove the cohort conceived after the tornado from the control group. Thus all cohorts are now compared only to the cohort born more than 3 months before the tornado. The results are reported in Table A5. We find that the results on AI, MUAC, and fever all retain their magnitudes and statistical significance. As we would predict, the inclusion of the cohort conceived after the tornado makes the estimates of tornado impact in early life and the protective effect of vitamin A stronger.

6.6.2 Changing the Definition of Tornado Exposure

Our baseline variable for tornado exposure is an indicator that equals 1 for each infant if the sector in which the infant was born had a positive percentage of homes destroyed. Exposure might be better defined using higher cutoffs, because low levels of tornado damage may not generate large enough impacts on infant anthropometry to detect statistically. On the other hand, since defining the exposure cutoff at 0 yields about 10 percent of sectors defined as exposed, increasing the cutoff will yield a very small fraction of the sample classified as exposed. This creates small cells of infants who were born in exposed sectors around the time of the tornado, and thus estimates become more imprecise. We favor the "any exposure" definition to mitigate this latter concern, but we check whether exposure at higher cutoffs has similar effects.

To do implement this, we take our basic specification and divide tornado exposure into two dummies – one for 0-20 percent of homes destroyed, and one for 20-100 percent. We look at the double and triple interaction coefficients for each of these indicators. The results are presented in Table A11. We find in general that the size of the coefficients for both the impact of the tornado and the protective effect of vitamin A are not statistically different for both definitions of exposure, suggesting that our baseline definition seems to capture the appropriate variation in exposure.

Another possible concern for our estimates is that 6 of the most damaged sectors were all control sectors. As a result, among the tornado hit sectors, 47.6% of houses in control sectors were destroyed compared to 33.7% of houses in vitamin A sectors. If we exclude those 6 sectors most damaged then the balance shifts such that 28.7% of houses in control sectors are destroyed compared to 33.5% in the vitamin A sectors. We re-estimated our key regressions excluding these 6 sectors and report the findings in Table A14. Our findings are similar and in fact statistically stronger than before. It therefore appears unlikely that our findings are driven by control sectors being especially hard hit, at least not by our measure of residential house destruction.

6.6.3 Changing the definition of the in-utero period

In Table **??** we change the definition of the *in-utero* period to correspond to the 9 months before birth to remove the mechanical correlation between gestational length and tornado exposure (Currie and Rossin-Slater (2013) note that this causes a downward bias in estimates of the impact of shocks). Our results of the impact of the shock are largely unchanged. With this new definition the tornado is estimated to cause 0.16cm reduction in 3 month MUAC versus a 0.15cm drop using the original definition. The number of fever episodes is estimated to increase by 0.31 versus an increase of .38 using the original definition. We do find some positive effects of vitamin A on infants that experienced the tornado shock *in-utero* using this new definition, but the effect is marginally significant, only found for MUAC, and in other preliminary analysis, does not seem to be very robust.

7 Conclusion

Infants are vulnerable to a variety of assaults *in utero* and in early life. Quantifying the deleterious effects of environmental factors, income and nutritional scarcity, and natural disasters on infant health and survival is the focus of a rapidly expanding set of studies in economics. We know from this work that impacts, particularly in low-income contexts, can be large and long-lasting. But we have little rigorous empirical evidence that intervening in early life can change outcomes for children exposed to trauma.

In this study, we leverage the unique combination of a natural disaster and an RCT to estimate the negative impacts of tornado exposure on birth outcomes, and the protective effect of vitamin A supplementation at birth. We find significant impacts of the tornado on anthropometric outcomes at 3 and 6 months. But babies who received a one-time dose of vitamin A at birth did not experience the same drops in anthropometric measures. Results on the incidence of fever episodes in infancy reinforce these findings, lending some insight into the mechanism through which the protective capacity of vitamin A operates.

The results this study demonstrate, to our knowledge for the first time, that simple interventions at birth can protect effectively against trauma in early life. This is important because improving the health and survival of infants, particularly in low-income countries, is a primary goal for global health policy. Moreover, a growing literature in economics shows that in addition to these immediate impacts, early life assaults have far-reaching long run consequences. Disease (Almond, 2006; Bleakley, 2007, 2010; Cutler et al., 2010), natural disasters (Currie and Rossin-Slater, 2013), income shocks (Maccini and Yang, 2009), and war (Akresh et al., 2012) all leave lasting scars on health, human capital, and welfare that persist well into adulthood. The role of public policy in mitigating these impacts or protecting against them is widely recognized but poorly understood. In large part the dearth of rigorous evidence on policy levers is due to the difficulty in finding overlapping episodes of early life trauma and an orthogonal natural experiment that changed the incentives for investing in children.

Our study takes a step toward filling this gap. Our results demonstrate a strong protective effect of one-time vitamin A supplementation at birth. We interpret this protection as evidence that, at least in very early life, endowments (as proxied for by tornado exposure) and investments (vitamin A) are substitutes. Whether this remains true when outcomes are measured in later childhood and adulthood is an open question. Although our findings hold up to various robustness checks and are consistent across a diverse set of outcomes (anthropometry, fever incidence and mortality), their strength is somewhat limited by the relatively small share of infants in the study affected by the tornado. Our results hopefully offer a valuable start and suggest that more research on the role of micronutrient deficiencies in infants' resilience to shocks is likely to be very valuable.

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Table 1: **Summary Statistics of Infants in the Pre-tornado Cohorts**

	All N = 5269		Tornado N = 345		Non-tornado N = 4924		Difference		Within Tornado Area: Vitamin A N = 184		Within Tornado Area: Placebo N = 161		Within Tornado Area: Difference	
	Mean	SD	Mean	SD	Mean	SD	Mean	SE	Mean	SD	Mean	SD	Mean	SE
Infant birth anthropometry														
Weight (kg)	2.49	0.43	2.51	0.41	2.49	0.43	0.02	0.03	2.54	0.38	2.49	0.43	0.04	0.06
Height (cm)	46.67	2.35	46.61	2.23	46.68	2.36	−0.06	0.17	46.80	2.09	46.40	2.37	0.40	0.31
MUAC (cm)	9.44	0.85	9.48	0.81	9.43	0.85	0.04	0.06	9.50	0.73	9.44	0.89	0.06	0.11
Head Circumference (cm)	32.67	1.62	32.73	1.71	32.67	1.61	0.06	0.12	32.82	1.58	32.63	1.84	0.19	0.24
Chest Circumference (cm)	30.74	2.10	30.77	1.96	30.73	2.11	0.03	0.15	30.80	1.74	30.73	2.18	0.07	0.27
Infant anthropometry at 3 months														
MUAC (cm)	12.38	1.06	12.43	1.07	12.37	1.06	0.05	0.06	12.43	1.02	12.42	1.14	0.01	0.12
Head Circ. (cm)	38.71	1.48	38.58	1.45	38.72	1.48	−0.14	0.09	38.51	1.33	38.67	1.59	−0.16	0.17
Chest Circumference (cm)	38.89	2.21	38.98	2.17	38.89	2.22	0.10	0.13	38.82	2.15	39.18	2.18	−0.36	0.25
Anthropometric Index	0.17	0.98	0.17	0.97	0.17	0.99	0.00	0.06	0.13	0.91	0.22	1.05	−0.09	0.11
Infant anthropometry at 6 months														
MUAC	13.09	1.04	13.20	1.06	13.09	1.04	0.11	0.06*	13.27	1.05	13.12	1.07	0.15	0.12
Head Circumference (cm)	40.89	1.41	41.01	1.38	40.88	1.42	0.13	0.08	40.97	1.41	41.05	1.36	−0.08	0.16
Chest Circumference (cm)	41.34	2.11	41.59	2.11	41.32	2.11	0.27	0.12**	41.51	2.13	41.67	2.10	−0.16	0.24
Anthropometric Index	0.04	0.99	0.16	1.00	0.03	0.98	0.13	0.06**	0.17	1.02	0.16	0.99	0.01	0.11
Other infant outcomes														
Gender is Male	0.51	0.50	0.54	0.50	0.51	0.50	0.03	0.03	0.52	0.50	0.57	0.50	−0.06	0.05
Fever Incidence, 0-3 months	0.58	0.49	0.56	0.50	0.59	0.49	−0.03	0.03	0.56	0.50	0.55	0.50	0.01	0.06
Fever Incidence 0-6 months	0.55	0.50	0.57	0.50	0.55	0.50	0.02	0.03	0.57	0.50	0.57	0.50	0.00	0.06
Mortality 0-24 weeks	0.05	0.22	0.04	0.20	0.05	0.23	−0.01	0.01	0.04	0.21	0.04	0.19	0.01	0.02
Maternal characteristics														
Parity	1.33	2.41	1.23	1.48	1.33	2.46	−0.10	0.13	1.38	1.64	1.07	1.26	0.31	0.16*
LSI	−0.04	0.99	−0.11	0.94	−0.04	0.99	−0.07	0.06	−0.09	0.97	−0.13	0.90	0.04	0.10
Height (cm)	149.32	5.15	149.01	5.08	149.34	5.16	−0.34	0.29	148.72	4.97	149.33	5.20	−0.61	0.55
MUAC (cm)	22.66	1.93	22.61	2.00	22.66	1.93	−0.05	0.11	22.58	2.08	22.65	1.91	−0.07	0.22
Education (years)	3.62	4.03	3.54	3.94	3.62	4.04	−0.08	0.22	3.92	4.26	3.11	3.50	0.81	0.42*
Dosing														
Dosed <= 6 hours	0.49	0.50	0.55	0.50	0.49	0.50	0.07	0.03**	0.50	0.50	0.62	0.49	−0.12	0.06*
Dosed <= 12 hours	0.63	0.48	0.69	0.46	0.63	0.48	0.06	0.03*	0.65	0.48	0.73	0.45	−0.07	0.06
Dosed <= 18 hours	0.71	0.45	0.75	0.43	0.71	0.46	0.04	0.03	0.71	0.45	0.80	0.40	−0.08	0.06
Dosed <= 24 hours	0.75	0.43	0.78	0.42	0.75	0.43	0.03	0.03	0.75	0.43	0.81	0.39	−0.06	0.05
Dosed <= 7 days	0.85	0.35	0.88	0.32	0.85	0.36	0.03	0.02	0.88	0.32	0.88	0.32	0.00	0.04

Summary statistics for the study sample (infant sample), limited to infants born at least 9 months before the tornado. Tornado and Non-Tornado refer to inside vs. outside the tornado area. The last three columns restrict the sample to only within the tornado area. We report OLS standard errors and associated p-values to give a general idea of the variation in the data rather than as formal hypothesis tests (which would need to take account of clustering).
Significance: * < 0.1; ** < 0.05; *** < 0.01.

Table 2: **Attrition by 3 and 6 months**

	3 month measures		6 month measures	
	Missing	Missing or late	Missing	Missing or late
	b/se	b/se	b/se	b/se
Tornado area X 0-3 month cohort X Vitamin A	-0.04	-0.04		
	(0.06)	(0.06)		
Tornado area X 0-3 month cohort	0.01	0.01		
	(0.04)	(0.04)		
0-3 month cohort X Vitamin A	0.02	0.02		
	(0.02)	(0.02)		
0-3 month cohort	-0.03***	-0.04***		
	(0.01)	(0.01)		
Tornado area X 0-6 month cohort X Vitamin A			-0.00	-0.02
			(0.04)	(0.04)
Tornado area X 0-6 month cohort			-0.01	-0.01
			(0.02)	(0.02)
0-6 month cohort X Vitamin A			0.01	0.01
			(0.01)	(0.01)
0-6 month cohort			-0.01	-0.01
			(0.01)	(0.01)
Dependent variable mean	0.11	0.13	0.13	0.14
Observations	13890	13890	13890	13890

Attrition in the data by cohort. The dependent variable in columns 1 and 3 is a dummy indicating missing values for 3-month and 6 month-anthropometry. The dependent variable in columns 2 and 4 is the same as the odd columns except that infants measured late (8 weeks after the target date) are also coded as missing. Our main outcome measures used in the paper are set to missing after these cutoff dates so the even numbered columns correspond to the attrition for those main outcome measures. Standard errors are clustered at the sector (treatment randomization) level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table 3: **Anthropometry at 3 months: Main specification (triple-difference).**

	Males		Females		Pooled	
	AI	MUAC	AI	MUAC	AI	MUAC
	b/se	b/se	b/se	b/se	b/se	b/se
Cohort and treatment indicators:						
Tornado area X 0-3 month cohort X Vitamin A	0.55*	0.66**	0.07	-0.03	0.32	0.30
	(0.29)	(0.29)	(0.23)	(0.24)	(0.21)	(0.21)
Tornado area X 0-3 month cohort	-0.47**	-0.56**	0.00	0.02	-0.29*	-0.30**
	(0.24)	(0.22)	(0.13)	(0.14)	(0.15)	(0.15)
0-3 month cohort X Vitamin A	-0.04	-0.06	0.00	-0.05	-0.04	-0.06
	(0.06)	(0.07)	(0.06)	(0.07)	(0.05)	(0.05)
0-3 month cohort	0.02	0.01	0.01	0.03	0.02	0.02
	(0.05)	(0.06)	(0.04)	(0.05)	(0.03)	(0.04)
Controls:						
Best guess length of gestation (weeks)	0.06***	0.05***	0.05***	0.04***	0.05***	0.04***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***	0.02***	0.02***	0.02***	0.02***	0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Maternal MUAC	0.07***	0.08***	0.05***	0.07***	0.06***	0.07***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)
Maternal height	0.03***	0.02***	0.03***	0.03***	0.03***	0.03***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Living Standards Index	0.08***	0.08***	0.10***	0.10***	0.09***	0.09***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Dependent variable mean	0.00	12.21	0.00	12.21	0.00	12.21
Observations	6173	6164	5976	5970	12149	12134

Linear regression models of infant development measured by anthropometry at 3 months. The outcome variables are mid-upper arm circumference (MUAC), head circumference (HC) and chest circumference (CC), all measured in centimeters and an anthropometric index (AI) that is a standardized (zero mean, unit SD) average of the three variables after each has been standardized to zero mean and unit standard deviation. Each variable is winsorized at 1%. "Vit A" is an indicator that is 1 if infants in the sector were given vitamin A and zero if they were in the placebo group. "In Tornado Area" is an indicator defined as 1 if any households in the sector were destroyed in the tornado. "In utero" is an indicator that is 1 if the infant was in utero at the date of the tornado and "0-10 weeks of age" is 1 if the infant was in his or her first 10 weeks of life at the date of the tornado. Combined these three types of indicators define our triple difference strategy. Each regression contains randomization sector fixed effects (this absorbs main effects of the tornado area and treatment indicators). Living Standards is an index based on a principal components analysis of household assets. Best guess gestational length is based on date of last menstrual period reported at enrollment in the study (in the first trimester). Standard errors are clustered at the sector (treatment randomization) level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table 4: **Anthropometry at 6 months: Main specification (triple-difference).**

	Males		Females		Pooled	
	AI	MUAC	AI	MUAC	AI	MUAC
	b/se	b/se	b/se	b/se	b/se	b/se
Cohort and treatment indicators:						
Tornado area X 0-6 month cohort X Vitamin A	0.21	0.49**	0.26	0.24	0.25*	0.35**
	(0.21)	(0.21)	(0.20)	(0.19)	(0.15)	(0.14)
Tornado area X 0-6 month cohort	-0.30*	-0.49***	-0.08	-0.06	-0.21**	-0.29***
	(0.15)	(0.14)	(0.11)	(0.09)	(0.10)	(0.08)
0-6 month cohort X Vitamin A	-0.05	-0.06	0.00	-0.05	-0.02	-0.04
	(0.06)	(0.06)	(0.05)	(0.06)	(0.04)	(0.04)
0-6 month cohort	-0.00	-0.05	-0.04	-0.06	-0.03	-0.06**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
Controls:						
Best guess length of gestation (weeks)	0.04***	0.03***	0.03***	0.02***	0.03***	0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 6 month measurement (centered)	0.01***	0.00	0.01***	0.00**	0.01***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Maternal MUAC	0.08***	0.08***	0.07***	0.08***	0.08***	0.08***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)
Maternal height	0.03***	0.02***	0.03***	0.02***	0.03***	0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Living Standards Index	0.10***	0.10***	0.11***	0.11***	0.11***	0.11***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Dependent variable mean	0.01	13.04	0.01	13.04	0.01	13.04
Observations	6040	6034	5885	5880	11925	11914

Linear regression models of infant development measured by anthropometry at 6 months. The outcome variables are mid-upper arm circumference (MUAC), head circumference (HC) and chest circumference (CC), all measured in centimeters and an anthropometric index (AI) that is a standardized (zero mean, unit SD) average of the three variables after each has been standardized to zero mean and unit standard deviation. Each variable is winsorized at 1%. "Vit A" is an indicator that is 1 if infants in the sector were given vitamin A and zero if they were in the placebo group. "In Tornado Area" is an indicator defined as 1 if any households in the sector were destroyed in the tornado. "In utero" is an indicator that is 1 if the infant was in utero at the date of the tornado and "0-10 weeks of age" is 1 if the infant was in his or her first 10 weeks of life at the date of the tornado. Combined these three types of indicators define our triple difference strategy. Each regression contains randomization sector fixed effects (this absorbs main effects of the tornado area and treatment indicators). Living Standards is an index based on a principal components analysis of household assets. Best guess gestational length is based on date of last menstrual period reported at enrollment in the study (in the first trimester). Standard errors are clustered at the sector (treatment randomization) level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table 5: **Incidence of fever: main specification (triple-difference)**

	Episodes in 0-3 months			Episodes in 0-6 months		
	Males	Females	Pooled	Males	Females	Pooled
	b/se	b/se	b/se	b/se	b/se	b/se
Cohort and treatment indicators:						
Tornado area X 0-3 month cohort X Vitamin A	-0.68**	0.03	-0.37*	-0.69**	-0.09	-0.40
	(0.26)	(0.25)	(0.19)	(0.30)	(0.48)	(0.29)
Tornado area X 4-6 month cohort X Vitamin A				0.08	-0.46	-0.06
				(0.32)	(0.58)	(0.31)
Tornado area X 0-3 month cohort	0.81***	0.10	0.50***	1.05***	0.41	0.72***
	(0.16)	(0.18)	(0.12)	(0.22)	(0.36)	(0.20)
Tornado area X 4-6 month cohort				0.34	0.65	0.38*
				(0.23)	(0.39)	(0.22)
0-3 month cohort X Vitamin A	0.01	0.01	-0.01	0.03	0.00	-0.01
	(0.08)	(0.08)	(0.05)	(0.11)	(0.11)	(0.08)
4-6 month cohort X Vitamin A				-0.05	0.09	0.01
				(0.11)	(0.11)	(0.08)
0-3 month cohort	-0.01	-0.11**	-0.06	0.02	-0.13*	-0.05
	(0.05)	(0.05)	(0.03)	(0.08)	(0.07)	(0.05)
4-6 month cohort				-0.24***	-0.38***	-0.32***
				(0.08)	(0.07)	(0.05)
Controls:						
Best guess length of gestation (weeks)	0.01	-0.00	0.00	0.00	-0.00	0.00
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)
Maternal MUAC	-0.00	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)
Maternal height	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Living Standards Index	-0.09***	-0.04***	-0.07***	-0.12***	-0.08***	-0.09***
	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)
Age at 3 month measurement (centered)	0.01***	0.01***	0.01***			
	(0.00)	(0.00)	(0.00)			
Age at 6 month measurement (centered)				0.00	0.00	0.00
				(0.00)	(0.00)	(0.00)
Dependent variable mean	0.95	0.87	0.91	1.82	1.65	1.73
Observations	6284	6057	12341	5979	5808	11787

Linear regression models of fever using our main specifications. The outcome variables of fever episodes in 0-3 months and 4-6 months are top coded at 4 (>4 episodes are coded as 4).
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table 6: **Gender differences in anthropometric growth, fever incidence and supplemental feeding**

	3 months			6 months		
	Size index	Fever episodes	Supplementary feeding	Size index	Fever episodes	Supplementary feeding
	b/se	b/se	b/se	b/se	b/se	b/se
Male	0.63***	0.04***	0.09***	0.71***	0.04***	0.14***
	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Constant	-0.32***	0.55***	0.21***	-0.35***	0.58***	0.47***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	12167	12451	12543	11943	12362	12733

Linear regression models the size index, fever episodes and supplementary feeding on gender. The outcome variables of fever episodes in 0-3 months and 4-6 months are top coded at 4 (>4 episodes are coded as 4). Supplemental feeding is an indicator variable equal to 1 if the infant received any supplemental feeding during the period (anything other than breast milk or water).
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table 7: **Anthropometry and fever at 3 months by supplementary feeding**

	Feeding begun		No feeding		Pooled	
	MUAC	Fever	MUAC	Fever	MUAC	Fever
	b/se	b/se	b/se	b/se	b/se	b/se
Cohort and treatment indicators:						
Tornado area X 0-3 month cohort X Vitamin A	0.81	-0.42	0.18	-0.36	0.30	-0.37*
	(0.59)	(0.44)	(0.21)	(0.25)	(0.21)	(0.19)
Tornado area X 0-3 month cohort	-0.59	0.37	-0.18	0.57***	-0.30**	0.50***
	(0.42)	(0.36)	(0.13)	(0.17)	(0.15)	(0.12)
0-3 month cohort X Vitamin A	-0.11	-0.08	-0.07	0.01	-0.06	-0.01
	(0.13)	(0.13)	(0.06)	(0.06)	(0.05)	(0.05)
0-3 month cohort	0.10	-0.05	0.00	-0.08*	0.02	-0.06
	(0.09)	(0.09)	(0.04)	(0.04)	(0.04)	(0.03)
Controls:						
Best guess length of gestation (weeks)	0.06***	-0.00	0.04***	0.00	0.04***	0.00
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.01***	0.00	0.02***	0.01***	0.02***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Maternal MUAC	0.08***	-0.00	0.07***	-0.01	0.07***	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)
Maternal height	0.03***	0.01**	0.02***	0.00	0.03***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Living Standards Index	0.12***	-0.10***	0.08***	-0.06***	0.09***	-0.07***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Dependent variable mean	12.21	0.91	12.21	0.91	12.21	0.91
Observations	3121	3161	9013	9180	12134	12341

Each variable is winsorized at 1%. "Vit A" is an indicator that is 1 if infants in the sector were given vitamin A and zero if they were in the placebo group. "In Tornado Area" is an indicator defined as 1 if any households in the sector were destroyed in the tornado. "In utero" is an indicator that is 1 if the infant was in utero at the date of the tornado and "0-10 weeks of age" is 1 if the infant was in his or her first 10 weeks of life at the date of the tornado. Combined these three types of indicators define our triple difference strategy. Each regression contains randomization sector fixed effects (this absorbs main effects of the tornado area and treatment indicators). Living Standards is an index based on a principal components analysis of household assets. Best guess gestational length is based on date of last menstrual period reported at enrollment in the study (in the first trimester). Standard errors are clustered at the sector (treatment randomization) level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table 8: **Anthropometry and fever at 6 months by supplementary feeding**

	Feeding begun		No feeding		Pooled	
	MUAC	Fever	MUAC	Fever	MUAC	Fever
	b/se	b/se	b/se	b/se	b/se	b/se
Tornado area X 0-6 month cohort X Vitamin A	0.41**	0.11	0.30	-0.48	0.35**	-0.14
	(0.18)	(0.18)	(0.20)	(0.40)	(0.14)	(0.20)
Tornado area X 0-6 month cohort	-0.30***	0.23*	-0.35***	0.84***	-0.29***	0.43***
	(0.09)	(0.12)	(0.12)	(0.30)	(0.08)	(0.14)
0-6 month cohort X Vitamin A	-0.04	-0.07	-0.05	0.11*	-0.04	-0.00
	(0.06)	(0.06)	(0.06)	(0.06)	(0.04)	(0.04)
0-6 month cohort	-0.05	0.10**	-0.06	0.00	-0.06**	0.07**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)
Controls:						
Best guess length of gestation (weeks)	0.02***	-0.00	0.02***	-0.00	0.02***	-0.00
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
Age at 6 month measurement (centered)	0.00	-0.00	0.01***	0.00	0.00***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Maternal MUAC	0.07***	-0.01	0.09***	-0.00	0.08***	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)
Maternal height	0.02***	0.00	0.02***	0.00	0.02***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Living Standards Index	0.12***	-0.05***	0.11***	-0.07***	0.11***	-0.06***
	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Dependent variable mean	13.04	0.94	13.04	0.94	13.04	0.94
Observations	6637	6787	5277	5441	11914	12228

Each variable is winsorized at 1%. "Vit A" is an indicator that is 1 if infants in the sector were given vitamin A and zero if they were in the placebo group. "In Tornado Area" is an indicator defined as 1 if any households in the sector were destroyed in the tornado. "In utero" is an indicator that is 1 if the infant was in utero at the date of the tornado and "0-10 weeks of age" is 1 if the infant was in his or her first 10 weeks of life at the date of the tornado. Combined these three types of indicators define our triple difference strategy. Each regression contains randomization sector fixed effects (this absorbs main effects of the tornado area and treatment indicators). Living Standards is an index based on a principal components analysis of household assets. Best guess gestational length is based on date of last menstrual period reported at enrollment in the study (in the first trimester). Standard errors are clustered at the sector (treatment randomization) level. Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table 9: **Destruction of toilet facilities in the tornado**

	Any toilet facility
	b/se
Asset survey conducted after tornado X In tornado area	-0.21***
	(0.08)
Asset survey conducted after the tornado	0.05**
	(0.02)
In tornado area	0.13**
	(0.06)
Constant	0.55***
	(0.01)
Observations	2855

Any toilet facility is an indicator variable for having any toilet facility (water sealed or slab latrine, or flush toilet). The sample is restricted to those who were interviewed about their asset holdings from 45 days before the tornado up to 45 days after the tornado. Significance: * < 0.10; ** < 0.05; *** < 0.01.

8 Appendix

Table A1: **Time to Dosing by Tornado and Treatment Status for Infants In-Utero at the Time of the Tornado**

									Within Tornado Area					
	Full sample N = 5343		**Tornado N = 346**		**Non-tornado N = 4997**		**Difference**		**Vitamin A N = 183**		**Placebo N = 163**		**Difference**	
	Mean	SD	Mean	SD	Mean	SD	Mean	SE	Mean	SD	Mean	SD	Mean	SE
Dosing														
Dosed <= 6 hours	0.47	0.50	0.48	0.50	0.47	0.50	0.01	0.03	0.47	0.50	0.50	0.50	−0.03	0.05
Dosed <= 12 hours	0.64	0.48	0.63	0.48	0.64	0.48	0.00	0.03	0.62	0.49	0.65	0.48	−0.02	0.05
Dosed <= 18 hours	0.71	0.45	0.71	0.45	0.71	0.45	0.00	0.03	0.69	0.46	0.73	0.45	−0.04	0.05
Dosed <= 24 hours	0.75	0.43	0.75	0.43	0.75	0.43	0.01	0.02	0.74	0.44	0.77	0.42	−0.04	0.05
Dosed <= 7 days	0.84	0.36	0.85	0.36	0.84	0.36	0.00	0.02	0.82	0.38	0.87	0.33	−0.05	0.04

Summary statistics of time-to-dosing by area. Tornado and Non-tornado refer to inside vs. outside the tornado area. The last three columns restrict the sample to only within the tornado area. The sample includes only infants that were in-utero when the tornado hit (whether inside or outside the affected area).
Significance: * < 0.1; ** < 0.05; *** < 0.01.

Table A2: **Attrition by cohort inside and outside the tornado area**

	In tornado area								Not in tornado area							
	Pre-tornado		0-24 weeks		In-utero		Post-tornado		Pre-tornado		0-24 weeks		In-utero		Post-tornado	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Singleton births in the infant trial	209		315		340		266		3003		4331		4520		3682	
Non missing vital status at 24 weeks	208	100	315	100	339	100	266	100	2998	100	4325	100	4514	100	3682	100
At birth																
Non missing birth anthropometry	195	93	305	97	322	95	253	95	2756	92	4058	94	4289	95	3461	94
Non missing or late birth anthr.	166	79	260	83	276	81	220	83	2322	77	3409	79	3622	80	3002	82
At 3 months																
Alive at 3 months	198	95	302	96	325	96	253	95	2839	95	4084	94	4331	96	3434	93
Non missing 3 month anthropometry	191	91	290	92	306	90	241	91	2632	88	3825	88	4088	90	3288	89
Non missing or late 3 month anthr.	189	90	284	90	301	89	236	89	2597	86	3791	88	4029	89	3264	89
At 6 months																
Alive at 6 months	197	94	301	96	320	94	252	95	2819	94	4063	94	4313	95	3416	93
Non missing 6 month anthropometry	195	93	291	92	305	90	235	88	2553	85	3749	87	4015	89	3202	87
Non missing or late 6 month anthr.	193	92	289	92	304	89	235	88	2495	83	3699	85	3987	88	3194	87

The table lists the number of infants by cohort and area that were born during the trial in the first row. In subsequent rows it lists number of infants and percentage of the total that fulfill the given data requirements (e.g., having non-missing anthropometric data at birth (Row 3)). In analyses we use only singleton births (this sample is given in Row 2). Pre-tornado (Column 1) is the cohort of infants that were at least 6 months of age when the tornado hit. The next two columns are the cohorts affected by the tornado, in the first 24 weeks of life (Column 2) or in-utero (Column 3). Infants in the post-tornado cohort (Column 4) are those conceived after the tornado (based on reported last menstrual period). In Column 5 (Unknown) are infants for which we do not have enough data to determine the cohort (these are excluded from the analysis). Anthropometry at birth is considered on time if taken no later than 7 days after birth. Anthropometry at 3 and 6 months is considered on time if taken no later than 6 weeks after the target date (target date is 12 and 24 weeks, respectively).

Table A3: **Robustness of key regressions to defining a post-tornado cohort - Males Only Sample.**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple int.: In tornado area X Vit A X ..						
Conceived after tornado	-0.27	-0.49**	-0.33	-0.60***	0.00	0.32
	(0.17)	(0.19)	(0.20)	(0.22)	(0.24)	(0.26)
In utero	0.27	0.08	0.33	0.22	-0.29	0.22
	(0.18)	(0.21)	(0.21)	(0.24)	(0.23)	(0.28)
0-3 months of age	0.58*		0.64**		-0.71***	
	(0.29)		(0.30)		(0.27)	
0-6 months of age		0.10		0.32		-0.23
		(0.22)		(0.23)		(0.22)
Double interaction: In tornado area X ..						
Conceived after tornado	0.31***	0.27*	0.28**	0.22	-0.02	-0.31*
	(0.12)	(0.14)	(0.14)	(0.16)	(0.13)	(0.16)
In utero	-0.07	-0.05	-0.17	-0.17	0.55***	0.11
	(0.13)	(0.17)	(0.16)	(0.19)	(0.14)	(0.21)
0-3 months of age	-0.35		-0.45*		0.87***	
	(0.24)		(0.23)		(0.18)	
0-6 months of age		-0.19		-0.40**		0.50***
		(0.17)		(0.17)		(0.14)
Double interaction: Vit A X ..						
Conceived after tornado	0.00	-0.00	-0.02	-0.01	-0.02	0.06
	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)
In utero	-0.01	-0.03	-0.07	-0.07	-0.01	0.04
	(0.06)	(0.06)	(0.06)	(0.07)	(0.06)	(0.07)
Age 0-3 months	-0.07		-0.08		0.02	
	(0.07)		(0.08)		(0.08)	
0-6 months of age		-0.05		-0.06		-0.00
		(0.06)		(0.07)		(0.07)
Cohorts:						
Conceived after tornado	-0.12***	-0.06	-0.09*	-0.07	0.24***	0.13**
	(0.04)	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)
In utero	-0.08*	-0.05	-0.06	-0.10**	-0.00	0.06
	(0.04)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)
Age 0-3 months	-0.02		-0.02		0.08	
	(0.05)		(0.06)		(0.06)	
0-6 months of age		-0.01		-0.07		0.16***
		(0.04)		(0.05)		(0.05)
- Other controls -						
Best guess length of gestation (weeks)	0.07***	0.05***	0.06***	0.04***	-0.00	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.01***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00**		0.00
		(0.00)		(0.00)		(0.00)
Observations	8395	8241	8383	8233	8560	8444

Linear regression models of anthropometric growth and fever incidence using specifications similar to our main specifications except that we add a new cohort of those that were conceived after the tornado time (by our best guess). In this table we limit the sample to male infants. Using this specification the comparison (reference) group includes only infants born more than 3 months before the tornado (6 months in even numbered columns). Standard errors are clustered at the sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A4: **Robustness of key regressions to defining a post-tornado cohort - Females Only Sample.**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple int.: In tornado area X Vit A X ..						
Conceived after tornado	0.31	0.26	0.27	0.18	0.03	-0.37
	(0.23)	(0.28)	(0.26)	(0.32)	(0.25)	(0.28)
In utero	0.18	0.29	0.10	0.30	0.47*	-0.24
	(0.25)	(0.24)	(0.28)	(0.28)	(0.28)	(0.24)
0-3 months of age	0.12		0.05		0.02	
	(0.23)		(0.26)		(0.26)	
0-6 months of age		0.35**		0.30		-0.15
		(0.17)		(0.19)		(0.28)
Double interaction: In tornado area X ..						
Conceived after tornado	0.12	0.06	0.11	-0.05	-0.03	0.21
	(0.18)	(0.21)	(0.20)	(0.23)	(0.18)	(0.24)
In utero	-0.13	-0.08	-0.07	-0.10	0.03	0.23
	(0.17)	(0.17)	(0.19)	(0.21)	(0.16)	(0.17)
0-3 months of age	0.02		0.01		0.08	
	(0.15)		(0.17)		(0.19)	
0-6 months of age		-0.09		-0.12		0.42**
		(0.09)		(0.10)		(0.19)
Double interaction: Vit A X ..						
Conceived after tornado	-0.05	-0.09	-0.02	-0.10	0.05	0.01
	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)
In utero	0.03	0.01	0.04	-0.03	0.05	-0.04
	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)	(0.06)
Age 0-3 months	-0.02		-0.05		0.04	
	(0.07)		(0.07)		(0.08)	
0-6 months of age		-0.04		-0.08		0.01
		(0.06)		(0.07)		(0.06)
Cohorts:						
Conceived after tornado	-0.07*	-0.02	-0.06	-0.01	0.20***	0.21***
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
In utero	-0.05	-0.06	-0.06	-0.07	0.04	0.17***
	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)
Age 0-3 months	-0.00		0.02		-0.06	
	(0.05)		(0.05)		(0.05)	
0-6 months of age		-0.04		-0.05		0.12***
		(0.04)		(0.05)		(0.04)
- Other controls -						
Best guess length of gestation (weeks)	0.06***	0.04***	0.05***	0.03***	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.02***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00***		0.00
		(0.00)		(0.00)		(0.00)
Observations	8095	7985	8088	7978	8216	8154

Linear regression models of anthropometric growth and fever incidence using specifications similar to our main specifications except that we add a new cohort of those that were conceived after the tornado time (by our best guess). In this table we limit the sample to female infants. Using this specification the comparison (reference) group includes only infants born more than 3 months before the tornado (6 months in even numbered columns). Standard errors are clustered at the sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A5: **Robustness of key regressions to defining a post-tornado cohort - Pooled Sample.**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple int.: In tornado area X Vit A X ..						
Conceived after tornado	0.04	-0.11	-0.02	-0.22	-0.01	0.07
	(0.12)	(0.15)	(0.15)	(0.16)	(0.17)	(0.20)
In utero	0.19	0.11	0.18	0.17	0.03	0.05
	(0.16)	(0.15)	(0.17)	(0.16)	(0.18)	(0.17)
0-3 months of age	0.39*		0.36		-0.40**	
	(0.21)		(0.22)		(0.18)	
0-6 months of age		0.23		0.29**		-0.12
		(0.15)		(0.14)		(0.17)
Double interaction: In tornado area X ..						
Conceived after tornado	0.21***	0.17*	0.20**	0.11	-0.00	-0.14
	(0.08)	(0.11)	(0.08)	(0.12)	(0.11)	(0.16)
In utero	-0.09	-0.02	-0.11	-0.07	0.33***	0.10
	(0.11)	(0.09)	(0.11)	(0.11)	(0.11)	(0.14)
0-3 months of age	-0.25		-0.27*		0.53***	
	(0.16)		(0.16)		(0.12)	
0-6 months of age		-0.16		-0.27***		0.37***
		(0.11)		(0.09)		(0.12)
Double interaction: Vit A X ..						
Conceived after tornado	-0.05	-0.07	-0.03	-0.06	0.02	0.02
	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
In utero	-0.00	-0.02	-0.02	-0.06	0.02	-0.01
	(0.04)	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)
Age 0-3 months	-0.07		-0.07		0.01	
	(0.05)		(0.05)		(0.06)	
0-6 months of age		-0.04		-0.06		-0.00
		(0.05)		(0.05)		(0.05)
Cohorts:						
Conceived after tornado	-0.07**	-0.02	-0.06	-0.02	0.23***	0.17***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
In utero	-0.05*	-0.04	-0.05	-0.07*	0.02	0.12***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)
Age 0-3 months	0.01		0.00		0.02	
	(0.03)		(0.04)		(0.04)	
0-6 months of age		-0.02		-0.06*		0.14***
		(0.03)		(0.03)		(0.03)
- Other controls -						
Best guess length of gestation (weeks)	0.06***	0.04***	0.05***	0.03***	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.02***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00***		0.00
		(0.00)		(0.00)		(0.00)
Observations	16490	16226	16471	16211	16776	16598

Linear regression models of anthropometric growth and fever incidence using specifications similar to our main specifications except that we add a new cohort of those that were conceived after the tornado time (by our best guess). Using this specification the comparison (reference) group includes only infants born more than 3 months before the tornado (6 months in even numbered columns). Standard errors are clustered at the sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A6: **Key regressions using two-way clustering - Males Only Sample**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple interaction: In tornado area X Vit A X ..						
In utero	0.37***	0.30*	0.44***	0.48**	-0.27	0.08
	(0.14)	(0.16)	(0.15)	(0.19)	(0.21)	(0.23)
0-3 months of age	0.67**		0.76**		-0.70**	
	(0.31)		(0.34)		(0.32)	
0-6 months of age		0.31		0.58**		-0.37
		(0.22)		(0.23)		(0.25)
Double interaction: In tornado area X ..						
In utero	-0.18	-0.17	-0.27**	-0.27*	0.55***	0.26
	(0.12)	(0.14)	(0.13)	(0.15)	(0.14)	(0.17)
0-3 months of age	-0.46**		-0.55***		0.87***	
	(0.21)		(0.20)		(0.16)	
0-6 months of age		-0.31**		-0.50***		0.64***
		(0.15)		(0.15)		(0.19)
Double interaction: Vit A X ..						
In utero	-0.01	-0.03	-0.06	-0.07	-0.00	0.01
	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
0-3 months of age	-0.07		-0.08		0.02	
	(0.05)		(0.06)		(0.08)	
0-6 months of age		-0.05		-0.06		-0.03
		(0.05)		(0.06)		(0.06)
Cohorts:						
In utero	-0.04	-0.02	-0.03	-0.07*	-0.09**	0.00
	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)
0-3 months of age	0.02		0.01		-0.01	
	(0.05)		(0.06)		(0.05)	
0-6 months of age		0.02		-0.04		0.10**
		(0.04)		(0.04)		(0.05)
second*						
- Other controls -						
Best guess length of gestation (weeks)	0.07***	0.05***	0.06***	0.04***	-0.00	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.01***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00**		-0.00
		(0.00)		(0.00)		(0.00)
Observations	8395	8240	8383	8232	8560	8443

Linear regression models of anthropometric growth and fever incidence using our main specifications but using two-way clustered standard errors: on randomization sector and on week of birth. In this table we limit the sample to male infants.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A7: **Key regressions using two-way clustering - Females Only Sample**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple interaction: In tornado area X Vit A X ..						
In utero	0.08	0.18	0.01	0.22	0.47*	-0.07
	(0.21)	(0.15)	(0.23)	(0.20)	(0.25)	(0.20)
0-3 months of age	0.02		-0.04		0.02	
	(0.21)		(0.20)		(0.24)	
0-6 months of age		0.24		0.22*		0.03
		(0.15)		(0.13)		(0.30)
Double interaction: In tornado area X ..						
In utero	-0.17	-0.10	-0.11	-0.08	0.03	0.13
	(0.13)	(0.07)	(0.14)	(0.12)	(0.12)	(0.13)
0-3 months of age	-0.03		-0.03		0.08	
	(0.13)		(0.15)		(0.16)	
0-6 months of age		-0.11		-0.10		0.32*
		(0.09)		(0.07)		(0.19)
Double interaction: Vit A X ..						
In utero	0.05	0.05	0.04	0.01	0.04	-0.04
	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.05)
0-3 months of age	0.00		-0.05		0.02	
	(0.07)		(0.06)		(0.09)	
0-6 months of age		0.00		-0.04		0.00
		(0.05)		(0.05)		(0.05)
Cohorts:						
In utero	-0.03	-0.05	-0.04	-0.06*	-0.03	0.08
	(0.04)	(0.03)	(0.05)	(0.04)	(0.04)	(0.05)
0-3 months of age	0.02		0.04		-0.12*	
	(0.04)		(0.05)		(0.06)	
0-6 months of age		-0.03		-0.05		0.03
		(0.03)		(0.04)		(0.04)
second*						
- Other controls -						
Best guess length of gestation (weeks)	0.06***	0.04***	0.05***	0.03***	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.02***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00***		-0.00
		(0.00)		(0.00)		(0.00)
Observations	8095	7985	8088	7978	8216	8154

Linear regression models of anthropometric growth and fever incidence using our main specifications but using two-way clustered standard errors: on randomization sector and on week of birth. In this table we limit the sample to female infants.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A8: **Key regressions using two-way clustering - Pooled Sample**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple interaction: In tornado area X Vit A X ..						
In utero	0.18	0.16	0.19	0.26*	0.05	0.03
	(0.14)	(0.12)	(0.14)	(0.14)	(0.16)	(0.15)
0-3 months of age	0.38*		0.37		-0.39*	
	(0.20)		(0.23)		(0.20)	
0-6 months of age		0.27**		0.38***		-0.14
		(0.13)		(0.12)		(0.20)
Double interaction: In tornado area X ..						
In utero	-0.17	-0.10	-0.18*	-0.12	0.33***	0.16
	(0.10)	(0.08)	(0.09)	(0.09)	(0.10)	(0.12)
0-3 months of age	-0.32**		-0.34**		0.53***	
	(0.14)		(0.14)		(0.14)	
0-6 months of age		-0.24***		-0.32***		0.43***
		(0.09)		(0.07)		(0.14)
Double interaction: Vit A X ..						
In utero	0.02	0.01	-0.01	-0.03	0.02	-0.02
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
0-3 months of age	-0.05		-0.06		0.00	
	(0.05)		(0.05)		(0.05)	
0-6 months of age		-0.01		-0.03		-0.01
		(0.04)		(0.04)		(0.04)
Cohorts:						
In utero	-0.03	-0.03	-0.03	-0.06**	-0.06	0.04
	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)
0-3 months of age	0.03		0.02		-0.06*	
	(0.04)		(0.05)		(0.04)	
0-6 months of age		-0.01		-0.05		0.07**
		(0.03)		(0.03)		(0.03)
second*						
- Other controls -						
Best guess length of gestation (weeks)	0.06***	0.04***	0.05***	0.03***	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.02***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00***		-0.00
		(0.00)		(0.00)		(0.00)
Observations	16490	16226	16471	16211	16776	16598

Linear regression models of anthropometric growth and fever incidence using our main specifications but using two-way clustered standard errors: on randomization sector and on week of birth.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A9: **Robustness of key regressions to different levels of tornado exposure - Males Only Sample.**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple: Tornado damage 0-20% X Vit A X ..						
In utero	0.46*	0.34	0.50*	0.48	-0.43	0.40
	(0.27)	(0.32)	(0.27)	(0.34)	(0.32)	(0.42)
Age 0-3 months	0.56*	0.53	0.68**	0.80***	-0.97**	-1.36***
	(0.30)	(0.36)	(0.28)	(0.29)	(0.44)	(0.50)
Age 4-6 months		0.13		0.40		-0.11
		(0.41)		(0.47)		(0.47)
Triple: Tornado damage 20-100% X Vit A X ..						
In utero	0.42*	0.33	0.49*	0.53*	-0.22	-0.15
	(0.24)	(0.22)	(0.28)	(0.30)	(0.28)	(0.29)
Age 0-3 months	0.72*	0.69	0.80*	1.10**	-0.56	-0.13
	(0.42)	(0.47)	(0.45)	(0.50)	(0.43)	(0.30)
Age 4-6 months		0.01		0.32		-0.31
		(0.31)		(0.33)		(0.35)
Double interaction: Tornado damage 0-20% X ..						
In utero	-0.39	-0.29	-0.42*	-0.37	0.72***	0.08
	(0.24)	(0.26)	(0.21)	(0.27)	(0.21)	(0.34)
Age 0-3 months	-0.40*	-0.43	-0.51***	-0.72***	1.09***	1.41***
	(0.21)	(0.32)	(0.14)	(0.18)	(0.39)	(0.46)
Age 4-6 months		-0.28		-0.63*		0.42
		(0.32)		(0.38)		(0.38)
Double interaction: Tornado damage 20-100% X ..						
In utero	-0.10	-0.11	-0.22	-0.22	0.48***	0.32*
	(0.15)	(0.16)	(0.18)	(0.17)	(0.17)	(0.17)
Age 0-3 months	-0.46*	-0.47**	-0.55**	-0.65***	0.80***	0.54**
	(0.28)	(0.24)	(0.27)	(0.18)	(0.17)	(0.21)
Age 4-6 months		-0.12		-0.20		0.67**
		(0.24)		(0.26)		(0.29)
Double interaction: Vit A X ..						
In utero	-0.01	-0.03	-0.06	-0.07	-0.00	0.01
	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
Age 0-3 months	-0.07	-0.13**	-0.08	-0.19***	0.02	0.01
	(0.06)	(0.07)	(0.08)	(0.07)	(0.08)	(0.09)
Age 4-6 months		0.03		0.06		-0.05
		(0.07)		(0.08)		(0.08)
Cohorts:						
In utero	-0.04	-0.02	-0.03	-0.07	-0.09**	0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Age 0-3 months	0.02	0.08*	0.01	0.04	-0.01	0.14**
	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.06)
Age 4-6 months		-0.05		-0.11**		0.07
		(0.05)		(0.06)		(0.06)
- Other controls -						
Best guess length of gestation (weeks)	0.07***	0.05***	0.06***	0.04***	-0.00	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.01***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00**		-0.00
		(0.00)		(0.00)		(0.00)
Observations	8395	8241	8383	8233	8560	8444

Regression models of key outcome variables where exposure to the tornado is defined in two ways: 1) being in a sector where 0-20% of houses were destroyed by the tornado or 2) being in a sector where 20-100% of houses were destroyed by the tornado. In this table we limit the sample to male infants. Standard errors are clustered at the (randomization) sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A10: **Robustness of key regressions to different levels of tornado exposure - Females Only Sample.**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple: Tornado damage 0-20% X Vit A X ..						
In utero	-0.15	-0.09	-0.32	-0.15	0.42	-0.19
	(0.29)	(0.19)	(0.32)	(0.28)	(0.29)	(0.26)
Age 0-3 months	-0.38	0.36	-0.43	0.15	0.41	-0.59
	(0.31)	(0.43)	(0.30)	(0.36)	(0.45)	(0.54)
Age 4-6 months		0.11		0.04		-0.59
		(0.32)		(0.24)		(0.53)
Triple: Tornado damage 20-100% X Vit A X ..						
In utero	0.32	0.47	0.32	0.61*	0.58	0.05
	(0.31)	(0.31)	(0.33)	(0.33)	(0.45)	(0.30)
Age 0-3 months	0.24	0.33	0.17	0.46	-0.04	0.55
	(0.24)	(0.23)	(0.27)	(0.29)	(0.32)	(0.45)
Age 4-6 months		0.28		0.26		0.41
		(0.23)		(0.30)		(0.50)
Double interaction: Tornado damage 0-20% X ..						
In utero	-0.06	0.05	0.11	0.16	-0.04	0.22
	(0.23)	(0.15)	(0.24)	(0.24)	(0.20)	(0.16)
Age 0-3 months	0.22**	-0.15	0.24**	0.03	-0.46	0.30
	(0.11)	(0.19)	(0.11)	(0.12)	(0.41)	(0.50)
Age 4-6 months		-0.22		-0.21		0.83**
		(0.23)		(0.16)		(0.39)
Double interaction: Tornado damage 20-100% X ..						
In utero	-0.25	-0.22	-0.26	-0.26*	0.07	0.07
	(0.18)	(0.15)	(0.19)	(0.16)	(0.19)	(0.19)
Age 0-3 months	-0.12	-0.04	-0.14	-0.10	0.27	0.22
	(0.18)	(0.15)	(0.19)	(0.14)	(0.17)	(0.31)
Age 4-6 months		-0.13		-0.10		0.10
		(0.15)		(0.20)		(0.25)
Double interaction: Vit A X ..						
In utero	0.05	0.05	0.04	0.01	0.04	-0.04
	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Age 0-3 months	0.00	0.02	-0.05	-0.03	0.02	0.01
	(0.07)	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)
Age 4-6 months		-0.01		-0.06		-0.00
		(0.07)		(0.07)		(0.07)
Cohorts:						
In utero	-0.03	-0.05	-0.04	-0.06	-0.03	0.08*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Age 0-3 months	0.02	0.00	0.04	-0.01	-0.12**	0.03
	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)
Age 4-6 months		-0.05		-0.08		0.03
		(0.05)		(0.05)		(0.05)
- Other controls -						
Best guess length of gestation (weeks)	0.06***	0.04***	0.05***	0.03***	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.02***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00***		-0.00
		(0.00)		(0.00)		(0.00)
Observations	8095	7985	8088	7978	8216	8154

Regression models of key outcome variables where exposure to the tornado is defined in two ways: 1) being in a sector where 0-20% of houses were destroyed by the tornado or 2) being in a sector where 20-100% of houses were destroyed by the tornado. In this table we limit the sample to female infants. Standard errors are clustered at the (randomization) sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A11: **Robustness of key regressions to different levels of tornado exposure - Pooled Sample.**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple: Tornado damage 0-20% X Vit A X ..						
In utero	0.18	0.12	0.11	0.15	-0.03	0.07
	(0.23)	(0.16)	(0.19)	(0.17)	(0.20)	(0.27)
Age 0-3 months	0.20	0.62***	0.22	0.57**	-0.24	-0.77
	(0.24)	(0.22)	(0.22)	(0.23)	(0.40)	(0.59)
Age 4-6 months		0.05		0.14		-0.37
		(0.32)		(0.28)		(0.30)
Triple: Tornado damage 20-100% X Vit A X ..						
In utero	0.26	0.23	0.30	0.40*	0.13	-0.03
	(0.21)	(0.19)	(0.23)	(0.21)	(0.30)	(0.20)
Age 0-3 months	0.45*	0.44*	0.44*	0.70***	-0.36	0.21
	(0.25)	(0.23)	(0.25)	(0.22)	(0.27)	(0.29)
Age 4-6 months		0.11		0.27		0.08
		(0.17)		(0.20)		(0.35)
Double interaction: Tornado damage 0-20% X ..						
In utero	-0.28	-0.13	-0.19	-0.10	0.35**	0.17
	(0.21)	(0.11)	(0.15)	(0.13)	(0.16)	(0.22)
Age 0-3 months	-0.17	-0.44***	-0.21***	-0.44***	0.28	0.70
	(0.14)	(0.11)	(0.07)	(0.09)	(0.38)	(0.57)
Age 4-6 months		-0.16		-0.35		0.63***
		(0.28)		(0.24)		(0.22)
Double interaction: Tornado damage 20-100% X ..						
In utero	-0.10	-0.09	-0.17	-0.13	0.32**	0.16
	(0.11)	(0.10)	(0.12)	(0.12)	(0.14)	(0.13)
Age 0-3 months	-0.36*	-0.31**	-0.38*	-0.41***	0.60***	0.35**
	(0.20)	(0.15)	(0.19)	(0.12)	(0.11)	(0.18)
Age 4-6 months		-0.13		-0.16		0.31
		(0.14)		(0.14)		(0.22)
Double interaction: Vit A X ..						
In utero	0.02	0.01	-0.01	-0.03	0.02	-0.02
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Age 0-3 months	-0.05	-0.05	-0.06	-0.09*	0.00	0.00
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
Age 4-6 months		0.03		0.02		-0.02
		(0.05)		(0.05)		(0.05)
Cohorts:						
In utero	-0.03	-0.03	-0.03	-0.06**	-0.06**	0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Age 0-3 months	0.03	0.04	0.02	0.01	-0.06*	0.09**
	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)
Age 4-6 months		-0.07*		-0.11***		0.05
		(0.04)		(0.04)		(0.04)
- Other controls -						
Best guess length of gestation (weeks)	0.06***	0.04***	0.05***	0.03***	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.02***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00***		-0.00
		(0.00)		(0.00)		(0.00)
Observations	16490	16226	16471	16211	16776	16598

Regression models of key outcome variables where exposure to the tornado is defined in two ways: 1) being in a sector where 0-20% of houses were destroyed by the tornado or 2) being in a sector where 20-100% of houses were destroyed by the tornado. Standard errors are clustered at the (randomization) sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A12: **Robustness of key regressions to excluding the most damaged sectors - Males Only Sample.**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple interaction: In tornado area X Vit A X ..						
In utero	0.38**	0.25	0.43**	0.41*	-0.39*	0.07
	(0.18)	(0.19)	(0.18)	(0.21)	(0.22)	(0.27)
0-3 months of age	0.73**		0.74**		-0.77***	
	(0.35)		(0.35)		(0.27)	
0-6 months of age		0.39*		0.61***		-0.53**
		(0.20)		(0.23)		(0.21)
Double interaction: In tornado area X ..						
In utero	-0.19	-0.13	-0.26**	-0.20	0.67***	0.26
	(0.14)	(0.14)	(0.11)	(0.14)	(0.15)	(0.20)
0-3 months of age	-0.52*		-0.54*		0.94***	
	(0.30)		(0.28)		(0.19)	
0-6 months of age		-0.39***		-0.54***		0.79***
		(0.14)		(0.16)		(0.15)
Double interaction: Vit A X ..						
In utero	-0.01	-0.03	-0.06	-0.07	-0.00	0.01
	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
0-3 months of age	-0.07		-0.08		0.02	
	(0.06)		(0.08)		(0.08)	
0-6 months of age		-0.05		-0.06		-0.03
		(0.06)		(0.06)		(0.06)
Cohorts:						
In utero	-0.04	-0.02	-0.03	-0.07	-0.09**	0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
0-3 months of age	0.02		0.01		-0.01	
	(0.05)		(0.06)		(0.05)	
0-6 months of age		0.02		-0.04		0.10**
		(0.04)		(0.04)		(0.05)
second*						
- Other controls -						
Best guess length of gestation (weeks)	0.07***	0.05***	0.06***	0.04***	-0.00	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.01***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00**		-0.00
		(0.00)		(0.00)		(0.00)
Observations	8311	8157	8299	8149	8475	8360

Regression models of key outcome variables where we exclude the sectors that had more than 80 % of houses destroyed (which all happened to be control sectors). In this table we limit the sample to male infants. Standard errors are clustered at the (randomization) sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A13: **Robustness of key regressions to excluding the most damaged sectors - Females Only Sample.**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple interaction: In tornado area X Vit A X ..						
In utero	0.11	0.17	-0.05	0.12	0.51*	-0.06
	(0.24)	(0.20)	(0.26)	(0.24)	(0.28)	(0.22)
0-3 months of age	0.21		0.16		0.24	
	(0.22)		(0.24)		(0.29)	
0-6 months of age		0.29		0.27		-0.04
		(0.19)		(0.18)		(0.36)
Double interaction: In tornado area X ..						
In utero	-0.20	-0.09	-0.05	0.02	-0.01	0.12
	(0.18)	(0.14)	(0.19)	(0.18)	(0.17)	(0.15)
0-3 months of age	-0.22		-0.23		-0.14	
	(0.14)		(0.17)		(0.23)	
0-6 months of age		-0.17		-0.14		0.39
		(0.13)		(0.10)		(0.28)
Double interaction: Vit A X ..						
In utero	0.05	0.05	0.04	0.01	0.04	-0.04
	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
0-3 months of age	0.00		-0.05		0.02	
	(0.07)		(0.07)		(0.07)	
0-6 months of age		0.00		-0.04		0.00
		(0.05)		(0.06)		(0.06)
Cohorts:						
In utero	-0.03	-0.05	-0.04	-0.06	-0.03	0.08*
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
0-3 months of age	0.02		0.04		-0.12**	
	(0.05)		(0.05)		(0.05)	
0-6 months of age		-0.03		-0.05		0.03
		(0.04)		(0.04)		(0.04)
second*						
- Other controls -						
Best guess length of gestation (weeks)	0.06***	0.04***	0.05***	0.03***	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.02***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00***		-0.00
		(0.00)		(0.00)		(0.00)
Observations	8021	7913	8014	7906	8142	8080

Regression models of key outcome variables where we exclude the sectors that had more than 80 % of houses destroyed (which all happened to be control sectors). In this table we limit the sample to female infants. Standard errors are clustered at the (randomization) sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A14: **Robustness of key regressions to excluding the most damaged sectors - Pooled Sample.**

	AI		MUAC		Fever	
	3 Mo.	6 Mo.	3 Mo.	6 Mo.	3 Mo.	6 Mo.
	b/se	b/se	b/se	b/se	b/se	b/se
Triple interaction: In tornado area X Vit A X ..						
In utero	0.24	0.16	0.18	0.21	-0.02	0.00
	(0.17)	(0.13)	(0.15)	(0.13)	(0.19)	(0.18)
0-3 months of age	0.51**		0.47**		-0.36*	
	(0.24)		(0.24)		(0.20)	
0-6 months of age		0.35**		0.42***		-0.29
		(0.15)		(0.15)		(0.21)
Double interaction: In tornado area X ..						
In utero	-0.23*	-0.10	-0.17*	-0.06	0.40***	0.19
	(0.13)	(0.09)	(0.10)	(0.08)	(0.13)	(0.14)
0-3 months of age	-0.46**		-0.44**		0.50***	
	(0.21)		(0.19)		(0.15)	
0-6 months of age		-0.31***		-0.36***		0.58***
		(0.11)		(0.10)		(0.16)
Double interaction: Vit A X ..						
In utero	0.02	0.01	-0.01	-0.03	0.02	-0.02
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
0-3 months of age	-0.05		-0.06		0.00	
	(0.05)		(0.05)		(0.05)	
0-6 months of age		-0.01		-0.03		-0.01
		(0.04)		(0.04)		(0.04)
Cohorts:						
In utero	-0.03	-0.03	-0.03	-0.06**	-0.06**	0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
0-3 months of age	0.03		0.02		-0.06*	
	(0.03)		(0.04)		(0.03)	
0-6 months of age		-0.01		-0.05*		0.07**
		(0.03)		(0.03)		(0.03)
second*						
- Other controls -						
Best guess length of gestation (weeks)	0.06***	0.04***	0.05***	0.03***	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age at 3 month measurement (centered)	0.02***		0.02***		0.01***	
	(0.00)		(0.00)		(0.00)	
Age at 6 month measurement (centered)		0.01***		0.00***		-0.00
		(0.00)		(0.00)		(0.00)
Observations	16332	16070	16313	16055	16617	16440

Regression models of key outcome variables where we exclude the sectors that had more than 80 % of houses destroyed (which all happened to be control sectors). Standard errors are clustered at the (randomization) sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A15: **Difference-in-Difference Table: Anthropometric index at 3 months.**

	Not in Tornado Window		
	Placebo	Vitamin A	Difference (VA-PL)
	b (se)	b (se)	b (se)
Not in Tornado Area	-0.00	-0.01	-0.01 (0.02)
In Tornado Area	0.14	0.09	-0.06 (0.08)
Difference	0.14 (0.05)***	0.10 (0.06)*	-0.05 (0.08)
	In utero at tornado		
	Placebo	Vitamin A	Difference (VA-PL)
	b (se)	b (se)	b (se)
Not in Tornado Area	-0.01	-0.00	0.01 (0.04)
In Tornado Area	-0.01	0.09	0.10 (0.15)
Difference	-0.01 (0.09)	0.09 (0.12)	0.10 (0.15)
	In first 10 weeks at tornado		
	Placebo	Vitamin A	Difference (VA-PL)
	b (se)	b (se)	b (se)
Not in Tornado Area	0.01	-0.02	-0.03 (0.05)
In Tornado Area	-0.10	0.13	0.23 (0.16)
Difference	-0.11 (0.14)	0.15 (0.08)*	0.26 (0.16)
Difference in-utero	-0.15 (0.10)	-0.01 (0.13)	0.14 (0.16)
Difference in first 10 weeks	-0.26 (0.14)*	0.05 (0.10)	0.31 (0.18)*

The table shows means and differences (along with standard errors of differences) for the various subsamples that define the triple-difference strategy: within vs. outside the tornado area; within versus outside the tornado window (i.e. in utero or in first 10 weeks of life at the time of tornado) and in treatment versus control sectors. The outcome variable is the anthropometric index (standardized average of MUAC, head circumference and chest circumference) measured at 3 months of age (the index SD is 1). Standard errors are clustered at the sector (vitamin A randomization) level. Significance: * < 0.1; ** < 0.05; *** < 0.01.

Table A16: **Difference-in-Difference Table: Anthropometric index at 6 months.**

	Not in Tornado Window		
	Placebo	Vitamin A	Difference (VA-PL)
	b (se)	b (se)	b (se)
Not in Tornado Area	0.01	-0.00	-0.01 (0.03)
In Tornado Area	0.18	0.14	-0.04 (0.07)
Difference	0.17 (0.06)***	0.15 (0.05)***	-0.03 (0.08)
	In utero at tornado		
	Placebo	Vitamin A	Difference (VA-PL)
	b (se)	b (se)	b (se)
Not in Tornado Area	-0.02	-0.02	-0.01 (0.04)
In Tornado Area	0.08	0.17	0.09 (0.12)
Difference	0.09 (0.06)*	0.19 (0.11)*	0.09 (0.12)
	In first 22 weeks at tornado		
	Placebo	Vitamin A	Difference (VA-PL)
	b (se)	b (se)	b (se)
Not in Tornado Area	-0.02	-0.02	-0.01 (0.04)
In Tornado Area	-0.06	0.17	0.23 (0.12)*
Difference	-0.04 (0.10)	0.20 (0.08)**	0.24 (0.13)*
Difference in-utero	-0.08 (0.07)	0.04 (0.10)	0.12 (0.12)
Difference in first 22 weeks	-0.21 (0.10)**	0.05 (0.09)	0.26 (0.14)*

The table shows means and differences (along with standard errors of differences) for the various subsamples that define the triple-difference strategy: within vs. outside the tornado area; within versus outside the tornado window (i.e. in utero or in first 22 weeks of life at the time of tornado) and in treatment versus control sectors. The outcome variable is the anthropometric index (standardized average of MUAC, head circumference and chest circumference) measured at 6 months of age (the index SD is 1). Standard errors are clustered at the sector (vitamin A randomization) level. Significance: * < 0.1; ** < 0.05; *** < 0.01.

Table A17: **Difference-in-Difference Table: Fever episodes at 0-3 months.**

	Not in Tornado Window		
	Placebo	Vitamin A	Difference (VA-PL)
	b (se)	b (se)	b (se)
Not in Tornado Area	0.89	0.92	0.03 (0.07)
In Tornado Area	0.73	0.88	0.15 (0.22)
Difference	-0.16 (0.19)	-0.03 (0.12)	0.12 (0.22)
	In utero at tornado		
	Placebo	Vitamin A	Difference (VA-PL)
	b (se)	b (se)	b (se)
Not in Tornado Area	0.76	0.96	0.21 (0.10)**
In Tornado Area	1.44	1.17	-0.27 (0.37)
Difference	0.68 (0.27)**	0.20 (0.26)	-0.48 (0.37)
	In first 10 weeks at tornado		
	Placebo	Vitamin A	Difference (VA-PL)
	b (se)	b (se)	b (se)
Not in Tornado Area	1.00	1.00	0.00 (0.18)
In Tornado Area	1.60	1.00	-0.60 (0.92)
Difference	0.60 (0.46)	0.00 (0.71)	-0.60 (0.85)
Difference in-utero	0.84 (0.27)***	0.24 (0.27)	-0.60 (0.38)
Difference in first 10 weeks	0.76 (0.51)	0.03 (0.71)	-0.72 (0.88)

The table shows means and differences (along with standard errors of differences) for the various subsamples that define the triple-difference strategy: within vs. outside the tornado area; within versus outside the tornado window (i.e. in utero or in first 10 weeks of life at the time of tornado) and in treatment versus control sectors. The outcome variable is number of fever episodes in the first 3 months top coded at 4 (> 4 episodes are set to 4). Standard errors are clustered at the sector (vitamin A randomization) level. Significance: * < 0.1; ** < 0.05; *** < 0.01.

Table A18: **Anthropometry Growth at 3 Months.**

	Δ AI		Δ MUAC		Δ CC		Δ HC	
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
*X*X*								
inTareaX*								
*Xtx								
first*								
Controls:								
Best guess length of gestation (weeks)								
Age at 3 month measurement (centered)	0.02***	0.03***	0.02***	0.02***	0.04***	0.04***	0.03***	0.03***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Weight at birth (kg)	0.60***	0.56***	0.49***	0.45***	1.10***	1.02***	0.61***	0.58***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.12)	(0.12)	(0.07)	(0.07)
Height at birth (cm)	0.06***	0.05***	0.04***	0.03***	0.11***	0.10***	0.07***	0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
MUAC at birth (cm)	-0.39***	-0.40***	-0.79***	-0.80***	-0.14***	-0.15***	-0.14***	-0.14***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.05)	(0.03)	(0.03)
Head circumference at birth (cm)	-0.14***	-0.14***	0.05***	0.05***	0.09***	0.09***	-0.58***	-0.58***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Chest circumference at birth (cm)	-0.12***	-0.12***	0.03**	0.02**	-0.69***	-0.70***	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Maternal MUAC		0.04***		0.05***		0.07***		0.03***
		(0.00)		(0.01)		(0.01)		(0.01)
Maternal height		0.01***		0.01***		0.03***		0.01***
		(0.00)		(0.00)		(0.00)		(0.00)
Living Standards Index		0.07***		0.07***		0.15***		0.05***
		(0.01)		(0.01)		(0.02)		(0.01)
Observations	8804	8790	8794	8780	8570	8559	8787	8773

Linear regression models of anthropometric growth at 3 months using our main specifications. The outcome variables are changes in anthropometry between birth and 3 months (Δ MUAC = MUAC at 3 months - MUAC at birth) measured in centimeters. ΔAI is a standardized (zero mean, unit SD) average of the three variables (Δ MUAC, Δ CC and Δ HC) after each has been standardized to zero mean and unit standard deviation. Living Standards is an index based on a principal components analysis of household assets. Standard errors are clustered at the sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A19: **Anthropometry Growth at 6 Months.**

	Δ AI		Δ MUAC		Δ CC		Δ HC	
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
*X*X*								
inTareaX*								
*Xtx								
first*								
second*								
Controls:								
Best guess length of gestation (weeks)								
Age at 6 month measurement (centered)	0.01***	0.01***	0.00***	0.00***	0.01***	0.01***	0.02***	0.02***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Weight at birth (kg)	0.51***	0.46***	0.46***	0.41***	1.02***	0.92***	0.56***	0.52***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.14)	(0.14)	(0.08)	(0.08)
Height at birth (cm)	0.05***	0.04***	0.03***	0.02***	0.10***	0.09***	0.06***	0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
MUAC at birth (cm)	-0.38***	-0.39***	-0.81***	-0.82***	-0.20***	-0.21***	-0.14***	-0.15***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.05)	(0.03)	(0.03)
Head circumference at birth (cm)	-0.15***	-0.15***	0.02**	0.02*	0.08***	0.07***	-0.60***	-0.60***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Chest circumference at birth (cm)	-0.15***	-0.15***	-0.00	-0.01	-0.77***	-0.77***	-0.05***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Maternal MUAC		0.05***		0.06***		0.10***		0.04***
		(0.00)		(0.01)		(0.01)		(0.01)
Maternal height		0.01***		0.01***		0.03***		0.01***
		(0.00)		(0.00)		(0.00)		(0.00)
Living Standards Index		0.09***		0.10***		0.19***		0.05***
		(0.01)		(0.01)		(0.02)		(0.01)
Observations	8562	8548	8558	8544	8242	8228	8501	8487

Linear regression models of anthropometric growth at 6 months using our main specifications. The outcome variables are changes in anthropometry between birth and 3 months (Δ MUAC = MUAC at 6 months - MUAC at birth) measured in centimeters. ΔAI is a standardized (zero mean, unit SD) average of the three variables (Δ MUAC, Δ CC and Δ HC) after each has been standardized to zero mean and unit standard deviation. Living Standards is an index based on a principal components analysis of household assets. Standard errors are clustered at the sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A20: **Vitamin Supplementation for Low Birthweight Infants**

	AI		Fever episodes	
	3 months	6 months	3 months	6 months
	b/se	b/se	b/se	b/se
Vitamin A X Birth weight < 2kg	0.03	0.00	-0.05	-0.12**
	(0.05)	(0.05)	(0.06)	(0.05)
Vitamin A	0.01	0.01	0.01	0.00
	(0.02)	(0.02)	(0.02)	(0.02)
Birth weight < 2kg	-1.19***	-0.93***	0.09**	0.11***
	(0.04)	(0.04)	(0.04)	(0.04)
Age in days at 3 month visit	0.02***		0.00***	
	(0.00)		(0.00)	
Age in days at 6 month visit		0.01***		-0.00
		(0.00)		(0.00)
Constant	-1.78***	-1.41***	0.45***	1.01***
	(0.07)	(0.16)	(0.08)	(0.16)
Observations	14955	14631	15156	14913

Linear regression models of infant outcomes by birth weight. The outcome variables are the Anthropometric Index (AI) at 3 and 6 months (standardized average of MUAC, CC and HC) and the number of fever episodes at 3 and 6 months (top coded at 4). All regressions include sector (randomization unit) fixed effects. Standard errors are clustered at the sector level.

Significance: * < 0.10; ** < 0.05; *** < 0.01.

Table A21: **Time at dosing.**

	Dosed at				
	<= 6 hours	<= 12 hours	<= 18 hours	<= 24 hours	<= 7 days
	b/se	b/se	b/se	b/se	b/se
In tornado area X	0.00	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)	(.)
In tornado area X 0-2.5 months	0.01	0.01	0.06	0.05	0.02
	(0.06)	(0.06)	(0.05)	(0.05)	(0.03)
tri123C	0.00	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)	(.)
0-2.5 months	-0.05***	-0.05***	-0.04***	-0.03***	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.47***	0.63***	0.72***	0.75***	0.86***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	12044	12044	12044	12044	12044

Linear regression models of time at dosing using our main specifications. Standard errors are clustered at the sector level.
Significance: * < 0.10; ** < 0.05; *** < 0.01.