Maternal Depression, Parental Investments and Early Child Development: Evidence from a Randomized Control Trial

PRELIMINARY AND INCOMPLETE, DO NOT CITE

Please see the latest version here.

Victoria Baranov [*] Sonia Bhalotra [†] Pietro Biroli [‡]
Joanna Maselko [§]

December 14, 2016

Abstract

We evaluate the impact of maternal depression on parental investment and children's human capital development, exploiting a cluster-randomized control trial that provided cognitive behavioral therapy to women diagnosed with depression in their third trimester of pregnancy. The trial, conducted in rural Pakistan, was highly successful in reducing postnatal depression. We conducted a followup study when the children were age 7 and assessed their cognitive, socio-emotional and physical development, parental investments in children, indicators of the quality of parenting, and of the home environment. We find that treated mothers exhibited significantly better parenting behaviors both during infancy and at the age 7 followup, providing a better home environment and investing more in their children's education. Our results are robust to conservative adjustments for attrition and are not driven by differential shocks to treated clusters. We find weak evidence of improvements in physical development and health but no detectable effects on children's cognitive or socio-emotional development at age 7. Since we find sustained reinforcing parental investments in many domains in the treated group, it is also unlikely that the limited effects on child development are explained by unobserved compensating investments in the control group. Furthermore,

[*]University of Melbourne. *Email: victoria.baranov@unimelb.edu.au*
[†]University of Essex. *Email: srbhal@essex.ac.uk*
[‡]University of Zurich. *Email: pietro.biroli@uzh.ch*
[§]University of North Carolina. *Email: joanna.maselko@unc.edu*

The authors thank Grand Challenges Canada for funding this research under their Saving Brains programme Grant Number #0072-03. We also thank the Human Development Research Foundation for providing support for the original trial. We received helpful feedback from James Fenske, Satadru Mukherjee, Kjell Salvanes, Siham Sikander, Agne Suziedelyte, Atif Rahman and seminar and conference participants at Oxford, IFS, University of Sydney, CSAE, PacDev, and RES. All errors and opinions are our own.

a comparison of control children to children from baseline non-depressed mothers reveals little difference in cognitive development and physical growth though significant differences in socio-emotional development and illness. We conclude that there are possibly positive but latent effects of the intervention that may be detectable in later life.

JEL Classification Codes: I15, I30, O15
Keywords: early life, child development, mental health, depression, randomized controlled trial

1 Introduction

Perinatal depression is exceptionally common, affecting 10-15% of mothers worldwide, leaving 10-35% of children exposed to maternal depression in their first year of life (Rahman, 2005). Furthermore, rates of perinatal depression are higher in developing countries due to poverty, high fertility, and fewer treatment options.

How does maternal depression impact parental investments in early childhood and the subsequent development of human capital during childhood? Recent literature suggests that poor mental health, by affecting economic primitives such beliefs or rates of time preference and hence decision-making, may be an important and factor in the persistence of poverty (Banerjee and Duflo, 2007; Case and Deaton, 2005; Haushofer and Fehr, 2013).[1] Given that depression around the time of childbirth is both common and more prevalent among low-income individuals, and that conditions in early life have important implications for later life outcomes, maternal depression is potentially critical in the intergenerational transmission of socioeconomic inequality.[2] Although no causal evidence yet exists, maternal depression around the time of childbirth has been adversely associated with psychological development, intellectual competence, and psychosocial function throughout childhood and even into adulthood (Murray et al., 1996, 1999). Part of the difficulty in identifying the causal effect of maternal depression is due to mental health being highly endogenous and that outcomes are realized long after exposure. This paper aims to bridge the gap using experimental variation in maternal depression generated by a randomized control trial (RCT) providing psychotherapy to depressed mothers and by exploring the intermediate effects on endogenous parental investment.

Prenatal depression is likely to have physiological effects and is associated with adverse perinatal outcomes such as slower fetal growth rates. In addition to in-utero effects of perinatal depression, postpartum depression may also affect child outcomes.

[1] With good mental health, individuals can tolerate reasonable amounts of pressure, adapt to changing circumstances, and work according to their abilities (WHO, 2005). A fairly large literature in public health hypothesizes that mental health may play a role in generating poverty traps (Knapp et al., 2006; Lund et al., 2011; Patel and Kleinman, 2003). Of mental health disorders, depression is one of the most prevalent. Perinatal depression is defined as a Major Depressive Disorder (MDD) during pregnancy or within one year postpartum.

[2] For example, studies have found that shocks to the physical health of pregnant women have large and long-lasting effects on outcomes of the children (Almond and Currie, 2011b,a; Currie, 2011). Early childhood environment is also important in explaining later outcomes as adults. Gaps in cognitive function and personality traits that emerge very early in life persist, and grow, over time through dynamic complementarity (Cunha et al., 2010; Conti and Heckman, 2014). For example, Perry Preschool and Abecedarian projects in the U.S. show large positive effects of early environment enrichments for disadvantaged children on behavioral traits, school achievements, and job performance. Other studies have found that early home environment and stimulation can impact both cognitive and non-cognitive skills (Walker et al., 2005; Carneiro et al., 2007; Attanasio et al., 2014).

Adverse effects of postnatal depression on infant development are mediated through the child's direct exposure to mother's depressive symptoms and difficulties of parenting associated with depression (Murray and Cooper, 1997). Mothers provide infants with essential care, from breastfeeding to engaging with the child. Mothers suffering from depression may not eat nutritiously, thereby affecting the quality of breastmilk, they may stop breastfeeding earlier, and they may not play with the child or provide a stimulating environment. Furthermore, they may neglect to go for immunizations or do other tasks to ensure adequate care is given to the child.

Economic theory predicts that maternal depression may also impact the human capital development of the child through optimal parental investments. Due to adverse physiological effects, perinatal depression is a negative shock to the human capital endowment of the infant. Parents may exhibit reinforcing behavior, investing less in infants exposed to maternal depression, because of static complementarity (Becker and Tomes, 1986). Alternatively, parents may exhibit compensating behavior, investing more in exposed children, if they are inequality averse. Furthermore, maternal depression may impact the mothers' cost of effort, time preferences, and/or aspirations, which would generally reduce maternal investment. In this case, there may be compensatory behavior within the family, where husbands and extended family members help with child-rearing.

We evaluate the medium-term impacts of a large randomized controlled trial for perinatally depressed mothers on parental investment and child development. The intervention, called Thinking Healthy Programme (THP), took place in rural Pakistan and used cognitive behavioral therapy techniques to treat depression in pregnant mothers beginning one month before birth and continuing for 11 months. Village based community health workers were trained to provide this enhanced care with routine practice of maternal and child health education. Both treatment and control arms received 16 home visits: 4 in the last month of pregnancy, 3 neonatal, and the rest monthly with the difference that treatment arms received the additional "Thinking Healthy" component. Mother-child dyads were interviewed 6 months and 12 months postnatally to assess the effectiveness of the intervention on maternal depression. The intervention was remarkably effective at reducing the rates of depression during infancy (up to 1 year postpartum, as reported in Rahman et al. (2008)) and had persistent effects on mothers mental health even 6 years after the intervention concluded.[3]

[3]The trial had first order effects on the mother's depression status and behaviors such as breastfeeding and interacting with the infant (Rahman et al., 2008). For example, treated mothers in our sample were 30 percentage points less likely to be depressed a year after their child's birth and the intervention was effective in reducing the presence and severity of depression. Rahman et al. (2008) find that infants of treated mothers in this study were more likely to have completed immunization

We conducted a followup study when the children were age 7 and assessed their cognitive, socio-emotional and physical development, parental investments in children, indicators of the quality of parenting, and of the home environment.[4] Our results indicate significant improvements in parental investments in the treated group at age 1 and age 7, particularly time- and monetary-intensive investments. Although we do not measure parenting between the 1-year and 7-year followups, our results indicating increased parental investment at both points in time would suggest that the treatment had a sustained effect on parental investment.

However, we find weaker evidence of improvement in the physical health and development of the child and no detectable effects on cognitive or socio-emotional development at age 7. Our results are not driven by differential attrition, and in a unique analysis for a randomized evaluation, we can rule out that our results are driven by omitted trends using a second comparison group of non-treated women from treatment and controls clusters. Furthermore, comparing control children to children of mothers who were not prenatally depressed revealed very limited differences in outcomes for physical growth and cognitive function; however, children of prenatally non-depressed mothers exhibited somewhat better socio-emotional outcomes and fewer illnesses. These results indicate that cognitive development was unlikely to be affected at this age, though given the improvements of high-return parental inputs, there is potential for differences to emerge at a later time.

Our study is amongst a few that explore the causal impact of improving mental health, by providing psychotherapy, on decision-making. A number of recent studies in economics have used cognitive behavioral therapy (CBT)-based methods to improve non-cognitive skills such as impulse control. A prominent example is Heller et al. (2013), which reports the results of a large randomized field experiment with high-crime youth in Chicago, finding that in-school programming incorporating cognitive behavioral therapy (CBT) reduced violent-crime arrests and generated sustained gains in schooling outcomes. Our intervention was similar in intensity, in terms of duration, number of sessions, and contact hours, to that of Heller et al. (2013). While these recent studies providing CBT for subgroups of the population with particular behavioral

and were less likely to experience episodes of diarrhea during a 12 month follow-up survey. Mothers and fathers in the intervention group were more likely to spend time playing with their children, and mothers in the treatment group were more likely to exclusively breastfeed the child. The effects of the trial on maternal depression are evident even at the 7 year followup, particularly for mothers who had limited social support at baseline. At the 7 year followup, mothers were 6 percentage points less likely to be depressed as a result of treatment.

[4]Previous studies find that measures of human capital at ages 6-8 can explain a substantial amount variation in educational attainment (McLeod and Kaiser, 2004) and wages in adulthood (Currie and Thomas, 2012).

problems appears to be effective at modifying behavior (Heller et al., 2013, 2015; Blattman et al., 2015), it is unclear whether improved mental health more broadly could impact economic decision-making.

Our study also adds to a growing literature that has explored the impacts of maternal stress or other traumatic shocks around the time of childbirth on later life outcomes. Persson and Rossin-Slater (2014), for example, find that perinatal stress caused by the death of close relative impacts later life mental health of children exposed in utero. Aizer et al. (2009) find that maternal stress, measured using cortisol levels, is associated with worse cognitive function. On the other hand, Black et al. (2014) find that maternal stress caused by the death of a relative does not impact later life economic outcomes such as educational attainment or wages.

The rest of the paper is organized as follows. Section 2 provides an overview of the related literature (Appendix Section K surveys the psychology literature and elaborates on the physiological and behavioral mechanisms by which maternal mental health may impact child development), and Section 3 describes the intervention, and Section 4 describes the data. In Section 5, we describe our empirical approach and address potential threats to the validity of the experiment. Section 6 presents the overall results of the program both in the short-run and the long-run. Finally, Section 7 discusses our findings.

2 Related Literature

Defined broadly, mental health goes beyond the absence of a mental disorder to include concepts such as subjective well-being, perceived self-efficacy, autonomy, competence, and the achievement of one's intellectual and emotional potential. Layard et al. (2014) find that the most powerful childhood predictor of adult life-satisfaction is the child's emotional health. Mental health is closely related to non-cognitive skills (or psychosocial competencies) and is considered an important input into the human capital production function (Heckman et al., 2006; Currie and Stabile, 2006; Currie, 2009; Krishnan and Krutikova, 2013). The productive potential of mental health, combined with the recent findings suggesting the poverty itself may have direct effects on mental health by increasing exposure to long-term stress (Haushofer and Shapiro, 2013; Haushofer and Fehr, 2014), imply that mental health may be an important mechanism reinforcing the persistence of poverty.

Mental health may be important for decision-making by affecting aspirations. Poverty traps may arise due to internal constraints reflecting low aspirations or reference points (Dalton et al., 2015; Genicot and Ray, 2009; Ray, 2006). Aspirations are closely related to psychological concepts of locus of control and fatalism, which are

themselves components of mental health. Empirical studies have found that the role of aspirations in economic decision-making may be quantitatively large (Macours and Vakis, 2009; Bernard et al., 2011; Glewwe et al., 2015). Poverty may increase the risk of maternal depression, which could affect the aspirations and effort of the mother.

Psychological processes may contribute to the persistence of poverty through yet another channel called scarcity. In the scarcity hypothesis, the presence of a scarce resource may alter cognitive function by creating tunneling, or excess focus and attention, on the scarce resource at the expense of attention to other dimensions (Shah et al., 2012; Mani et al., 2013; Mullainathan and Shafir, 2013). The alterations on cognitive function are predictable: individuals become more present-biased, and executive function with respect to tasks that are not immediately related to the scarce resource becomes hindered. Psychological well-being, or mental health, might reflect the individual's ability to control or mitigate the psychological effects of scarcity. Thus, mental health may play an even more important role for individual decision-making in resource-poor conditions.

Our study also contributes to the vast literature on early childhood environment and later life outcomes. Studies exploring the determinants of mental health suggest that early life conditions may also affect later life mental health outcomes (Persson and Rossin-Slater, 2014; Adhvaryu et al., 2014; Friedman and Thomas, 2009; Kesternich et al., 2013). Adult mental health problems impair productivity and potentially hamper economic decision-making (Kessler and Frank, 1997; Currie and Madrian, 1999; Organization, 2003). Since poverty places mothers at higher risk for more severe and untreated perinatal depression, which in turn affects the quality of parenting during critical periods of child development, maternal depression would appear to be an intergenerational pathway generating a poverty trap. However, there are also important behavioral responses to early life shocks that might exacerbate or diminish the long-term repercussions of the shocks (Adhvaryu et al., 2015; Kesternich et al., 2013). While a number of studies explore the relationship between mental health and life outcomes, relatively little is known about the causal link between mental health and decision-making.

Recent studies have explored the effects of early life shocks on later outcomes, and focused in particular on simple health interventions that can mitigate the effects of in utero shocks. For example, Gunnsteinsson et al. (2014) find that vitamin A delivered to infants at birth largely protected them from the deleterious effects of a severe tornado which was experienced in utero. Attanasio et al. (2014), in a large randomized intervention in Colombia, explored the effects of micronutrient supplementation and psychosocial stimulation for children aged 1-2 years. They find that the psychosocial

stimulation improved cognitive scores, while micronutrient supplementation had no significant effect on any outcome. Investigating these results further, Attanasio et al. (2015) find that the improvements in cognitive score were largely driven by increases in endogenous parental investments.

Finally, a large literature has investigated how child care and maternal leave policies impact later child outcomes. Overall, studies have found little evidence that mothers' return to work behavior after childbirth negatively impacts child outcomes (Washbrook et al., 2011; Dustmann and Schönberg, 2012). A notable exception is Baker et al. (2008), who find that the expansion of highly subsidized childcare in Canada had negative effects on child outcomes, such as aggressive behavior, motor skills, and illness, at age 2. The authors also find that the policy increased parental anxiety. However, analyzing the same policy when the children were aged 4 and 5, Baker and Milligan (2015) find no lasting negative effects on child cognitive or socio-emotional development. These results remain somewhat puzzling, since maternal employment generally replaces breastfeeding and reduces maternal time spend with the child. On the other hand, maternal employment increases household income. Furthermore, working mothers may trade quantity of time for better "quality" of time (Hsin and Felfe, 2014).

3 The Intervention

This paper evaluates the long-term impact of the Thinking Healthy Programme (THP), an intervention that successfully treated maternal depression in Pakistan (Rahman et al., 2008). Based on the success of THP, the WHO has now incorporated the treatment approach into the Thinking Healthy manual, which outlines an evidence-based approach describing how community health workers can reduce perinatal depression through evidence-based cognitive-behavioral techniques recommended by the mhGAP program (World Health Organization, 2015).[5]

THP was a cluster randomized community trial of a perinatal depression intervention in rural Punjab province, Pakistan. 20 Union Council administrative units, the smallest geo-political unit, were randomized to intervention and 20 clusters into the control arm. The study enrolled women in these 40 Union Councils from April 2005 to March 2006. All women in their third trimester of pregnancy (married, ages 16-45, no other significant illness) who met Diagnostic and Statistical Manual of Mental Disorders, IV-TR (DSM-IV) diagnostic criteria for Major Depressive Episode were invited

[5]The WHO Mental Health Gap Action Programme (mhGAP) aims at scaling up services for mental, neurological and substance use disorders for countries especially with low- and middle-income. This manual is the first volume of WHO's new series on low-intensity psychological interventions, and can be downloaded free of charge here: http://www.who.int/mental_health/maternal-child/thinking_healthy/en/.

to participate in the study. The baseline depression evaluation was conducted by a team of clinical psychiatrists. 3898 women were identified, with 8% refusing before any screening, and 2% were not found (rates were not differential by treatment status, Table A.2 in the appendix shows the precise sample number by treatment cluster through time). A total of 3518 women were screened for clinical depression, with 903 (26%) identified as prenatally depressed, a prevalence consistent with previous literature identifying the prevalence of prenatal depression in this region (Rahman et al. (2003) find antenatal depression rates of 25%, and that in more than 90% of women, postnatal depression was a continuation of a depressive episode during pregnancy). Only women who screened positive for depression completed the baseline survey.

All women who were offered to participate in the study accepted the invitation, and women were unable to receive the intervention treatment or other similar psychotherapies outside of the intervention.[6] There were 463 depressed mothers in the clusters randomized to the THP intervention and 440 depressed women who were in the control arm clusters.

The THP intervention was based on principles of cognitive behavioral therapy (CBT), a class of psychosocial interventions that are the most widely used evidence-based practice for treating mental disorders (Field et al., 2015). CBT focuses on the development of personal coping strategies that target solving current problems and changing unhelpful patterns in cognitions (thoughts, beliefs, and attitudes), behaviors, and emotional regulation. In a number of meta-analyses, CBT has been found to be at least as effective as, if not more effective than other forms of therapy (Bolier et al., 2013; Tolin, 2010; Cuijpers et al., 2008). Through extensive piloting (Rahman, 2007), the original study team further designed an intervention which could be delivered by ordinary village- based primary health workers. The team developed a manual (with step by step instructions for each session) to train the health workers and for them to keep for reference (an excerpt from the manual is provided in Appendix J).

During the CBT-based sessions, the Lady Health Workers (LHWs) focused on identifying and modifying cognitive distortions common in depression specific to how the mother views her own health, her relationship with the baby, and the people around her (changing "unhealthy thinking" to "healthy thinking"). Mothers received health education and supporting materials with pictorial and verbal key messages to facilitate discovery of alternative health beliefs. The intervention was based on a psychosocial model and not presented as a treatment for a mental health problem. While other studies have provided CBT to perinatally depressed mothers in developing countries,

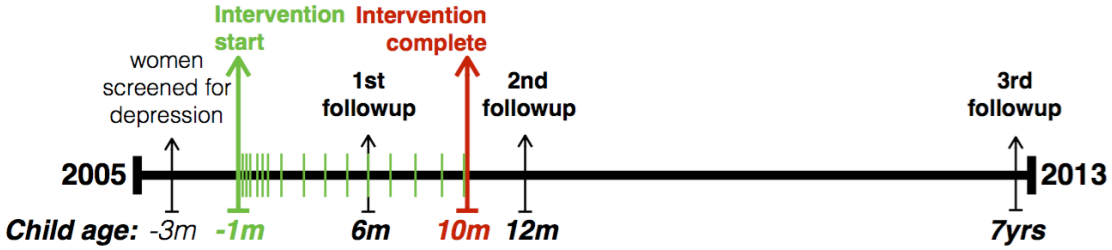
[6]There are no psychologists in the public sector and only 3 psychiatrists (based in Rawalpindi city) for the whole of the district (Rahman, 2007).

the component of the intervention that provided guided discovery of healthy behavior is unique to this study.[7]

The intervention was delivered by LHWs through 16 home visits to each respondent. The intervention consisted of a weekly session for 4 weeks in the last pregnancy month, three sessions in the first postnatal month, and monthly sessions thereafter for the following 9 months. Mothers in the control arm received enhanced routine care with an equal number of visits (enhanced not because of content but because the frequency of visits was greater than what women would usually receive, which is just once monthly).[8] Each LHW is responsible for approximately 1000 women in her catchment area. There were a total of 40 LHWs who visited either treatment and control mothers. Thus, the catchment areas of LHWs were nested within clusters to avoid contamination.

The THP study conducted detailed followup surveys at 6 months and 12 months post-partum to evaluate maternal mental health, infant outcomes, parenting behavior and other household characteristics. The timeline for the intervention and all followups is summarized in figure 3.1.

Figure 3.1 – Timeline of intervention and followups



There had been no additional data collection, followup, or contact with the women since 2007 when the children were 12 months old. In 2013, when the children were 7 years old, a followup study was initiated in order to assess the children's developmental outcomes.

As a first step the follow-up study extracted a list of all the women with their contact information from the original trial and re-contacted them. Five field supervisors,

[7] For example, previous studies aimed at improving mother-infant relationship through sessions with lay community workers (Cooper et al., 2002, 2009) or providing psycho-educational training to pregnant mothers (Gao et al., 2010; ling Gao et al., 2012; Lara et al., 2010; Mao et al., 2012) suggest that mental health is key to the mother's and child's well-being and mental health impacts development of the children in the short run. In a meta-analysis of interventions for common perinatal maternal depression administered by non-specialist community workers in low- and middle-income countries, Rahman et al. (2013) report benefits to the child which included improved mother-infant interaction, better cognitive development and growth, reduced diarrheal episodes and increased immunization rates. However, no study to our knowledge examines the impact of a psycho-educational training on maternal depression and child development outcomes more specifically in the long run.

[8] The content of standard health visits include advice on infant health issues such as tetanus and immunizations, as well as advice about and encouragement of breastfeeding.

who were blind to the woman's depression or trial status, worked directly with the LHWs to relocate and re-enroll study participants. Additional queries with neighbors or relatives, as well as local hospital record checks, also assisted in locating the women. Fieldwork, lasted between March 2013 and January 2014 with a field team of 9 assessors / interviewers. The assessors, who were also blind to treatment status of women, visited treated and control clusters at equal rates. Each dyad interview consisted of two parts: the first in the woman's home and the second either in the child's school or in the LHW's house, which is a commonly used meeting place. The purpose of the second session was to administer the cognitive function tests to the child in a quiet and more standardized environment than the home.

The follow-up study also enrolled 300 mother-child dyads from a sample of prenatally non-depressed women who were screened for the original THP study but did not pass the DSM-IV criteria for major depression. Because of limited data available about women who screened out of the original THP study, the follow-up study used each trial participant's village, neighborhood and LHW assignment to identify a prenatally non-depressed woman to contact for re-enrollment. Although a full follow-up interview was completed by the non-depressed sample, baseline characteristics are not available.

3.1 Effectiveness of CBT on depression trajectories

The first-order aim of the THP intervention was to reduce the incidence of depression among prenatally depressed mothers. As such, the design of the study was very careful to measure clinical depression and mental health using the most rigorous methods, which provides unique data on depression and mental health that other studies in economics rarely have. Maternal depression was assessed by psychiatrists using the Structured Clinical Interview (SCID) for DSM-IV diagnosis. All mothers were evaluated by a psychiatrist at baseline, 6-month followup and 1-year followup to determine if they were experiencing a major depressive episode (MDE). At the 7-year followup, maternal depression was also determined using the SCID interview, but administered by trained assessors. In addition to the binary status of whether the mother was classified as clinically depressed, the surveys at baseline, 6-month, and 1-year followups also contained mental health questionnaires such as the Hamilton Depression Rating (a measure of depression severity), Brief Disability Questionnaire (measure of how disabling symptoms are), the Generalized Assessment of Functioning (assessor-determined measure of functioning incorporating severity of symptoms and their effect on functioning), and the Multidimensional Scale of Perceived Social Support (MSPSS). The 7-year followup contained information on depression severity based on the SCID interview (number and severity of symptoms present) and the MSPSS.

The intervention was evaluated in the short run (at 6-month and 1-year followups) by the original study team and was shown to be extremely successful in reducing depression and improving mental health (Rahman et al., 2008). For example, the intervention reduced depression rates by 31 percentage points in the treated group relative to control by the 1-year followup, and these effects were nearly as large by the 6-month followup (where the difference by treatment status was 30pp). The intervention improved mental health among treatment women by 0.6 standard deviations by 6 months, and 0.7 standard deviations by 1 year (where we incorporate all measures of mental health into one index for ease of reporting). Furthermore, the short-run effects were significant everywhere along the distribution of depression severity.

Despite expected catchup among the control women, the mental health benefits of the intervention persisted even at the 7-year followup (6 years after the intervention concluded). We investigate the effects of the intervention on the trajectory of depression and mental health in depth in a companion paper (Baranov et al., 2015). By the 7-year followup, treated mothers were 6 percentage points less likely to be depressed and had significantly higher mental health scores by 0.2 standard deviations. The intervention was especially effective, both in the short-and long-run, for mothers who were identified as vulnerable based on low social support at baseline, which in this context is primarily women without the child's grandmother cohabitating with them (usually the paternal grandmother). For example, by the 7-year followup, treatment women who were identified as vulnerable at baseline were 11 percentage points less likely to be depressed than controls. Thus, the intervention was successful in reducing depression of mothers in the short-and long-run, and especially for vulnerable women without the mother-in-law present at baseline. Given this strong first stage effect of the intervention on depression of mothers, we expect that the intervention may have detectible effects on parental investments in children both in the short-run and the 7-year followup.

4 Data

4.1 Sample

The starting sample consisted of 463 mothers received the treatment intervention (THP) and 440 mothers were in the control group. After 1 year, 412 treated mothers and 386 mothers in the control group were analyzed. However, 360 infants in the treated group and 345 infants in the control group were analyzed at 1 year. The 7-year followup study took as a starting sample the mother-child dyads who completed the 1-year followup. The study team successfully located and re-enrolled 83% (n=585) of women and their children who were last interviewed in 2007, with 85.5% (n=295) of

the control group dyads and 80.3% (n=289) of the intervention arm dyads. Attrition from the 1 year followup was 5 percentage points higher in the treatment arm (p=0.13). Figure A.2 shows the flow of participants from the very start of the intervention to the 7-year followup.[9] We include this additional dyad in our analysis, however the results are not affect by excluding this observation.

Our analytical sample comprises of both an experimental group and an non-experimental group. The experimental group consists of 585 mother-child dyads that were located at the 7-year followup. The non-experimental group consists of 300 mother-child dyads which were chosen from among mothers who had been screened out of the experiment at baseline because they did not pass the DSM-IV criteria for perinatal depression. Mothers in the experimental group were surveyed at baseline, the 6-month followup, the 1-year followup and the 7-year followup. Mothers that were screened out were not surveyed at baseline or later followups, except for the 300 selected to be part of the non-experimental group followed up at 7 years.

4.2 Baseline Balance

Table 1 shows baseline characteristics for the sample of women who were interviewed at the 1-year followup and the 7-year followup.[10] There are several notable differences in characteristics between treated and control groups in both samples. Treated women at baseline in the 1-year followup sample are 11 percentage points more likely to have a grandmother of the index child (henceforth, just grandmother, which is either the mother's mother, or most commonly –90% of cases– mother-in-law) living with them, reported 0.58 more years of education, and 0.25 fewer children. The 7-year followup sample appears similarly balanced: perceived social support and presence of grandmothers were still greater in the intervention arm, and treatment women had with fewer children. Jointly testing all variables, we fail to reject the null hypothesis that treatment and control clusters were balanced in the 1-year followup sample (p=0.12). However, while the magnitudes of the differences between treatment and control were similar using the 1-year sample, we reject the null of balance (p=0.05) in the 7-year followup sample. Table 1 suggested that treatment women were slightly better off in terms of education and wealth and had substantially more social support. Baranov et

[9]The survey team located and interviewed one control dyad who completed a 6-month evaluation but the mother did not fully complete the 1-year followup. The mother answered questions related to the infant and parenting, and the infant was measured (length and weight), but the mother did not complete the psychiatric evaluation. Attrition rates are marginally statistically different by treatment status (p=0.07) from the starting sample of the fully completed 1-year dyads.

[10]The original baseline sample (N=904) was balanced (Rahman et al., 2008); however, since the starting sample for our 7-year followup were dyads that completed the 1-year followup, we treat the 1-year followup sample as our "starting" sample.

al. (2015) show that the benefits of the intervention were greater for women without social support, suggesting that estimated effects on depression and mother's mental health would be downward biased. We present all results with controls for standard demographic controls and any outcomes that were not balanced.[11]

4.3 Outcomes

We measure a diverse set of outcomes on parenting behavior during infancy and at the 7-year followup. Similarly, we have a rich set of measures of child development during infancy and at the 7-year followup. For both parenting and child development, the measures at infancy are more limited compared to those at the 7-year followup. To organize the results, we group measures in the following way: during infancy, one index summarizing parenting behavior and one summarizing child development. At 7-years, we will group parenting behavior into 3 domains: time-intensive investment, monetary-intensive investment, and parenting style. For child development at 7-years, we also have 3 domains: cognitive, physical, and socio-emotional development. We describe the measures in some detail below, and provide thorough definitions of measures and their summary statistics in Appendix B.

4.3.1 Parenting behavior

During infancy, the measures of parenting behavior are whether the family planned in advance for delivery (location, transport, finances), breastfeeding (at 6-months), frequency of mother and father play with the child (at 1-year), whether mother discussed child's development with the family (at 1-year), and whether the mother was practicing birth spacing (at 1-year).[12] These measures are all self-reported by the mother.

At the 7-year followup, we have measures of parental investment using both self-reported and observational data. Mothers answered a detailed module on the home environment, which is a modification of the HOME inventory (Caldwell and Bradley, 1984) similar to the HOME-SF used in a number of studies including the NLSY79. The HOME inventory is based on a set of 54 questions around 8 dimensions: responsivity, encouragement of maturity, emotional climate, learning materials and opportunities, enrichment, family companionship, family integration, and physical environment. A number of questions within the HOME inventory are interviewer observed, which we

[11] The full set of controls comprises of baseline values of mother's age, age-squared, height, parity, education, family structure, presence of grandmother (mother or mother-in-law of depressed mother), husbands' education, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview, as well as additional controls for cluster-level baseline averages of mother's age, height, parity, family structure, grandmother, wealth, mother and father education, depression severity and social support.

[12] Birth spacing could be either traditional or modern contraceptive methods, which are available and not uncommon in this setting.

indicate in the detailed description of indices in B.3.

In addition to the HOME inventory, we also have detailed measures of parenting practices (also a short form version of the Parenting Practices Inventory, or PPI), which captures the disciplinary style of the parents (Webster-Stratton et al., 2001). The short-form PPI is composed of 31 questions assessing the extent of harsh disciplining, inconsistent disciplining, and appropriate disciplining.

Finally, we construct a school quality index based on assessor reports. The interviewer visited the child at school and recorded information about whether the school had a set amenities (an office, playground, computers, library, etc), the number of teachers in the school, number of classrooms, class size, and classroom amenities (backboards and other materials). To generate the index, we construct a factor score of these measures.

There were several other questions outside of these 3 major inventories we use to measure parental investment. The 8 dimensions of HOME inventory were separated based on whether they measured more time or monetary investment, or style. Time-intensive parental investments included frequency of mother and father play with the child, whether someone helps with their studies, and the enrichment, family companionship, and family integration subscales of the HOME inventory.

Monetary-intensive investments included the school quality index, whether the child attends private school, the mother's expected grade attainment for the index child, the family's education expenditures in the past month, and the learning materials and physical environment subscales of the HOME inventory.

What we refer to as parenting style is parenting behavior that is not have explicit time or monetary costs. For example, how the mother speaks to the child and the style of discipline so not have an obvious time costs (although they may have cognitive costs for the mother, requiring patience).

4.3.2 Child outcomes

At 6-month and 1-year followups, interviewers measured the length (height) and weight of the infants. They also asked the mother about the infants' recent diarrheal episodes and Acute Respiratory Infections (ARIs). At the 7-year followup, the interviewers were able to measure a much broader set out child outcomes along cognitive, physical, and socio-emotional domains.

Cognitive skills were assessed with the Wechsler Preschool and Primary Scale of Intelligence, designed for children between 2.5 and 7.5 years old (WPPSI-IV). WPPSI-IV provides primary index scales for verbal comprehension (VCI), visual spatial (VSI), fluid reasoning (FRI), working memory (WMI), and processing speed (PSI). Executive

functioning was assessed using a Stroop-like Day/Night test, which gages inhibition and working memory. Additionally, at the start of the interview with the child, basic literacy and numeracy tests were administered, providing math and Urdu scores based on the number correct out of 16 and 12 questions respectively. The interviewer recorded the grade of the child based on teacher report.

Physical development was assessed with growth, fine motor skills, and illness. Interviewers measured height and weight and motor skills were assessed using the Grooved Pegboard Test, which asks the child to place pegs in a correct orientation on a board and records the amount of time the child took to complete the task. The mothers reported about any severe illness, hospitalizations, eye and hearing problems of the child.

Lastly, socio-emotional development was measured along two board domains: behavioral and emotional problems, assessed with the Strengths and Difficulties Questionnaire (SDQ) and anxiety, assessed with the Spence Children's Anxiety Scale (SCAS). Both measures are based on sets of questions answered by the mother.

4.4 Summary Indices

As there are many outcomes, especially at the 7-year followup, we present results using summary indices by generating indices that are the weighted average of a set of outcomes. The index weights outcomes by the sum of the corresponding row of the inverse covariance matrix of outcomes within the index (O'Brien, 1984; Kling et al., 2007; Anderson, 2008). As such, this method places more weight on outcomes with more information, e.g. more uncorrelated variation. This procedure is effectively like running a Seemingly Unrelated Regression on all outcomes on the treatment indicator jointly, and constraining the coefficients to be equal within each group.[13] It is also a Generalized Least Squares estimator, and as such, provides the most efficient estimation of the treatment effect. This approach addresses the problem of multiple inference, but also improves the power of our statistical test for whether the intervention had broad effects.

We group outcomes at the 7-year followup into three broad domains of parenting outcomes in the domains of parenting style, time-intensive parental investment, and monetary-intensive parental investment. We create three indices for child development:

[13]As an alternative approach, we compute factor scores instead of the summary indices. This method is more suited when the measures included in the factor score are proxies of an underlying one-dimensional latent factor, measured with noise. Mechanically, compared to the GLS-weighted summary index, factor scores place less weight on uncorrelated variation. We reestimate the main specifications using factor scores. The results, presented in Appendix Section I, are qualitatively similar.

cognitive development, physical development, and socio-emotional development.[14] All variables are standardized relative to the control group, who are set to be mean zero and standard deviation one, and so that positive values are always associated with positive outcomes. Table B.2 and B.1 show the summary statistics for the variables included in each index for child development and parenting.

5 Econometric Specifications

We first present the treatment effects using the experimental sample of baseline depressed women. Given that treatment assignment was random, the main identification strategy is straightforward. Our principal estimating equation for impacts on outcome measures is

$$Y_{ic} = \alpha + \beta T_c + \mathbf{\Gamma'X_{ic}} + \gamma' \bar{X}_c + \varepsilon_{ic} \tag{5.1}$$

where Y_{ic} is the outcome for the mother-child pair, i. T_c is a dummy equal to one if the mother is in the intervention group, which by the cluster design varies only at the Union Council level, c. Standard errors are clustered at the Union Council level, the unit of randomization. In the main text, we report standard errors clustered using the sandwich estimator, though because the number of clusters (40) is somewhat small, we also show p-values generated from the Wild-t bootstrap method to address few clusters following Cameron et al. (2008).[15]

$\mathbf{X_{ic}}$ is a vector of controls. The parsimonious specification includes only interviewer fixed effects, which absorb variation in outcome variables but are uncorrelated to treatment (thus considerably improving precision). Our main specification controls for the full list of baseline characteristics. The additional controls are baseline values of mental health measures (Hamilton, BDQ, and MSPSS scores and their squares), as well as baseline demographic characteristics: mother's age, its square, parity, mother's height, mother's and father's education, a dummy for the presence of a grandmother, a PCA-weighted wealth index,[16] and interview date (in days after the start of data collection).[17]

Finally, we also include cluster-level averages, $\bar{X}_c$, of baseline values of mother's

[14] Because the number of outcomes during infancy is small, summary indices are not essential. Nevertheless we also present the results in an index form to compare magnitudes over time.

[15] The results are reported in Appendix Table C.8 and show that there is little difference between the Wild-t bootstrapped p-values and those using the sandwich estimator.

[16] The wealth index used as a control is composed of if the following measures of house quality and asset ownership: brick walls, electricity, piped water, flush toilet, water pump, washing machine, air conditioning, refrigerator, TV, radio, bicycle, and car. Additionally, it includes if the mother reports having enough money for food, and the assessor-rated SES measure (5-point Likert scale from poorest to richest).

[17] Child age is excluded from the controls as it is potentially endogenous. The results are nearly identical, however, if we control for age.

age, height, parity, depression severity, perceived social support, family structure, presence of grandmother, wealth, and mother and father's education. We do this for two reasons: first, individual controls may not fully capture differences across clusters (if for example the mother lives in a household without the mother-in-law, but lives in a cluster where many women have social support, she may benefit from that support). Second, when introducing the baseline non-depressed sample, we have otherwise limited information on baseline characteristics for that group. Using cluster-level averages from the depressed sample, we can better control for baseline differences between treatment and control clusters. Results on the sensitivity analysis for the treatment effects with respect to specific sets of controls is presented in Appendix Table C.7.

While all women offered the treatment accepted it, we do not observe how many sessions the women actually received. Without further assumptions, we are only able to estimate the Intention-to-treat (ITT). However, if we assume that all treatment women actually received all sessions, as the treatment was not available to control mothers (and absent attrition concerns), the parameter identified above would be interpreted as the average treatment on the treated (TT) of the intervention.

Not all mothers recovered from depression in the treatment arm, and many mothers in the control arm spontaneously recovered. In our analysis, we will focus on producing only the reduced-form results instead of an instrumental variable approach estimating the impact on maternal depression on parenting and child development outcomes. We do this because it is possible that the intervention, through encouraging healthy thinking and bonding with the child, may have had direct impacts on these outcomes apart from affecting maternal depression, leading the exclusion restriction to not be satisfied.[18]

5.1 Heterogeneity and Quantile Treatment Effects

Our main analysis and hypothesis testing is done combining both genders. Given the setting of rural Pakistan, the culture of son preference, and the fact that the intervention was delivered to mothers, we might expect heterogeneous effects on parenting by child gender. In particular, since treating depression could empower the mother, she may be able to direct more resources to female children (who generally receive fewer inputs). Furthermore, a large literature in child development suggests that male and female children respond differently to early life shocks. Thus, although the main

[18]Furthermore, as the intervention affected the trajectory of maternal depression between child birth to age 7, it is not clear which measure measure of depression should be used for an IV setup. One could argue that the difference in the integrals between the depression trajectory curves of treated and control mothers summarizes the overall effect of the intervention on depression up to the year 7 followup.

hypothesis testing is done on the combined treatment effect, we report results of the treatment effects by gender by estimating 5.1 and replacing the treatment variable with one by gender, ie $\beta^g Treat_c \times Girl + \beta^b Treat_c \times Boy$, and controlling for child gender. We report the p-value of the test for whether the treatment effects differ by gender.[19]

We further explore the heterogeneity in impacts of the intervention and by examining the impacts across the distributions of outcomes. We show quantile treatment effects (QTE) for outcomes in child development and parenting behavior, where the QTE is the horizontal distance between the treated and control group CDF at a given percentile. Because treatment was randomized, the treatment effect at the quantiles is also identified. We estimate the QTE for each quantile between 5 and 95.[20] We use inverse propensity score weights to account for observables, controlling for full list of baseline variables described above. For inference, we construct point-wise confidence intervals at each quantile by bootstrapping using 1,000 replications with replacement, clustered at the Union Council level. Quantile treatment effects can be interpreted as the distribution of treatment effects under the assumption that treatment preserves the ranking of outcomes relative to the counterfactual ranking. Intuitively, this is unlikely to be the case in our setting. Tests of this assumption can be made if the outcome is measured before the treatment (in this case, depression severity is the only outcome we measure before treatment, and the assumption of rank preservation for depression severity is not satisfied).

5.2 Multiple Inference and Power

We further account for multiple hypothesis testing across the three indices within child development and parenting by calculating p-values using a step-down procedure with a non-parametric permutation test which controls the family-wise error rate (following (Anderson, 2008; Efron and Tibshirani, 1994)). We also calculate the Family-Wise Error Rate (FWER)-adjusted p-values when we explore the effects of the intervention

[19] We also explore heterogeneity in the treatment effects along several other characteristics. For example, treatment effects may differ by baseline depression severity, parental education, wealth, family structure, mother's age, whether the index child is the first child. We present heterogeneous treatment effects estimating one equation:

$$Y_{ic} = \alpha + \beta_1 Het_i + \beta_2 T_c + \beta_3 Het_i \times T_c + \mathbf{\Gamma}' \mathbf{X_{ic}} + \varepsilon_{ic} \tag{5.2}$$

where Het_i is the dimension of heterogeneity we are exploring (all measured at baseline, except for child gender). The coefficient on the interaction term, β_3, allows us to see the differential effect of the intervention along that specified dimension. However, as we find almost no evidence of heterogeneity, these result are presented in Appendix F.

[20] We implement the code from Frölich and Melly (2013) to calculate the QTEs. We use a bootstrapping procedure to calculate the confidence intervals instead of the analytical calculations in order to account for the cluster-randomized design.

within the components of the indices.

Power calculations for the 7-year re-enrollment relied on the WPPSI-III full scale IQ measure. Calculations were based on re-enrollment numbers that were slightly optimistic with N of 328 in the THP arm (actual 289) and 314 in the control arm (actual 296) and an inter-cluster correlation (ICC) of 0.05. The ICC was based on the observed ICC in the same clusters for the maternal mental health variables in the original study (Rahman et al., 2008). With these parameters, the study had 80% power to detect 0.36 standard deviation difference in IQ scores. We may also be concerned that the ex-post balance could substantially effect the power of our analysis. Updating the parameters to reflect the actual sample size, and adjusting for the reduction in explanatory variance (by calculating share of variance unexplained after controlling for the full set of demographics) due to imbalance in covariates, discussed below, the MDE increases to 0.38 standard devisions. Our study is thus powered similarly to the intervention by Attanasio et al. (2014), who provided psychosocial stimulation via weekly home visits to Colombian mothers with children 12-24 months for a period of 18 months. The study was powered to detect a 0.33 standard deviation in test score, and they find that stimulation improved cognitive scores by 0.26 of a standard deviation.

5.3 Attrition

The small differences in balance between the 1-year followup sample and the 7-year followup is due to attrition, and at first glance does not appear to be strongly differential by treatment group. Appendix Table D.12 confirms that LTFU (attritors) and mothers that were re-enrolled were fairly similar along most characteristics. LTFU mothers were poorer, perceived less social support, and were less likely to have a grandmother present at the 1-year followup (despite no baseline differences). Appendix Table D.13 shows baseline characteristics of the LTFU women by treatment group. Consistent with the similar balance between the original 1-year followup sample and the 7-year followup sample reported in Table 1, there were no differences between treated and control LTFU mothers at the 5% significance level.

Nevertheless, we take two approaches to account for attrition: one parametric and one non-parametric. First, we present estimates of the main results using Inverse Probability Weighting, where the weights were calculated as the predicted probability of being in the 7-year followup sample based on the available baseline controls. Second, we calculate attrition bounds based on Lee (2009), which sorts the outcomes from best to worst within each treatment arm and then trims the sample from above and below

to construct groups of equal size.[21] [22]

5.4 Difference-in-differences with prenatally non-depressed mothers

Because we interviewed baseline non-depressed dyads from both treatment and control clusters at the 7-year followup, we are able to construct an alternative specification using the baseline non-depressed as an additional control, effectively a difference-in-difference analysis. Because the treatment was randomized, a single difference is sufficient to estimate the causal effect of the intervention. Baseline balance tests are help validate the randomization when looking at outcomes in the shortly after the baseline measures. However, over time, in this case 7 years after the baseline measures, shocks correlated to treatment assignment could undermine randomization. Thus, by including the baseline non-depressed sample, we can test if our results are driven spuriously due to some clusters experiencing shocks unrelated to treatment in the period after the 1-year followup. We also test if there is balance along fixed demographic characteristics among prenatally non-depressed women along the dimension of randomization and we cannot reject that the two samples are different (with p-value=0.38, Appendix Table E.14). This alternative empirical approach assumes that if clusters experienced shocks that were correlated to treatment assignment, the trends of prenatally non-depressed mothers would be similar to those of the prenatally depressed mothers. The estimating equation is

$$Y_{ic} = \alpha + \beta T_c \times Depressed_{ic} + \delta Depressed_{ic} + \eta T_c + \mathbf{\Gamma'\tilde{X}_{ic}} + \gamma' \bar{X}_c + \lambda_{LHW} + \varepsilon_{ic} \quad (5.3)$$

where $Depressed_{ic}$ is a dummy that equals one if the mother was prenatally depressed at the baseline screening. The coefficient on the interaction $T_c \times Depressed_{ic}$ will pick up the effect of being in treated group (a Union Council assigned to treatment) and prenatally depressed, controlling for the overall difference between depressed and non-depressed mothers, and the overall effects of being associated with a Union Council

[21] We report bounds without tightening using covariates. However, the bounds were similar using the perceived social support, SES, and grandmother at baseline as controls for attrition bounding since these were the baseline characteristics that were most likely to predict attrition. Including these controls moved the bounds closer to zero, indicating that the controls were not strongly predicting attrition.

[22] We take as the original sample the women whose children were "interviewed" in the 1-year followup of the THP, since this was the starting sample that was targeted for re-enrollment in the SB followup. The overall attrition from baseline was 35%. Another attrition analysis could be preformed using the baseline sample of women at the start of THP, though this would include two types of attrition: attrition during THP and attrition due to not being located for the SB followup. In fact, we may be more concerned about the first type of attrition, since women who did not benefit or were adversely affected by the CBT intervention could have left the sample at that point and biased our estimates of short-term effects upwards. However, attrition between baseline and the 1-year followup was not differential to treatment status (column 6, Table 1).

assigned to treatment.

The vector of controls in $\mathbf{\Gamma}'\tilde{\mathbf{X}}_{\mathbf{ic}}$ is different to that in equation 5.1 because we do not have baseline characteristics for prenatally non-depressed mothers. Instead, we include time-invariant individual specific demographic characteristics and the cluster-averaged baseline characteristics ($\bar{X}_c$) from the depressed sample identical to those described above.[23] We are also able to control for current Lady Health Worker fixed effects (λ_{LHW}).[24]

The coefficient β represents the treatment effect in the difference-in-difference specification. The parameter η is of interest as it indicates the average difference between treated and control clusters for mothers who were not part of the experiment. If η were positive and significant, this would suggest that treatment and controls clusters experienced differential shocks benefiting treatment relative to control. Alternatively, it could signify that there might have been positive spillovers of the intervention to nearby non-depressed mothers. If we find that η is not different from zero, it provides further evidence that any positive treatment effects estimates from the simple randomization (Eqn 5.1) are not driven by differential shocks that might have occurred since baseline.[25] Last, δ provides an estimate of the difference in outcomes between control mothers who were prenatally depressed and mothers who were not prenatally depressed.

6 Results

6.1 Short-term effects

We first present results on the effects of the intervention on parenting and child development at infancy, noting that we have limited measurements at this point in time. Table 2 shows the effects of the intervention on parenting behavior, and Table 3 infant health outcomes.[26] Column 4 shows the covariate adjusted treatment effects, though

[23] The individual specific controls are mother's age and its square, mother's and father's education, parity at baseline (estimated based on parity in 2013 and the reported number of children born since the index child), date of interview and interviewer fixed effects.

[24] Recall that children were administered the cognitive tests at the LHWs house to ensure a more standardize environment. These are the LHWs who are currently serving the families, and not necessarily the original 40 LHWs from the intervention since many LHWs moved, retired, or stopped work for other reasons. At the 7-year followup, there were a total of 65 LHWs. The results are similar without LHW FEs.

[25] Alternatively, we could also include Union Council (UC) fixed effects, γ_c, which absorb the indicator for T_c, that is, being assigned to a treatment cluster. Since the parameter η is of interest, we present the results using the more parsimonious specification. However, the results are similar when including UC fixed effects.

[26] For consistency, the sample in these tables is the sample that was found at the 7-year followup. The results are similar including attritors, and generally mirror those reported in Rahman et al. (2008) despite different estimation strategies and controls.

we note that controlling for covariates has minor impacts on point estimate magnitudes or standard errors. Overall, the invention improved parenting by 0.5 standard deviations, and there was no evidence of heterogeneity by child gender. Our results indicate that treated mothers were more prepared for delivery of the child, and we see large and significant effects on the frequency of *both* mother and father play at 1-year. Weaker evidence points to effects on breastfeeding and practicing birthspacing. Treated mother were slightly more likely, by 9 percentage points (though not statistically significant), to be exclusively breastfeeding at 6 months and 12 percentage points more likely to practice birthspacing.[27]

There is some evidence that the intervention improved infant health in the short run. However, the effects on child length at 6 months and 1 year appear only after including the full battery of baseline controls (and are due to changing the point estimate rather than the standard error). Nevertheless, the patterns are the same throughout for length, diarrhea, and acute respiratory infections (but not weight). Overall, the intervention improved child health by 0.4 standard devations by 1 year (0.3 without controls), largely driven by reductions in acute respiratory infections. Similar to parenting, we see no evidence of heterogeneity by the gender of the child.

6.2 Parenting behavior at age 7

Consistent with the improvements in parenting observed during infancy, we find that the intervention improved parenting, specifically time- and monetary-intensive investments at age 7. Table 4 shows the effect of the intervention on parenting behavior at the 7-year followup for the three domains of parental investment. Column 1 shows the point estimates on the treatment indicator without controlling for baseline covariates, while Column 2 includes all baseline controls. Column 3 reports the FWER-adjusted p-values for the fully controlled specification. Our results indicate that the intervention significantly increased time-intensive investment by 0.20 standard deviations ($p=0.02$) and monetary-intensive investment by 0.28 standard deviations ($p<0.00$), but had no effect on parenting style. Including the full baseline controls has very small impacts on the parameter estimates: the coefficient on time investment is identical while the coefficient on monetary investment is 10% smaller. Interestingly, the coefficient on parenting style is negative but not measured precisely. Corrections for attrition reveal no evidence our results are biased due to endogenous attrition: Inverse Probability Weighting yields similar point estimates and the 95% confidence interval calculated from attrition bounds are strictly positive for time and monetary investment (Table

[27] Interestingly, we see no effects of the intervention on the trajectory of fertility, for either gender of the index child.

D.11).

Time and monetary investment respondent more to treatment if the index child is a girl, though differential effect of treatment by gender is significant only for monetary investment. Estimates of heterogeneous treatment effects along other dimensions of baseline characteristics do not reveal any strong patterns, as coefficients on the interaction term are small and statistically insignificant (Tables F.17 and F.18). Exploring the heterogeneity further, the results for quantile treatment effects, plotted in Figure 1a, reveal little difference in treatment effects over the distribution of parental inputs.

Looking within the indices (Tables G.23 and G.24), we find that the results for time-intensive investments are driven by enrichment and family companionship subscales of the HOME inventory, and the likelihood that someone in the family helps with studies. The effects on mother and father play with children (which were highly significant at the 1-year followup) are very small, though this is likely because very few mothers report the family plays with the children at all. For monetary investment, no individual outcome is significant after controlling for multiple inference, however, the direction of effects is consistent (except for the physical environment subscale from the HOME inventory). The pattern of larger effects for girls is consistent within individual components of the indices. We note that although most parts of the time-intensive domain is self-reported, many of measures within the monetary-intensive investment for which we find positive effects of treatment are interviewer observed (for example, if the child attends private school and the school quality score).[28]

The results are also similar using the alternative, difference-in-differences, specification. The point estimates of the effect of the intervention, in Column 2 of Table 5, are 0.19 standard deviations for time and 0.24 standard deviations for monetary investment, slightly smaller than those estimated using the straight difference, though the standard errors are considerably larger. We find no evidence that our results are driven by favorable shocks to treatment clusters relative to control, as the coefficients on the indicator for treatment cluster (Column 1) is actually negative across all domains. Interestingly, for parenting style, the coefficient on $Treat$ is actually significantly negative, while the coefficient on $Treat \times Depressed$ is slightly positive, indicating that the

[28]We refrain from inferring too much of within index analysis for domains that we cannot reject the null of no treatment effects. With that caveat in mind, we do note that the null effect on parenting style is largely driven by the parenting practices inventory. We find positive effects of the intervention on the emotional interaction between mother and child (responsivity and emotional climate subscales of the HOME inventory, Table G.22). Interestingly, portions of these subscales are interviewer observed, which means they are less prone to reporting bias from the mother. Table H.28 shows the treatment effects within subscales of the HOME inventory and an additional measure of positive parenting using the interviewer observed measures only. We find that the mothers responsivity and positive interactions with her child during the interview were significantly higher among treated girls (but insignificant and negative among treated boys).

negative effect in the simple difference estimated in Table 4 may be due to unfavorable trends in treatment clusters. In Column 3, we see that mothers who were prenatally depressed invested 0.16 standard deviations less time and 0.15 less momentary resources than prenatally non-depressed. We note these differences are imprecisely estimated in this specification, though more simple comparisons of depressed controls and prenatally non-depressed mothers reveal that time and monetary investment is highly statistically different, while there is still no difference in parenting style (Table E.16). Given the limited differences in parenting style among the endogenous comparison of prenatally depressed and non-depressed, it is perhaps not surprising that we find no effects on parenting style. In the second panel, we separate out the double-difference by gender and find that the effects of the intervention on time and monetary investment are still larger for girls than boys, mirroring the results in Table 4.

6.3 Child outcomes at age 7

While we find robust and persistent effects of the intervention on parental inputs through early childhood, we find limited effects of the intervention on child development measured at age 7. We find positive effects on physical development, but no effects on cognitive development despite improvements in schooling inputs. Furthermore, there appears to be a perverse, though indistinguishable from zero, effect on socio-emotional development.

Table 6 shows the effect of the intervention on the three broad domains of child development. The inclusion of covariates has little effect on the estimates of cognitive and socio-emotional development, though the controls do have an effect on the estimate of physical development. Without controls, the coefficient on physical development is 0.14, but including controls increases the point estimate to 0.24 standard deviations (and reduces the standard error by 30%). This pattern was also evident with infant growth (length). Looking within the index, it appears these results are driven by illness-related issues and motor function rather than height or weight. Comparisons of children from prenatally depressed controls to prenatally non-depressed mothers suggest the same pattern: there are no differences in weight or height, small but insignificant difference in rates of stunting and thinness, but significant differences emerge in rates of illness, eyesight problems, and hospitalization (Table E.16). Furthermore, in simple comparisons between prenatally depressed controls and prenatally non-depressed, we see no differences in cognitive development and some differences in socio-emotional development (particularly in child anxiety).

There is no evidence of heterogeneity by gender (Column 6, Table 6), and estimates of heterogeneous treatment effects along other dimensions of baseline characteristics

do not reveal any strong patterns, as coefficients on the interaction term are small and statistically insignificant (Tables F.19 and F.20). Estimates of Quantile Treatment Effects (QTEs), plotted in Figure 1b, provide no evidence that the null average effects on cognitive or socio-emotional development were masking heterogeneity in the distribution. QTEs for physical development show the largest effects in the lower two-thirds of the distribution.

The difference-in-difference specification reveals that the null effects on cognitive and socio-emotional domains are not being masked by spurious negative shocks to treatment clusters (Column 2 of Table 7). The coefficient on cognitive development becomes more negative, while the coefficient on socio-emotional development becomes less negative. Unfortunately, the coefficient on physical development is considerably smaller than that estimates in the single difference, due to the small positive point estimate on $Treat$. Although the difference-in-difference estimate of treatment on physical development is still positive (0.1 standard deviations), combined with the fact that the significant positive effect on physical development is not apparent without the inclusion of baseline controls, we interpret our positive findings on physical development with caution. Overall, we note there is no clear pattern indicating spillovers to the non-depressed in treatment clusters or spurious shocks driving our results. Column 3, which reports differences between children of non-treated prenatally depressed mothers and prenatally non-depressed, mirror in the results of the simple comparisons in Table E.16 showing the most significant developmental differences in physical development, followed by socio-emotional, and no differences (indeed, the coefficient flips signs) for cognitive development.

7 Discussion

We find robust evidence that the intervention significantly impacted parenting behavior, improving time-intensive and monetary-intensive investment, though there was no effect parenting style. Although we do not measure parenting between the 1-year and 7-year followups, our results indicating increased parental investment at both points in time would suggest that the treatment had a sustained effect on parental investment.

We find weak evidence that the intervention impacted children's physical development but no detectible effects on cognitive and socio-emotional development at age 7. These null effects on child outcomes cannot be explained by attrition, heterogeneity, spurious trends in clusters masking treatment, or compensating investment in the control group.[29]

[29]It is possible the perverse effects of the intervention on socio-emotional development are an artifact of its measurement: it is entirely dependent on mother report (unlike other domains of child

One explanation of why we find no effects on cognitive and socio-emotional development is because the indices are not sensible constructs for this population. To check this, we regressed each index on relevant covariates (see Tables B.5 and B.6), and indeed, the indices look sensible. In another related check to see if the indices were sensible, we regressed each index of child development on parenting inputs, the results of which are reported in Table 8. The first column for each index show the association between parenting at infancy and child development at age 7: although positive for cognitive and physical development, the coefficients are small and not statistically different from zero (we note however, that in Table B.6, father play at infancy was indeed associated with cognitive development). Parenting measures at age 7, however, are strongly associated with child development but different inputs are associated with different outputs. For cognitive development, we find that monetary investment is the most strongly associated, though parenting style and time investment are both positively associated. Meanwhile, only monetary investment is statistically associated with physical development, and only parenting style is statistically associated with socio-emotional development. Including the sample of prenatally non-depressed women does not affects these gradients, ie, the gradients of inputs and outputs are similar for the two samples. Further echoing other results, prenatal depression is associated with worse physical and socio-emotional development but the coefficient is positive for cognitive development.

A second explanation of why we find no effects on child development despite significant improvements in parenting inputs might be if our results are contaminated by Hawthorne effects: that is, if treated mothers reported feeling better to satisfy the experimenters but their mental health did not actually improve. But we find significant effects of the intervention on maternal mental health 7 years later, as well as effects on a number of interviewer-measured (noting that interviewers were blind to the treatment status of mothers) outcomes like school quality and positive interaction between the mother and child.

Are we failing to capture effects through domain selection? Interventions designed to improve cognitive skills may have larger effects on non-cognitive skills and vice versa (e.g. Project Star Chetty et al. (2011)) and evaluation sometimes concludes no effects when in fact it may be that it measures the "wrong" outcome. But we measured a fairly comprehensive range of indicators of parental investment and child development. In comparison between baseline depressed and non-depressed samples, children of depressed (and untreated) women have significantly worse socio-emotional

development and parental inputs). Mothers who received the intervention were potentially more attuned to the psychological disposition of her child.

development. They are also more likely to be ill/hospitalized. There are differences in indicators of parental monetary and time investment (though not parenting style). However they exhibit no significant deficits in cognitive development or physical growth. So treatment may not have the potential to modify cognitive and growth outcomes at this age, although there may be delayed effects.

Might it be that impacts of the intervention do not persist to outcomes at age 7 because it was initiated too late in pregnancy or stopped too early? For instance, maybe damage to child development was done before the 3rd trimester. So, although we see behavioral change, this is not sufficient to reverse the damage. If this were correct, we would expect to see children of depressed mothers do worse than children of non-depressed mothers. But we see limited differences in cognitive development and physical growth between these samples. Also, we see various early life inputs improve, so the intervention as designed was successful.

Another explanation of why we see no effects on cognitive development and physical growth could be due to fading. A mechanism by which effects fade is catch up on the part of the control group, a pattern we do observe for trajectories of maternal depression. However, we document endogenous reinforcing investments during infancy and at age 7. Chetty et al. (2011), who highlighted fading, argued that fading was observed for cognitive skills. They speculated that non-cognitive skills were affected by the treatment and that these drive positive effects on adult earnings. In our study, we measure non-cognitive skills and they do not respond to treatment. We think fading is unlikely to explain our results because (1) we find no evidence of compensation; (2) previous work shows that inputs in infancy have lasting effects; and (3) because despite any enhanced care that the control group received, the short term effects all favor the treated group.

8 Conclusion

We evaluate the effects of a randomized intervention that generated strong healing effects on maternal depression postpartum and through to age 7 on parental investment and child development. We identify significant improvements in parental investments in the treated group at age 1 and age 7, but find weak evidence of improvement in physical health and development of the child and no detectable effects on cognitive or socio-emotional development at age 7. Our results are not driven by differential attrition, and in a unique analysis for a randomized evaluation, we can rule out that our results are driven by omitted trends using a second comparison group of non-treated women from treatment and controls clusters. Further, the comparing children of prenatally non-depressed women to those of depressed women reveals limited differences

in development, particularly cognitive development and physical growth. We suggest possible latent effects, premised on evidence that the inputs we see improvements in have long run returns.

References

Adhvaryu, Achyuta, James Fenske, and Anant Nyshadham, "Early Life Circumstance and Adult Mental Health," 2014, (February).

__ , **Teresa Molina, Anant Nyshadham, and Jorge Tamayo**, "Recovering from Early Life Trauma: Dynamic Substitution between Child," 2015.

Aizer, Anna, Laura Stroud, and Stephen Buka, "Maternal Stress and Child Well-Being: Evidence from Siblings," 2009, pp. 1–49.

Almond, Douglas and Janet Currie, "Human capital development before age five," *Handbook of Labor Economics*, 2011, *4*, 1315–1486.

__ **and** __ , "Killing Me Softly: The Fetal Origins Hypothesis," *Journal of Economic Perspectives*, 2011, *25* (3), 153–172.

Anderson, Michael L., "Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects," *Journal of the American Statistical Association*, dec 2008, *103* (484), 1481–1495.

Apter-Levy, Yael, Michal Feldman, Adam Vakart, Richard P Ebstein, and Ruth Feldman, "Impact of maternal depression across the first 6 years of life on the child's mental health, social engagement, and empathy: The moderating role of oxytocin.," *The American journal of psychiatry*, 2013, *170* (10), 1161–8.

Attanasio, O. P., C. Fernandez, E. O. a. Fitzsimons, S. M. Grantham-McGregor, C. Meghir, and M. Rubio-Codina, "Using the infrastructure of a conditional cash transfer program to deliver a scalable integrated early child development program in Colombia: cluster randomized controlled trial," *BMJ*, 2014, *349* (sep29 5), g5785–g5785.

Attanasio, Orazio P, Sarah Cattan, Emla Fitzsimons, Costas Meghir, and Marta Rubio-Codina, "Estimating the production function for human capital : Results from a randomized control trial in Colombia," 2015.

Baker, Michael and Kevin Milligan, "Maternity Leave and Children's Cognitive and Behavioral Development," *Journal of Population Economics*, 2015, *28*, 373–391.

__ , **Jonathan Gruber, and Kevin Milligan**, "Universal Child Care, Maternal Labor Supply, and Family Well-Being," *Journal of Political Economy*, 2008, *116* (4), 709–745.

Banerjee, Abhijit V and Esther Duflo, "The Economic Lives of the Poor," *Journal of Economic Perspectives*, jan 2007, *21* (1), 141–167.

Baranov, Victoria, Sonia Bhalotra, and Joanna Maselko, "The Long-term Impact of Treating Maternal Depression: Evidence from a Randomized Controlled Trial in Pakistan," 2015.

Becker, G S and N Tomes, "Human capital and the rise and fall of families.," *Journal of labor economics*, 1986, *4* (3 Pt. 2), 1–47.

Bernard, Tanguy, Stefan Dercon, and Alemayehu Seyoum Taffesse, "Beyond fatalism-an empirical exploration of self-efficacy and aspirations failure in Ethiopia.," 2011.

Black, Sandra E, Paul J Devereux, and Kjell G Salvanes, "Does grief transfer across generations? Bereavements During Pregnancy and Child Outcomes," 2014.

Blattman, Christopher, Julian C Jamison, and Margaret Sheridan, "Reducing crime and violence : Experimental evidence on adult noncognitive investments in Liberia," 2015.

Bolier, Linda, Merel Haverman, Gerben Westerhof, Heleen Riper, Filip Smit, and Ernst Bohlmeijer, "Positive psychology interventions: a meta-analysis of randomized controlled studies.," *BMC public health*, 2013, *13*, 119.

Caldwell, B. and R. Bradley, *Home Observation for Measurement of the Environment (HOME)-revised edition.*, Little Rock, AR: University of Arkansas, Little Rock., 1984.

Cameron, A. Colin, Jonah B. Gelbach, and Douglas L. Miller, "Bootstrap-Based Improvements for Inference with Clustered Errors," 2008.

Carneiro, Pedro, Claire Crawford, and Alissa Goodman, "The Impact of Early Cognitive and Non-Cognitive Skills on Later Outcomes," 2007.

Case, Anne and Angus Deaton, "Health and Wealth among the Poor: India and South Africa Compared," *American Economic Review Papers and Proceedings*, 2005, *95* (2), 229–233.

Chetty, Raj, John N. Friedman, Nathaniel Hilger, Emmanuel Saez, Diane Whitmore Schanzenbach, and Danny Yagan, "How does your kindergarten classroom affect your earnings? Evidence from project star," *Quarterly Journal of Economics*, 2011, *126* (November), 1593–1660.

Conti, Gabriella and James J Heckman, *Economics of Child Well-Being*, Springer, 2014.

Cooper, Peter J, Mark Tomlinson, Leslie Swartz, Mireille Landman, Chris Molteno, Alan Stein, Klim McPherson, and Lynne Murray, "Improving quality of mother-infant relationship and infant attachment in socioeconomically deprived community in South Africa: randomised controlled trial.," *BMJ (Clinical research ed.)*, 2009, *338*, b974.

Cooper, Peter J., Mireille Landman, Mark Tomlinson, Christopher Molteno, Leslie Swartz, and Lynne Murray, "Impact of a mother-infant intervention in an indigent peri-urban South African context. Pilot study," *British Journal of Psychiatry*, 2002, *180*, 76–81.

Cuijpers, Pim, Annemieke van Straten, Gerhard Andersson, and Patricia van Oppen, "Psychotherapy for depression in adults: A meta-analysis of comparative outcome studies.," *Journal of Consulting and Clinical Psychology*, 2008, *76* (6), 909–922.

Cunha, Flavio, James J Heckman, and Susanne Schennach, "Estimating the Technology of Cognitive and Noncognitive Skill Formation.," *Econometrica*, may 2010, *78* (3), 883–931.

Currie, Janet, "Healthy, wealthy, and wise: Is there a causal relationship between child health and human capital development?," *Journal of Economic Literature*, 2009, *47* (1), 87–122.

__ , "Inequality at birth: Some causes and consequences," *American Economic Review*, 2011, *101*, 1–22.

__ **and Brigitte C Madrian**, "Health, health insurance and the labor market," *Handbook of labor economics*, 1999, *3*, 3309–3416.

__ **and Duncan Thomas**, "Early Test Scores, School Quality and SES: Longrun Effects on Wage and Employment Outcomes," in "35th Anniversary Retrospective (Research in Labor Economics, Volume 35)" 2012, pp. 185–214.

__ **and Mark Stabile**, "Child mental health and human capital accumulation: the case of ADHD," *Journal of health economics*, 2006, *25* (6), 1094–1118.

Dalton, Patricio S, Sayantan Ghosal, and Anandi Mani, "Poverty and Aspirations Failure," *The Economic Journal*, 2015.

Diego, Miguel, Tiffany Field, Maria Hernandez-Reif, Saul Schanberg, Cynthia Kuhn, and Victor Hugo Gonzalez-Quintero, "Prenatal depression restricts fetal growth," *Early Human Development*, 2009, *85* (1), 65–70.

Dustmann, Christian and Uta Schönberg, "Expansions in maternity leave coverage and children's long-term outcomes," *American Economic Journal: Applied Economics*, 2012, *4* (3), 190–224.

Efron, B and R J Tibshirani, *An Introduction to the Bootstrap*, Vol. 57, CRC Press, 1994.

Feldman, Ruth, Ilanit Gordon, Inna Schneiderman, Omri Weisman, and Orna Zagoory-Sharon, "Natural variations in maternal and paternal care are associated with systematic changes in oxytocin following parent-infant contact," *Psychoneuroendocrinology*, 2010, *35* (8), 1133–1141.

Field, Thomas A, Eric T Beeson, and Laura K Jones, "The New ABCs: A Practitioner's Guide to Neuroscience-Informed Cognitive-Behavior Therapy," *Journal of Mental Health Counseling*, jul 2015, *37* (3), 206–220.

Friedman, Jed and Duncan Thomas, "Psychological health before, during, and after an economic crisis: Results from Indonesia, 1993-2000," *World Bank Economic Review*, 2009, *23* (1), 57–76.

Frölich, Markus and Blaise Melly, "Unconditional Quantile Treatment Effects Under Endogeneity," *Journal of Business & Economic Statistics*, 2013, *31* (3), 346–357.

Gao, Ling Ling, Sally Wai Chi Chan, Xiaomao Li, Shaoxian Chen, and Yuantao Hao, "Evaluation of an interpersonal-psychotherapy-oriented childbirth education programme for Chinese first-time childbearing women: A randomised controlled trial," *International Journal of Nursing Studies*, 2010, *47*, 1208–1216.

Genicot, Garance and Debraj Ray, "Aspirations, inequality, investment and mobility," *Georgetown University and New York University, mimeo*, 2009.

Glewwe, Paul, Phillip H Ross, and Bruce Wydick, "Developing Aspirations: The Impact of Child Sponsorship on Self-Esteem and Life Expectations," 2015.

Gunnsteinsson, Snaebjorn, Achyuta Adhvaryu, Parul Christian, Alain Labrique, Jonathan Sugimoto, Abu Ahmed Shamim, and Keith P. Jr West, "Resilience to early life shocks," 2014.

Haushofer, Johannes and Ernst Fehr, "The Psychology and Neurobiology of Poverty," Technical Report, Revise and Resubmit in Science 2013.

__ **and** __ , "The Psychology and Neurobiology of Poverty," *Science*, 2014, *344* (6186), 1–40.

__ **and Jeremy Shapiro**, "Household Response to Income Changes : Evidence from an Unconditional Cash Transfer Program in Kenya," 2013.

Heckman, James J., Jora Stixrud, and Sergio Urzua, "The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior," Technical Report, National Bureau of Economic Research 2006.

Heller, Sara B, Anuj K Shah, Jonathan Guryan, Jens Ludwig, Sendhil Mullainathan, and Harold A Pollack, "Thinking, Fast and Slow? Some Field Experiments to Reduce Crime and Dropout in Chicago," *NBER Working Paper*, 2015, (21178).

Heller, Sara, Harold A Pollack, Roseanna Ander, and Jens Ludwig, "Preventing Youth Violence and Dropout: A Randomized Field Experiment," *NBER Working Paper*, 2013, (19014).

Hsin, Amy and Christina Felfe, "When Does Time Matter? Maternal Employment, Children's Time With Parents, and Child Development," *Demography*, 2014, *51* (5), 1867–1894.

Ifcher, John and Homa Zarghamee, "Happiness and Time Preference: The Effect of Positive Affect in a Random-Assignment Exper," *The American Economic Review*, dec 2011, *101* (7), 3109–3129.

Kaplow, Julie B, Patrick J Curran, Adrian Angold, and E Jane Costello, "The Prospective Relation Between Dimensions of Anxiety and the Initiation of Adolescent Alcohol Use," *Journal of Clinical Child Psychology*, 2001, *30* (3), 316–326.

Kessler, Ronald C and Richard G Frank, "The impact of psychiatric disorders on work loss days.," *Psychological medicine*, 1997.

Kesternich, Iris, Bettina Siflinger, James Smith, and Joachim Winter, "Individual Behavior as a Pathway between Early-Life Shocks and Adult Health: Evidence from Hunger Episodes in Post-War Germany," 2013.

Kling, Jeffrey R, Jeffrey B Liebman, and Lawrence F Katz, "Experimental Analysis of Neighborhood Effects," *Econometrica*, jan 2007, *75* (1), 83–119.

Knapp, Martin, Michelle Funk, Claire Curran, Martin Prince, Margaret Grigg, and David McDaid, "Economic Barriers to Better Mental Health Practice and Policy," *Health Policy and Planning*, may 2006, *21* (3), 157–170.

Krishnan, Pramila and Sofya Krutikova, "Non-cognitive skill formation in poor neighbourhoods of urban India," *Labour Economics*, oct 2013, *24* (0), 68–85.

Lara, Ma A., Claudia Navarro, and Laura Navarrete, "Outcome results of a psycho-educational intervention in pregnancy to prevent PPD: A randomized control trial," *Journal of Affective Disorders*, 2010, *122*, 109–117.

Layard, Richard, Andrew E Clark, Francesca Cornaglia, Nattavudh Powdthavee, and J Vernoit, "What predicts a successful life? A life-course model of well-being," *The Economic Journal*, 2014.

Lee, David S, "Training, wages, and sample selection: Estimating sharp bounds on treatment effects," *The Review of Economic Studies*, 2009, *76* (3), 1071–1102.

ling Gao, Ling, Sally Wai chi Chan, and Ke Sun, "Effects of an interpersonal-psychotherapy-oriented childbirth education programme for Chinese first-time childbearing women at 3-month follow up: Randomised controlled trial," *International Journal of Nursing Studies*, 2012, *49*, 274–281.

Lund, Crick, Mary De Silva, Sophie Plagerson, Sara Cooper, Dan Chisholm, Jishnu Das, Martin Knapp, and Vikram Patel, "Poverty and Mental Disorders: Breaking the Cycle in Low-Income and Middle-Income Countries," *Lancet*, oct 2011, *378*, 1502–1514.

Macours, Karen and Renos Vakis, "Changing Households Investments and Aspirations through Social Interactions," *World Bank Research Working papers*, 2009, pp. 1–45.

Mani, Anandi, Sendhil Mullainathan, Eldar Shafir, and Jiaying Zhao, "Poverty Impedes Cognitive Function," *science*, 2013, *341* (6149), 976–980.

Mao, Hong Jing, He Jiang Li, Helen Chiu, Wai Chi Chan, and Shu Ling Chen, "Effectiveness of Antenatal Emotional Self-Management Training Program in Prevention of Postnatal Depression in Chinese Women," *Perspectives in Psychiatric Care*, 2012, *48*, 218–224.

McLeod, J. D. and Karen Kaiser, "Childhood Emotional and Behavioral Problems and Educational Attainment," 2004.

Mullainathan, Sendhil and Eldar Shafir, *Scarcity: Why Having Too Little Means So Much*, Macmillan, 2013.

Murray, L and P J Cooper, "Postpartum depression and child development.," 1997.

Murray, Lynne, Agnese Fiori-Cowley, Richard Hooper, and Peter Cooper, "The impact of postnatal depression and associated adversity on early mother-infant interactions and later infant outcome," *Child development*, 1996, *67* (5), 2512–2526.

__ , Dana Sinclair, Peter Cooper, Pierre Ducournau, Patricia Turner, and Alan Stein, "The socioemotional development of 5-year-old children of postnatally depressed mothers," *Journal of Child Psychology and Psychiatry*, 1999, *40* (08), 1259–1271.

O'Brien, P C, "Procedures for comparing samples with multiple endpoints.," *Biometrics*, 1984, *40* (4), 1079–1087.

Organization, World Health, *Investing in mental health*, Geneva: World Health Organization, 2003.

__ , *Mental health and the workplace*, World Health Organization, 2005.

Patel, Vikram and Arthur Kleinman, "Poverty and Common Mental Disorders in Developing Countries," *Bulletin of the World Health Organization*, 2003, *81* (8), 609–615.

Persson, Petra and Maya Rossin-Slater, "Family Ruptures, Stress, and the Mental Health of the Next Generation," 2014, (April).

Rahman, A, Z Iqbal, and R Harrington, "Life events, social support and depression in childbirth: perspectives from a rural community in the developing world.," *Psychological medicine*, 2003, *33* (7), 1161–1167.

Rahman, Atif, "Maternal depression and child health: the need for holistic health policies in developing countries," *Harv Health Pol Rev*, 2005, *6*, 70–80.

__ , "Challenges and opportunities in developing a psychological intervention for perinatal depression in rural Pakistan – a multi-method study," *Archives of Women's Mental Health*, oct 2007, *10* (5), 211–219.

__ , Abid Malik, Siham Sikander, Christopher Roberts, and Francis Creed, "Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: a cluster-randomised controlled trial," *The Lancet*, 2008, *372* (9642), 902–909.

__ , Jane Fisher, Peter Bower, Stanley Luchters, Thach Tran, M Taghi Yasamy, Shekhar Saxena, and Waquas Waheed, "Interventions for common perinatal mental disorders in women in low- and middle-income countries: a systematic review and meta-analysis.," *Bulletin of the World Health Organization*, 2013, *91* (8), 593–601I.

Ray, Debraj, "Aspirations, poverty, and economic change," *Understanding poverty*, 2006, (March), 409–421.

Shah, Anuj K, Sendhil Mullainathan, and Eldar Shafir, "Some consequences of having too little," *Science*, 2012, *338* (6107), 682–685.

Sohr-Preston, Sara L. and Laura V. Scaramella, "Implications of timing of maternal depressive symptoms for early cognitive and language development," *Clinical Child and Family Psychology Review*, 2006, *9* (1), 65–83.

Spence, Susan H., "A measure of anxiety symptoms among children," *Behaviour Research and Therapy*, 1998, *36* (5), 545–566.

Syed, Ehsan Ullah, Sajida Abdul Hussein, Syed Iqbal Azam, and Abdul Ghani Khan, "Comparison of Urdu version of Strengths and Difficulties Questionnaire (SDQ) and the Child Behaviour Check List (CBCL) amongst primary school children in Karachi," *Journal of the College of Physicians and Surgeons Pakistan*, 2009, *19* (6), 375–379.

Tolin, David F, "Is cognitive-behavioral therapy more effective than other therapies?: A meta-analytic review," *Clinical Psychology Review*, 2010, *30* (6), 710–720.

Walker, S, S Chang, C Powell, and S M Grantham-McGregor, "Effects of early childhood psychosocial stimulation and nutritional supplementation on cognition and education in growth-retarded Jamaican children: a prospective cohort study.," *The Lancet*, 2005, *366* (9499), 1804–1807.

Washbrook, Elizabeth, Christopher J Ruhm, Jane Waldfogel, and Wen-Jui Han, "Public Policies, Women's Employment after Childbearing, and Child Well-Being.," *The B.E. journal of economic analysis & policy*, jul 2011, *11* (1).

Webster-Stratton, Carolyn, M. Jamila Reid, and Mary Hammond, "Preventing conduct problems, promoting social competence: A parent and teacher training partnership in Head Start," *Journal of Clinical Child and Adolescent Psychology*, 2001, *30* (3), 283–302.

World Health Organization, *Thinking Healthy: A manual for psychological management of perinatal depression*, World Health Organization, 2015.

Table 1 – Balance and Attrition: Characteristics of intervention and control clusters for 1-year and 7-year follow-up samples

	1-year Followup Sample					7-year Followup Sample				
	Control Mean	(st.dev.)	T-C Diff	(s.e.)	*p*-val	Control Mean	(st.dev.)	T-C Diff	(s.e.)	*p*-val
Mother's age	27.02	(5.0)	−0.47	(0.37)	0.21	27.07	(5.1)	−0.41	(0.41)	0.31
Index child is girl	0.43	(0.5)	0.02	(0.03)	0.63	0.47	(0.5)	0.07	(0.04)	0.11
Index child age (months)	90.80	(1.6)	0.03	(0.10)	0.77	90.74	(1.7)	0.04	(0.14)	0.75
Mother's education	3.77	(3.9)	0.58	(0.29)	0.05**	3.81	(3.8)	0.50	(0.32)	0.12
Parity	2.37	(1.8)	−0.25	(0.13)	0.06*	2.40	(1.8)	−0.28	(0.14)	0.05**
Index child is first born	0.18	(0.4)	−0.03	(0.02)	0.21	0.16	(0.4)	0.00	(0.03)	0.90
Mother's height (m)	1.56	(0.1)	0.00	(0.00)	0.28	1.56	(0.1)	0.00	(0.00)	0.31
Mother's BMI	23.20	(4.1)	0.07	(0.30)	0.83	23.05	(4.1)	0.25	(0.33)	0.45
Hamilton depression score	14.37	(3.9)	0.40	(0.30)	0.19	14.24	(3.9)	0.50	(0.33)	0.14
Baseline BDQ score	8.27	(2.7)	−0.20	(0.21)	0.34	8.17	(2.7)	−0.08	(0.23)	0.72
Perceived social support score	44.39	(16.1)	1.99	(1.21)	0.10	44.61	(16.3)	2.84	(1.36)	0.04**
Joint/extended family structure	0.56	(0.5)	0.06	(0.04)	0.12	0.56	(0.5)	0.06	(0.04)	0.13
Grandmother lives with	0.44	(0.5)	0.11	(0.04)	0.00***	0.44	(0.5)	0.11	(0.04)	0.01***
No. member per room	3.73	(1.6)	−0.13	(0.11)	0.25	3.74	(1.6)	−0.20	(0.12)	0.11
Father's education	7.20	(3.9)	−0.12	(0.29)	0.67	7.21	(3.7)	−0.25	(0.31)	0.43
Father employed	0.91	(0.3)	−0.02	(0.02)	0.50	0.90	(0.3)	−0.00	(0.03)	0.88
Father not manual worker	0.30	(0.5)	−0.01	(0.04)	0.86	0.30	(0.5)	−0.01	(0.04)	0.76
SES (0=poor, 4=rich)	1.35	(1.0)	0.07	(0.07)	0.33	1.37	(1.0)	0.08	(0.08)	0.32
Wealth index[a]	−0.11	(1.8)	0.21	(0.14)	0.13	−0.04	(1.8)	0.19	(0.15)	0.20
LTFU (from 1y followup, N=704)[b]	0.15	(0.4)	0.04	(0.03)	0.12					
Joint test (*p*-value)					0.12					0.05
Observations	347				704	296				585

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: This table tests for balance along a number of baseline characteristics among the 1-year followup sample (Rahman et al., 2008), and in the 7-year followup sample. Columns show the means and standard deviations (in parentheses) as noted, by intervention arm for the 1-year followup and 7-year followup samples. The p-value of the difference between intervention and control for each sample is also reported.

[a] The wealth index is a PCA-weighted index of house materials, water and waste infrastructure, and other assets including car, bike, TV, refrigerator, electricity, and whether mother reports having enough money to for food.

[b] Only those mother-child dyads that were interviewed at the THP 1-year followup were considered for the 7-year followup. The number of mothers in the treatment group at baseline was 463, and 440 in the control group. Between baseline and 1-year, 22% of the sample was LTFU, but not differential by treatment status. Attrition between baseline and 7-year followup was 35%. Attrition rate from baseline was 38% in treatment, and 33% in control, a difference of 5 percentage points (p=0.13).

Table 2 – Short-run Effects on Parenting (at 6 and 12 month followups)

	No controls		Full controls		By Gender		
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) Coeff β/(s.e.)	(4) FWER p-value	(5) Girls	(6) Boys	(7) FWER p-value
Parenting at Infancy index	0.00	0.59***	0.49***	0.00	0.51***	0.47**	0.81
	(1.00)	(0.13)	(0.15)		(0.17)	(0.17)	
Mother play frequency with infant (12mo)	2.38	0.35***	0.32***	0.00	0.30***	0.33***	0.78
	(0.78)	(0.07)	(0.07)		(0.11)	(0.08)	
Father play frequency with infant (12mo)	2.28	0.29***	0.21*	0.19	0.18	0.23*	0.74
	(0.92)	(0.10)	(0.11)		(0.14)	(0.13)	
Discussed child's development with family (12mo)	0.14	0.09	0.02	0.84	0.02	0.02	0.92
	(0.35)	(0.07)	(0.04)		(0.04)	(0.05)	
Practicing birth spacing (12mo)	0.55	0.10**	0.12**	0.06	0.17**	0.06	0.19
	(0.50)	(0.05)	(0.04)		(0.07)	(0.05)	
Exclusive breastfeeding (6mo)	0.11	0.09*	0.09**	0.15	0.09*	0.10*	0.86
	(0.32)	(0.05)	(0.04)		(0.05)	(0.06)	
Breastfeeding (6mo)	0.92	0.00	0.01	0.84	0.01	0.01	0.91
	(0.28)	(0.02)	(0.02)		(0.03)	(0.03)	
Selected appropriate place for delivery	0.75	0.18***	0.16***	0.01	0.17***	0.14**	0.64
	(0.44)	(0.04)	(0.05)		(0.05)	(0.06)	
Arranged transport for delivery	0.70	0.21***	0.19***	0.01	0.19***	0.19***	0.90
	(0.46)	(0.05)	(0.06)		(0.06)	(0.07)	
Arranged finances for delivery	0.75	0.17***	0.15***	0.02	0.15***	0.14**	0.85
	(0.44)	(0.05)	(0.05)		(0.05)	(0.06)	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: N=585. Sample includes children of mothers who were depressed at baseline and were located at the 7-year followup. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. Column 3 includes controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and UC-level controls. Columns 4 calculate the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table 3 – Effects on Infant Outcomes (at 6- and 12-month followups)

	No controls		Full controls		By Gender		
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) Coeff β/(s.e.)	(4) FWER p-value	(5) Girls	(6) Boys	(7) $\beta^g = \beta^b$ p-value
Infant health index (6m)	−0.00	0.06	0.25***	0.01	0.26**	0.25**	0.90
	(1.00)	(0.10)	(0.09)		(0.12)	(0.10)	
Child length CM (6mo)	65.11	−0.15	0.41*	0.22	0.39	0.43	0.91
	(2.69)	(0.25)	(0.24)		(0.25)	(0.31)	
Child weight KG (6mo)	6.81	−0.11	0.00	0.98	0.04	−0.04	0.52
	(0.98)	(0.09)	(0.10)		(0.11)	(0.13)	
Diarrhea episodes (6mo)	0.44	−0.08*	−0.08	0.35	−0.06	−0.10	0.58
	(0.50)	(0.05)	(0.06)		(0.06)	(0.08)	
Acute Respiratory Infection (6mo)	0.44	−0.04	−0.12**	0.05	−0.14**	−0.11*	0.65
	(0.50)	(0.06)	(0.05)		(0.07)	(0.06)	
Infant health index (1y)	0.00	0.30***	0.41***	0.00	0.34***	0.49***	0.35
	(1.00)	(0.09)	(0.09)		(0.11)	(0.12)	
Child length CM (12mo)	71.96	0.26	0.95***	0.00	0.67*	1.26***	0.27
	(3.24)	(0.29)	(0.26)		(0.35)	(0.37)	
Child weight KG (12mo)	8.24	−0.09	−0.01	0.90	0.02	−0.05	0.65
	(1.10)	(0.09)	(0.11)		(0.13)	(0.15)	
Diarrhea episodes (12mo)	0.41	−0.07	−0.06	0.65	−0.02	−0.10	0.31
	(0.49)	(0.06)	(0.07)		(0.08)	(0.07)	
Acute Respiratory Infection (12mo)	0.52	−0.25***	−0.29***	0.00	−0.27***	−0.30***	0.61
	(0.50)	(0.06)	(0.05)		(0.06)	(0.06)	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: N=585. Sample includes children of mothers who were depressed at baseline and were located at the 7-year followup. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. Column 3 includes controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and UC-level controls. Columns 4 calculate the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table 4 – Parenting behavior at 7-year followup by broad domains

	Interviewer FE	All baseline controls		By gender		
	(1) Coeff (s.e.)	(2) Coeff (s.e.)	(3) FWER p-value	(4) Girls	(5) Boys	(6) p-value Girl × T
Time investment index	0.20***	0.20***	0.02**	0.25***	0.15	0.45
	(0.07)	(0.07)		(0.09)	(0.10)	
Monetary investment index	0.31***	0.28***	0.00***	0.43***	0.14	0.04
	(0.08)	(0.08)		(0.12)	(0.09)	
Parenting style index	−0.04	−0.11	0.10	−0.04	−0.18	0.41
	(0.06)	(0.06)		(0.08)	(0.12)	

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: N=585. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects. Full set of controls comprises of baseline values of mother's age, age-squared, height, parity, education, family structure, presence of grandmother (mother or mother-in-law of depressed mother), husbands' education, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview, as well as additional controls for cluster-level baseline averages of mother's age, height, parity, family structure, grandmother, wealth, mother and father education, depression severity and social support. Column 3 calculates the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table 5 – Parenting behavior: Difference-in-difference specification

	(1) Treat	(2) Treat × Prenatally Depressed	(3) Prenatally Depressed
Time investment index	−0.07	0.19	−0.16
	(0.13)	(0.14)	(0.11)
Monetary investment index	−0.03	0.24*	−0.15
	(0.14)	(0.14)	(0.10)
Parenting style index	−0.32**	0.02	−0.05
	(0.13)	(0.13)	(0.09)

	Girls			Boys		
	(1) Treat	(2) Treat × Prenatally Depressed	(3) Prenatally Depressed	(4) Treat	(5) Treat × Prenatally Depressed	(6) Prenatally Depressed
Time investment index	−0.03	0.23	−0.00	−0.10	0.17	−0.30**
	(0.17)	(0.18)	(0.14)	(0.14)	(0.17)	(0.12)
Monetary investment index	0.00	0.42**	−0.17	−0.09	0.17	−0.15
	(0.19)	(0.21)	(0.13)	(0.16)	(0.17)	(0.14)
Parenting style index	−0.41**	0.18	−0.09	−0.24	−0.15	−0.02
	(0.20)	(0.18)	(0.13)	(0.15)	(0.17)	(0.13)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: N=885. Sample includes children of mothers who were depressed at baseline as well those who were not depressed at baseline, in both treatment and control clusters. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects, age of mother and its square, father's and mother's education, parity, and the date of interview, as well as additional controls for cluster-level baseline averages of mother's age, height, parity, family structure, grandmother, wealth, mother and father education, depression severity and social support (from the depressed sample).

Table 6 – Child development outcomes at age 7 by broad domains

	Interviewer FE	All baseline controls		By gender		
	(1) Coeff (s.e.)	(2) Coeff (s.e.)	(3) FWER p-value	(4) Girls	(5) Boys	(6) p-value Girl × T
Cognitive development index	−0.01	−0.01	0.89	−0.01	−0.02	0.96
	(0.09)	(0.08)		(0.13)	(0.10)	
Physical development index	0.14	0.24***	0.01***	0.24*	0.24**	1.00
	(0.10)	(0.07)		(0.13)	(0.09)	
Socio-emotional development index	−0.12	−0.12	0.20	−0.04	−0.19	0.36
	(0.10)	(0.07)		(0.10)	(0.11)	

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: N=585. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects. Full set of controls comprises of baseline values of mother's age, age-squared, height, parity, education, family structure, presence of grandmother (mother or mother-in-law of depressed mother), husbands' education, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview, as well as additional controls for cluster-level baseline averages of mother's age, height, parity, family structure, grandmother, wealth, mother and father education, depression severity and social support. Column 3 calculates the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table 7 – Child development: Difference-in-difference

	(1) Treat	(2) Treat × Prenatally Depressed	(3) Prenatally Depressed
Cognitive development index	0.07	−0.17	0.10
	(0.11)	(0.16)	(0.10)
Physical development index	0.08	0.10	−0.28**
	(0.10)	(0.15)	(0.10)
Socio-emotional development index	−0.12	−0.06	−0.18*
	(0.11)	(0.14)	(0.10)

	Girls			Boys		
	(1) Treat	(2) Treat × Prenatally Depressed	(3) Prenatally Depressed	(4) Treat	(5) Treat × Prenatally Depressed	(6) Prenatally Depressed
Cognitive development index	0.10	−0.18	−0.05	0.05	−0.22	0.25**
	(0.20)	(0.25)	(0.17)	(0.13)	(0.17)	(0.11)
Physical development index	0.12	0.04	−0.26	0.06	0.14	−0.29**
	(0.12)	(0.18)	(0.16)	(0.15)	(0.22)	(0.13)
Socio-emotional development index	−0.14	0.06	−0.28*	−0.13	−0.12	−0.10
	(0.16)	(0.20)	(0.15)	(0.15)	(0.18)	(0.14)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: N=885. Sample includes children of mothers who were depressed at baseline as well those who were not depressed at baseline, in both treatment and control clusters. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects, age of mother and its square, father's and mother's education, parity, and the date of interview, as well as additional controls for cluster-level baseline averages of mother's age, height, parity, family structure, grandmother, wealth, mother and father education, depression severity and social support (from the depressed sample).

Table 8 – Do measures of parental investment predict child development?

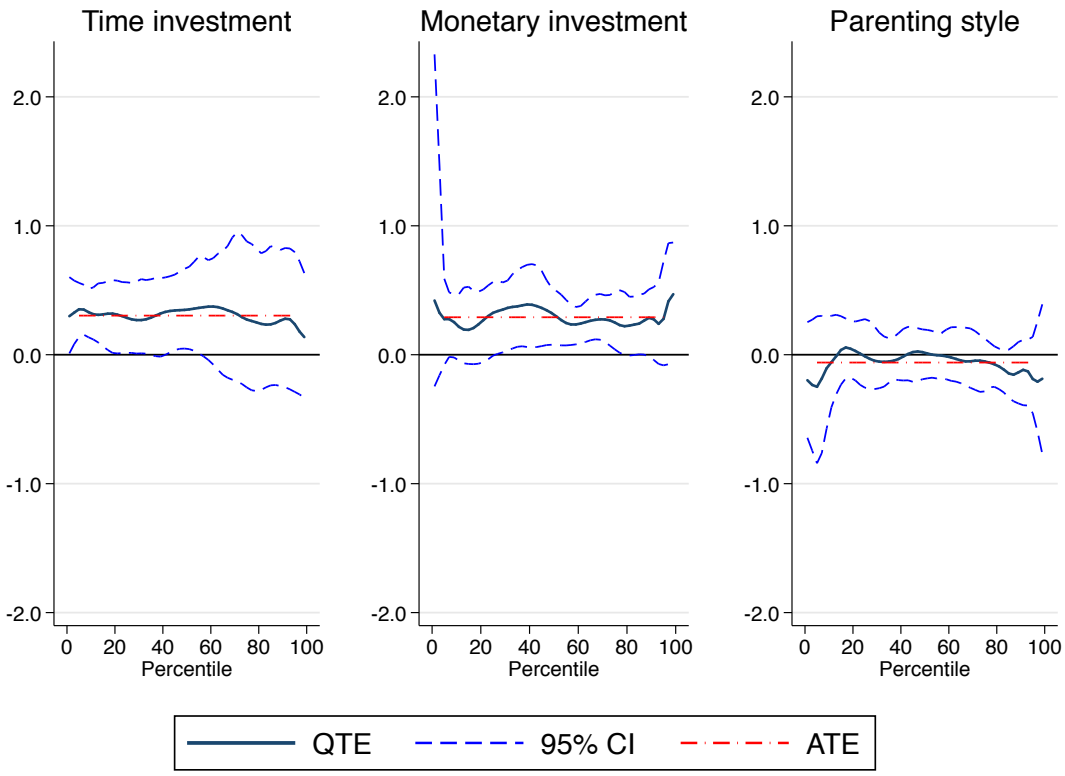
	Cognitive development				Physical development				Socioemotional development			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Parenting at Infancy index	0.04		0.02		0.02		0.02		0.00		−0.00	
	(0.04)		(0.04)		(0.03)		(0.04)		(0.04)		(0.04)	
Time investment index		0.04	0.03	0.03		−0.03	−0.03	−0.04		−0.00	−0.00	−0.02
		(0.05)	(0.05)	(0.05)		(0.06)	(0.06)	(0.05)		(0.05)	(0.06)	(0.05)
Monetary investment index		0.18***	0.18***	0.17***		0.11**	0.11**	0.10**		0.01	0.01	0.02
		(0.05)	(0.05)	(0.04)		(0.05)	(0.05)	(0.04)		(0.04)	(0.04)	(0.03)
Parenting style index		0.09*	0.09*	0.06		−0.04	−0.04	0.00		0.11*	0.11*	0.11**
		(0.05)	(0.05)	(0.04)		(0.04)	(0.04)	(0.04)		(0.05)	(0.05)	(0.05)
Baseline depressed				0.03				−0.16**				−0.20***
				(0.07)				(0.07)				(0.07)
Observations	584	584	584	884	584	584	584	884	584	584	584	884
R^2	0.19	0.23	0.23	0.20	0.10	0.11	0.11	0.10	0.18	0.19	0.19	0.18

* p $<$ 0.1, ** p $<$ 0.05, *** p $<$ 0.01.

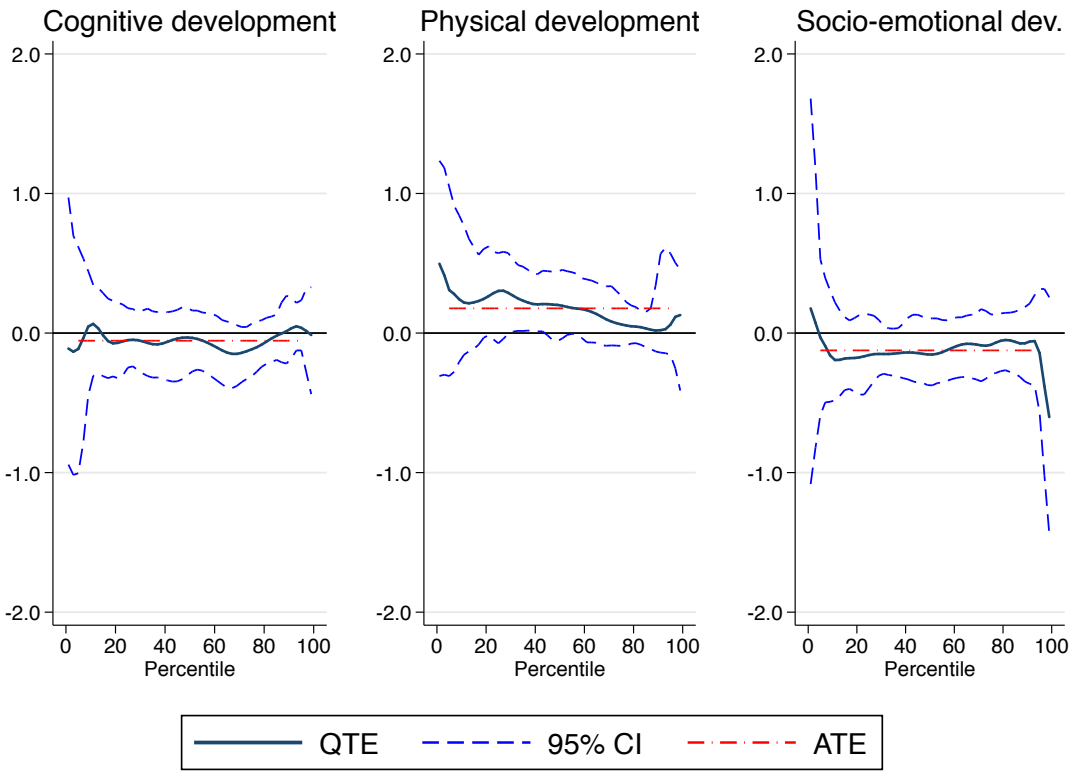
Notes: Sample includes children of mothers who were depressed at baseline as well those who were not depressed at baseline, in both treatment and control clusters. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects, age of mother and its square, father's and mother's education, parity, the date of interview, child gender and age at interview, and an indicator for treated cluster.

Figure 1 – Quantile Treatment Effects at the 7-year followup

(a) Parenting behavior



(b) Child outcomes

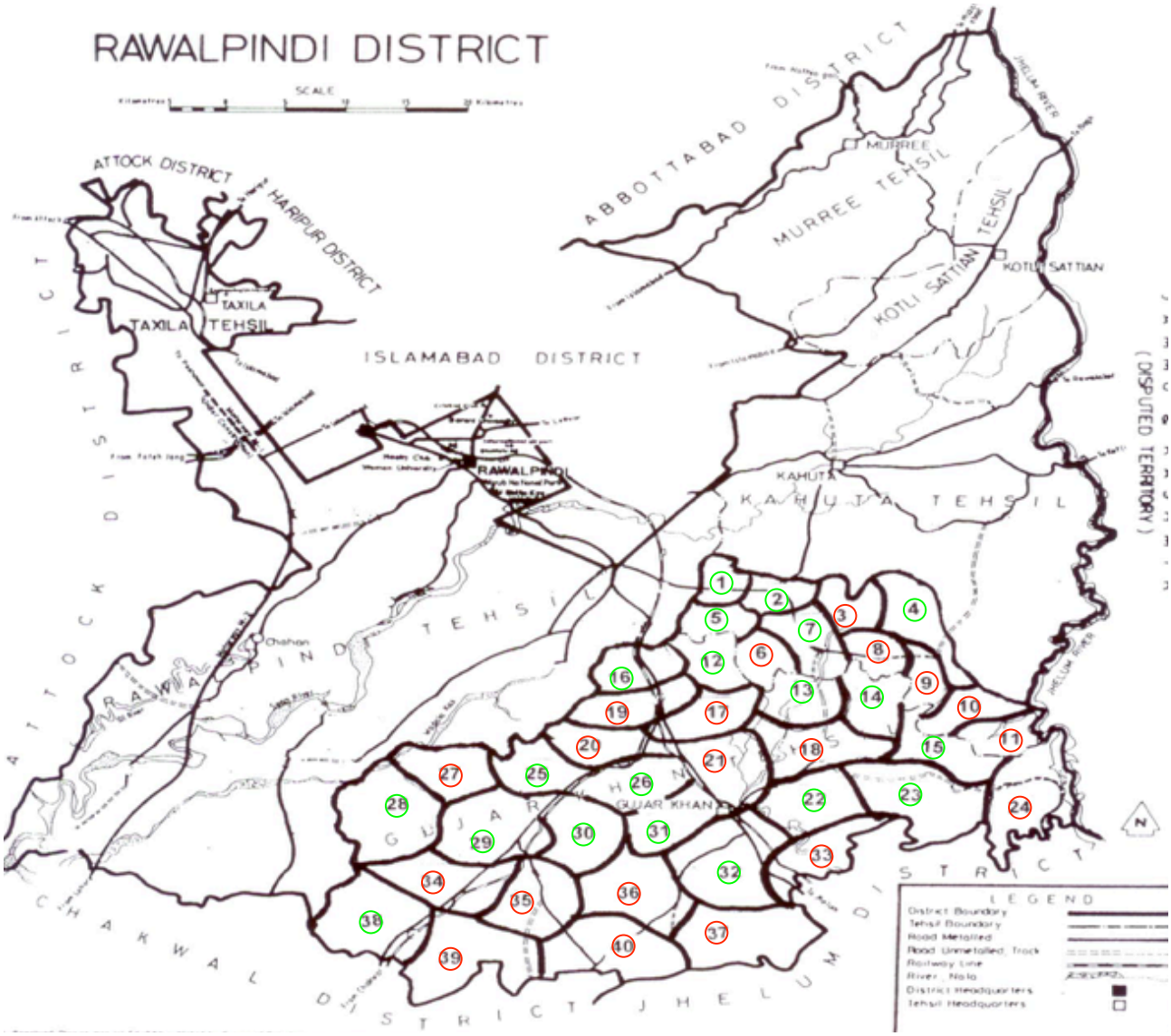


Notes: Quantile Treatment Effects of THP Intervention on child outcomes and parenting behavior at the 7 year followup. More positive values indicate more favorable outcomes. 95% confidence intervals for the QTE were calculated by bootstrapping using 1,000 replications with replacement, clustering at the UC level. The average treatment effect (ATE), the mean difference, is presented for comparison.

Appendix: For Online Publication

A Appendix Figures

Figure A.1 – Map of treatment and control clusters



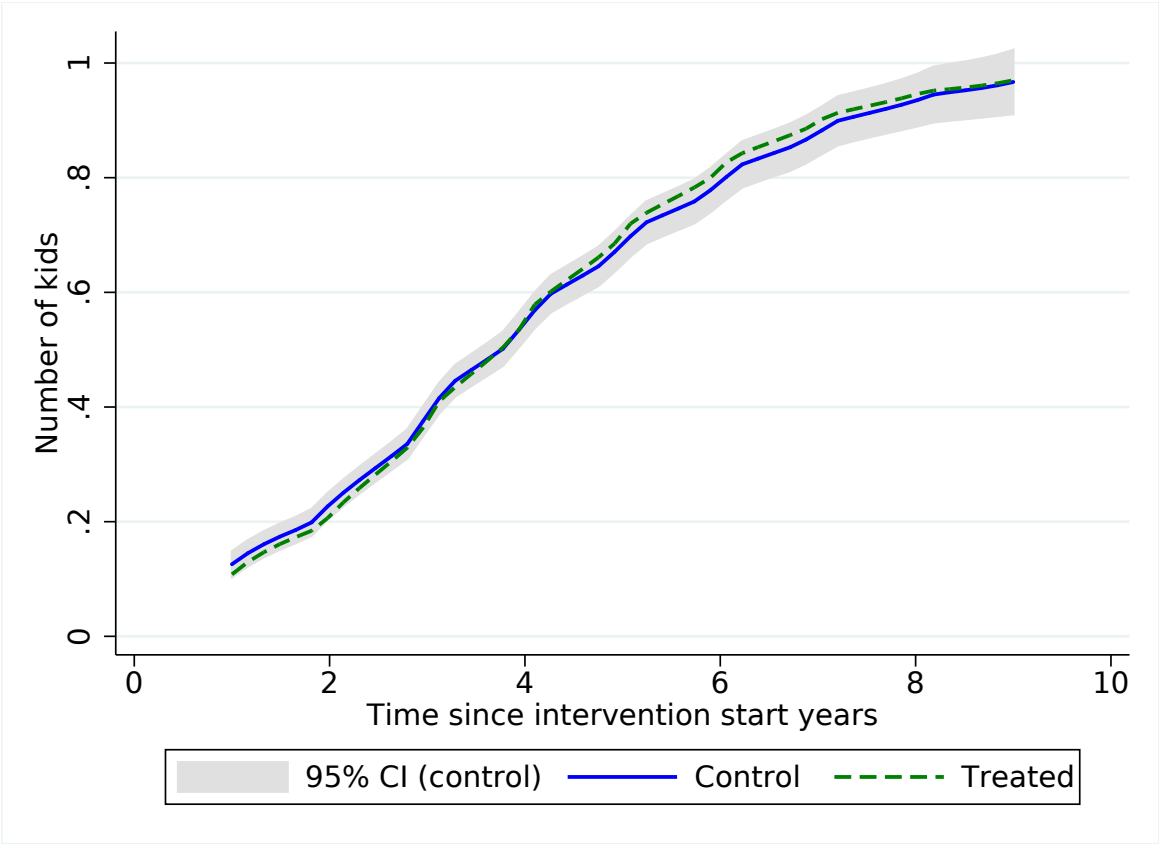
Notes: Treatment clusters are indicated by green circle, and control are indicated by red.

Figure A.2 – Sample sizes

	Treatment		Control		Total		T-C p-value
Pregnant women identified	**1967**		**1931**		**3898**		
refusals	140	7%	159	8%	299	8%	0.19
not found	40	2%	40	2%	80	2%	
Screened at baseline	**1787**	91%	**1731**	90%	**3518**	90%	0.20
excluded	138	8%	138	8%	276		
Depressed (completed survey)	**463**	26%	**440**	25%	**903**	26%	0.74
boys at birth	223	48%	226	51%	449	50%	0.95
Attrited btw baseline & 1yr	**103**	22%	**95**	22%	**198**	22%	
total child mortality/illness	52	11%	41	9%			0.34
stillbirths/abortions	15	3%	21	5%			0.24
infant mortality (of live births)	31	7%	18	4%			0.10
mother mortality	2	0%	3	1%			0.99
refused	11	2%	11	3%			0.90
moved	38	8%	40	9%			0.64
Complete dyads at 1yr	**360**		**345**		**705**		
Attrited btw 1yr & 7yr	**72**	20%	**51**	15%	**123**	17%	0.07
LTFU	62	13%	44	10%	106	12%	0.10
child mortality	4		3				
mother mortality	3		1				
child disabled/not eligible	2		2				
Attrited btw baseline & 7yr	**174**	38%	**145**	33%	**319**	35%	
child death/illness	55	32%	44	30%	99	31%	0.37
child death (of live births)	35	8%	21	5%	56	6%	0.09
mother death	5	3%	4	3%	9	3%	0.80
refused/moved/LTFU/not eligible	112	64%	96	66%	208	65%	0.39
Complete dyads at 7yr	**289**	62%	**295**	67%	**584**	65%	0.15
dyads at 7yr who completed 1yr	289	80%	295	86%		83%	0.07
in our data	289		296				0.13

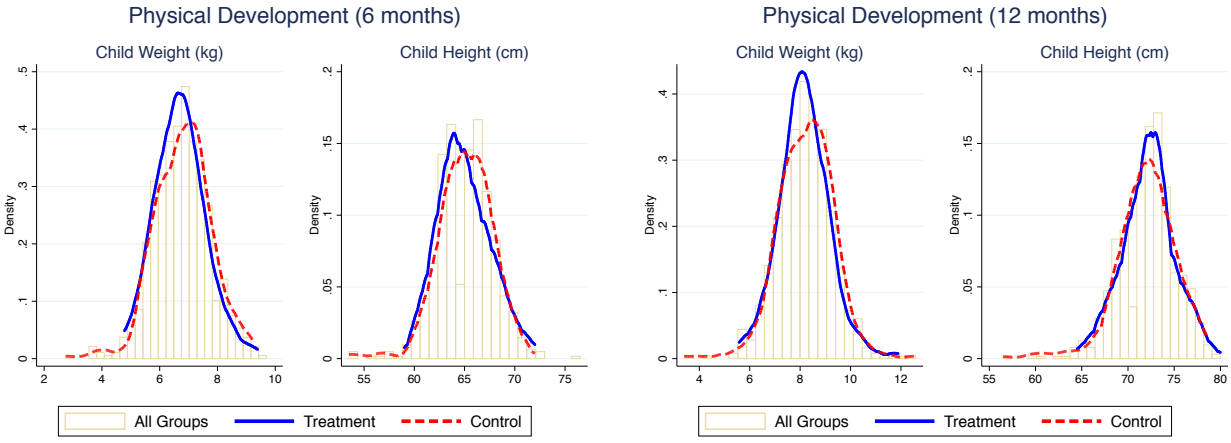
Notes: Table shows the sample flow from the start of the intervention when pregnant women were identified to the 7-year followup. Percentages are not defined in the same way from row to row. P-values of simple Ξ-squared tests of differences in rates across treatment and control groups are in the last column.

Figure A.3 – Effects on fertility: Number of children born since treatment



Notes: This figure show the average number of births women reported since the start of the intervention until the 7-year followup. Birth histories were constructed from the listing of children and their ages at the 7-year followup. 95% confidence interval, not adjusted for clustered errors or autocorrelation, is presented (and is thus tighter than the true CI).

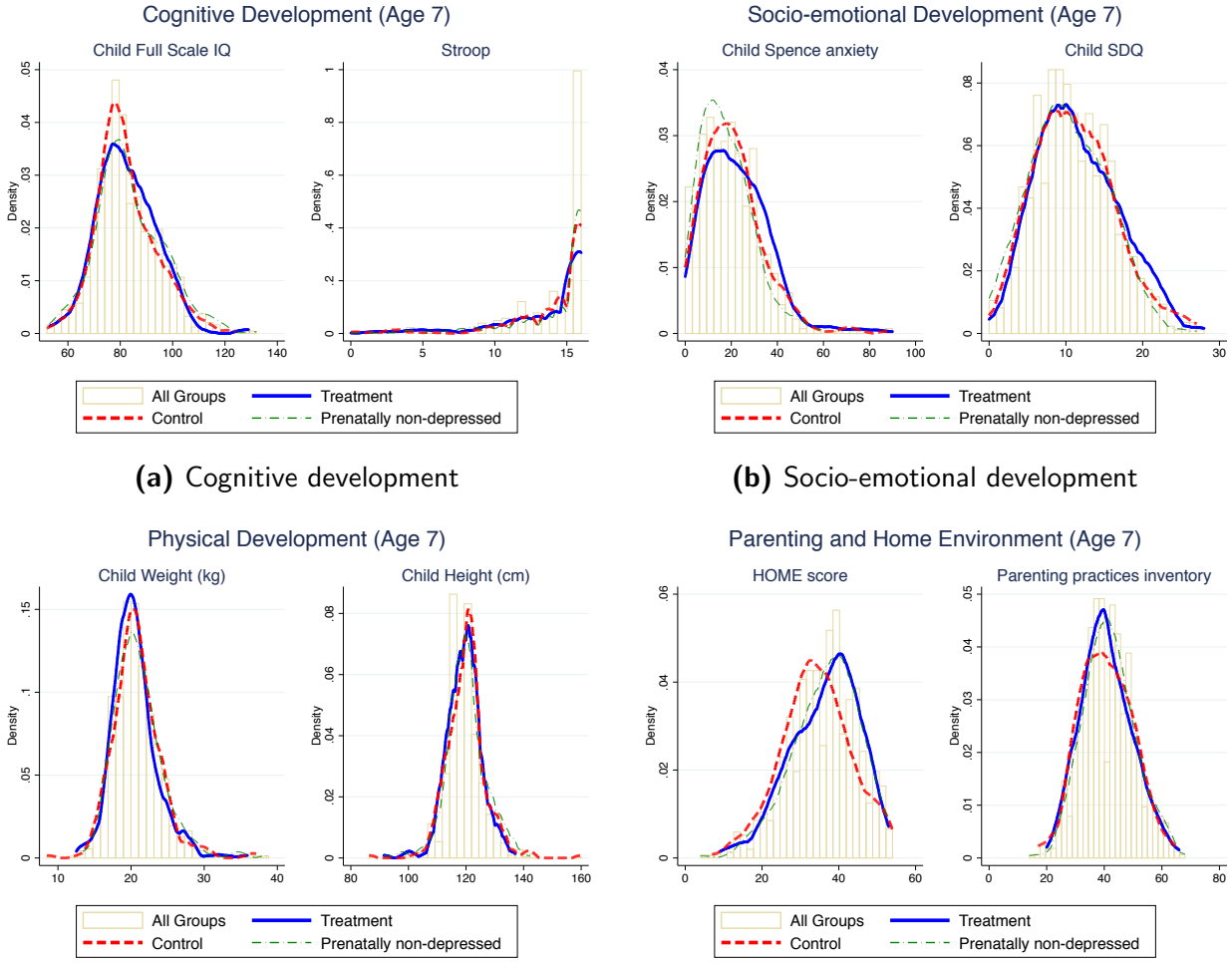
Figure A.4 – Child growth at 6 months, 1 year, and 7 years of age



(a) Child height and weight (6 months) **(b)** Child height and weight (12 months)

Notes: Distributions of child weight (kg) and height (cm) measurements at 6-month, and 1-year followups (infants were approximately 6 months and 12 months old at these followups). Histograms of the data for all groups combined (treatment and control, and non-depressed where available) are plotted in the background.

Figure A.5 – Distributions of key outcomes at the 7 year followup



(a) Cognitive development

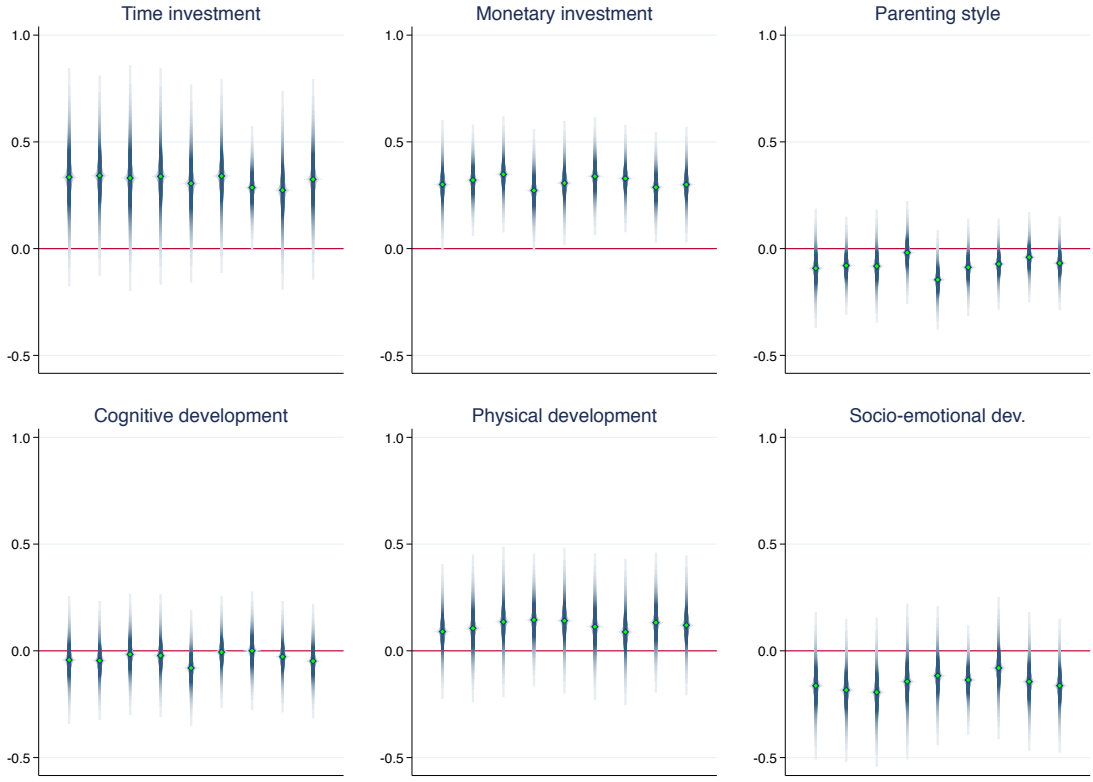
(b) Socio-emotional development

(c) Child height and weight (7 years)

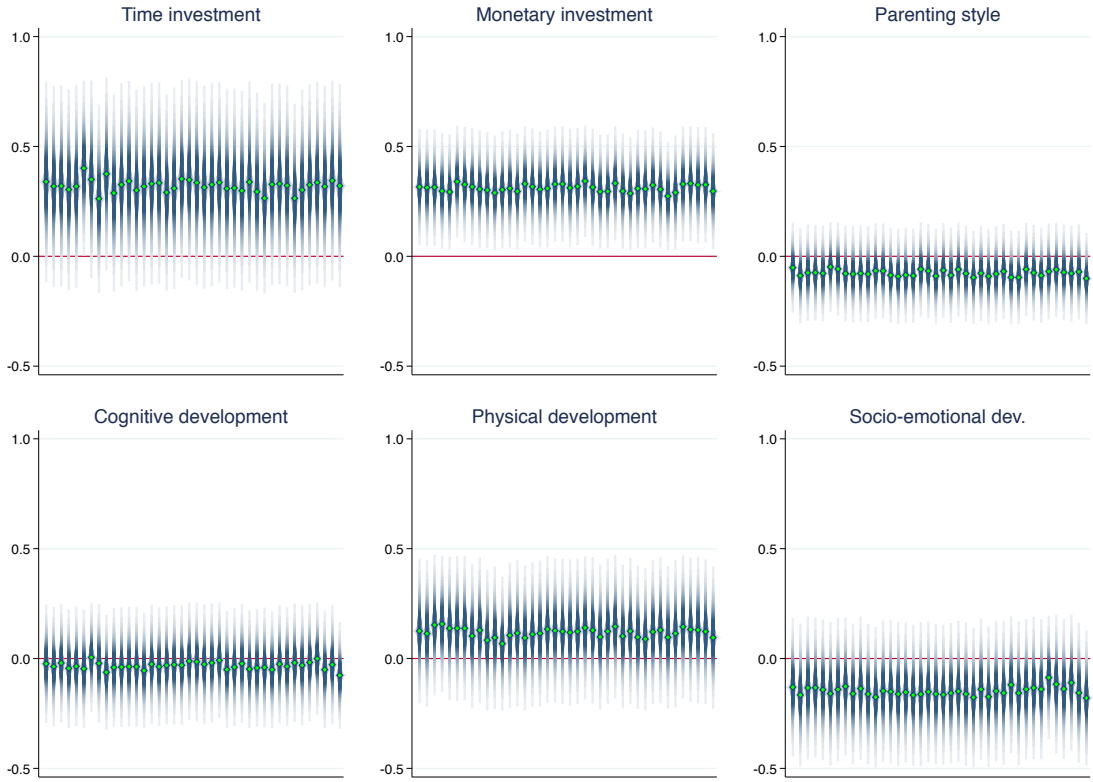
(d) Parenting and home environment

Notes: Distributions of child outcomes at the 7 year followup for main outcome variables, by treatment arm. Distributions for prenatally non-depressed mothers are also plotted for comparison. Histograms of the data for all groups combined (treatment, control, and non-depressed) are plotted in the background.

Figure A.6 – Treatment effects excluding individual interviewers and clusters



(a) Excluding interviewers



(b) Excluding Union Councils (clusters)

Notes: Treatment effects, measured in standard deviations from the control group mean, for broad domains of child development and parenting calculated by excluding either each interviewer or each cluster. Heteroskedasticity robust standard errors, clustered at the Union Council level, are used to construct the 95% confidence intervals. Regressions do not contain any controls.

B Description of indices and measures

Table B.1 – Summary Statistics for Parenting Outcomes

	Mean	SD	Median	Minimum	Maximum	Total Obs
Time investment index[a]	0.23	1.01	0.18	-2.16	3.87	885
HOME: Enrichment	2.94	1.40	3.00	0.00	5.00	885
HOME: Family companionship	3.36	1.73	3.00	0.00	6.00	885
HOME: Family integration	2.82	0.97	3.00	0.00	12.00	885
Frequency of mother play	0.77	1.35	0.00	0.00	4.00	885
Frequency of father play	0.72	1.22	0.00	0.00	4.00	829
Someone helps with studies	0.58	0.49	1.00	0.00	1.00	885
Monetary investment index[a]	0.22	1.03	0.29	-4.58	5.52	885
HOME: Learning materials	2.86	1.54	3.00	0.00	6.00	885
HOME: Physical environment	4.86	2.38	5.00	0.00	8.00	885
Education expend.(100s PKR)	24.55	33.24	15.00	0.00	400.00	884
Expected grade attainment	14.45	2.45	16.00	0.00	21.00	881
Private school	0.47	0.50	0.00	0.00	1.00	878
School quality	-0.00	0.97	0.07	-2.48	2.42	874
Parenting style index[a]	-0.02	1.01	0.05	-4.72	2.78	885
PPI: Not harsh	13.97	8.10	14.00	0.00	33.00	885
PPI: Not harsh for age	8.61	1.37	9.00	0.00	9.00	885
PPI: Consistent	9.88	3.46	10.00	0.00	18.00	885
PPI: Appropriate	8.56	4.43	9.00	0.00	27.00	885
HOME: Responsivity	8.96	1.60	10.00	1.00	10.00	885
HOME: Encouragement of maturity	5.23	1.58	5.00	0.00	7.00	885
HOME: Emotional climate	4.74	1.93	5.00	0.00	8.00	885

Notes: Index variables, created such that the control group has mean 0, standard deviation 1, are in bold. The individual variables that make up each index are listed below. The sample includes the intervention (baseline depressed mothers in treatment and control groups) and non-intervention (baseline non-depressed mothers) groups.
[a] Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices.
[b] Higher value indicates unfavorable outcome. These outcomes were flipped in order to be included in the indices.

Table B.2 – Summary Statistics for Child Development Outcomes

	Mean	SD	Median	Minimum	Maximum	Total Obs
Cognitive development index[a]	0.03	1.03	0.12	-3.82	2.73	885
WPPSI: Verbal comprehension	86.41	14.54	85.00	45.00	146.00	882
WPPSI: Visual spatial	86.94	14.58	86.00	45.00	148.00	883
WPPSI: Fluid reasoning	78.55	12.55	77.00	45.00	133.00	884
WPPSI: Working memory	99.62	15.90	100.00	58.00	146.00	884
WPPSI: Processing speed	77.74	10.07	77.00	45.00	112.00	877
Urdu score	6.73	3.75	6.00	0.00	12.00	877
Math score	9.35	3.52	11.00	0.00	16.00	876
Executive function (Stroop)	14.15	3.11	16.00	0.00	16.00	885
Grade	1.93	0.87	2.00	0.00	3.00	873
Physical development index[a]	0.12	0.95	0.30	-4.56	2.11	885
Weight-for-age (z)	-1.15	1.06	-1.19	-4.96	2.89	881
Height-for-age (z)	-0.82	1.12	-0.84	-4.95	3.24	879
Not stunted (height>2SD)	0.86	0.34	1.00	0.00	1.00	885
Not thin (BMI>2SD)	0.83	0.38	1.00	0.00	1.00	885
Motor function	3.40	0.67	3.59	0.00	4.21	885
No hospitalization	0.85	0.35	1.00	0.00	1.00	885
No severe illness	0.73	0.44	1.00	0.00	1.00	885
No eyesight problems	0.96	0.20	1.00	0.00	1.00	885
No hearing problems	0.98	0.12	1.00	0.00	1.00	885
Socio-emotional development index[a]	-0.01	0.96	0.03	-4.10	3.57	885
SDQ: Emotional [b]	2.20	1.97	2.00	0.00	10.00	885
SDQ: Conduct problems [b]	3.28	2.05	3.00	0.00	10.00	885
SDQ: Hyperactivity [b]	3.55	2.57	3.00	0.00	10.00	885
SDQ: Peer problems [b]	1.98	1.56	2.00	0.00	8.00	885
SDQ: Prosocial [b]	7.60	2.49	8.00	0.00	10.00	885
SCAS: Panic and agoraphobia [b]	1.51	2.77	0.00	0.00	25.00	885
SCAS: Separation [b]	5.75	4.12	6.00	0.00	17.00	885
SCAS: Injury fear [b]	5.89	3.72	6.00	0.00	15.00	885
SCAS: Social phobia [b]	2.15	2.74	1.00	0.00	17.00	885
SCAS: Obsessive-compulsive [b]	1.33	2.15	0.00	0.00	15.00	885
SCAS: General anxiety [b]	3.42	3.12	3.00	0.00	18.00	885

Notes: Index variables, created such that the control group has mean 0, standard deviation 1, are in bold. The individual variables that make up each index are listed below. The sample includes the intervention (baseline depressed mothers in treatment and control groups) and non-intervention (baseline non-depressed mothers) groups.

[a] Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices.

[b] Higher value indicates unfavorable outcome. These outcomes were flipped in order to be included in the indices.

Table B.3 – Outcome Variable Descriptions

Parental Investment	
Parenting Style Index	A standardized weighted average of the 4 subscales of the Parenting Practices Inventory (harsh, harsh for age, consistent, and appropriate) and the following 3 subscales of the HOME inventory: responsivity^{o}, encouragement of maturity^{o}, and emotional climate^{o}.
Time-intensive Investment Index	A standardized weighted average of frequency of mother play (to help learn new things) with index child, frequency of father play with index child, if anyone else in the family helps child with studies, and the following 3 subscales of the HOME inventory: enrichment, family companionship, and family integration.
Monetary-intensive Investment Index	A standardized weighted average of family education expenditure in past month, mother's expected grade attainment for index child, whether index child attends a private school, school quality* (constructed using a factor score of class size*, number of teachers in the school*, number of rooms in the school*, number of school rooms in use*, classroom amenities* [3 items: backboard, backboard functional, other materials], school amenities* [9 items: school has office, playground, computers, library, clean drinking water]), and 2 subscales of the HOME inventory (learning materials and physical environment*).
Child Development	
Cognitive Development Index	A standardized weighted average of the 5 subscales of the WPPSI IQ*, Urdu score*, Math score*, Stroop executive function test*, and current grade (teacher report)*. The Stroop-like Day/Night test gages inhibition and working memory. Basic literacy and numeracy tests were administered, providing math and Urdu scores based on the number correct out of 16 and 12 respectively.

Continued on next page

Table B.3 – continued from previous page

Physical Development Index	A standardized weighted average of (flipped) binary indicators of whether the child had been hospitalized, has had a severe illness, has eyesight or hearing problems, motor function (assessed using the Grooved Pegboard Test, which asks the child to place pegs in a correct orientation on a board and records the amount of time the child took to complete the task, also flipped), and measured height-for-age* and weight-for-age* (Z scores calculated according to WHO criteria) and if the child was not stunted* or thin* (according to WHO criteria).
Socioemotional Development Index	A standardized weighted average of the 5 subscales of the Strengths and Difficulties Questionnaire (4 subscales that make up the total SDQ score + the prosocial component) and 6 subscales of the Spence child anxiety scale (SCAS).

Notes: Items indicated with an asterisk (*) indicates outcomes measured by observation (ie, assessor observed or administered test), and ^{o} indicates the subscale comprises of some (but not all) direct observation. All other outcomes are self-reported by the mother. Index variables are generated following Anderson (2008), a GLS-weighted average of outcomes within the index group. More positive values of the index indicate more favorable outcomes (thus certain outcomes,as indicated above, are "flipped", i.e., redefined as the value subtracted from the maximum). An alternative construction of indices using the factor scores was also used, and the results, which are robust to the alternative method of defining the indices, are presented in Appendix I.

Table B.4 – Scales and Inventories

Parental Inputs	
HOME	Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell and Bradley, 1984). The HOME assessment used in our experiment contains 54 items in total and 8 subscales: (1) Learning Materials; (2) Encouragement of Maturity; (3) Physical Environment; (4) Responsivity of Parent to Child; (5) Family Companionship; (6) Family Integration; (7) Variety in Daily Stimulation and Enrichment; and (8) Emotional Climate. 19 items are based on observation. The HOME assessment is one of the most used child assessments. For example, it is the primary measure of the quality of a child's home environment included in the NLSY79 child survey.
PPI	The Parent Practices Interview (PPI) is a modified (shortened) version of an 72-item questionnaire adapted from the Oregon Social Learning Center's Discipline Questionnaire and revised for young children. It is composed of four subscales –Harsh Discipline, Harsh for Age, Inconsistent Discipline, and Appropriate Discipline – rated on a 4-point scale ranging from 0 (never) to 3 (always). The PPI has bee used in several studies, including a study of the effectiveness of parent and teacher training for Head Start mothers and their 4 year old children and Head Start teachers (Kaplow et al., 2001).
School Quality	An index constructed using a factor score of class size, number of teachers in the school, number of rooms in the school, number of school rooms in use, classroom amenities [3 items: backboard, backboard functional, other materials], and school amenities [9 items: sum of the following school characteristics: school has an office, a playground, a library, a water source, clean drinking water, fencing, computers, and if books and computers were visibly in use]. All items within the index were reported by the interviewer, who visited the school.
Child Development	
WPPSI	The Wechsler Preschool and Primary Scale of Intelligence (WPPSI-IV), fourth edition, is an intelligence test designed for children ages 2.5 years to 7.5 years. WPPSI-IV provides primary index scales for verbal comprehension (VCI), visual spatial (VSI), fluid reasoning (FRI), working memory (WMI), and processing speed (PSI).

Continued on next page

Table B.4 – continued from previous page

SCAS	The Spence Children's Anxiety Scale (SCAS) to assess anxiety (Spence, 1998). The SCAS is also parent administered and consists of six different subscales in addition to an overall anxiety score: panic and agoraphobia, separation anxiety, physical injury fears, social phobia, obsessive-compulsive problems, and generalized anxiety. The sum of items ranges from 0 to 114. Higher values indicate more anxious behavior.
SDQ	The Strengths and Difficulties Questionnaire (SDQ) is used to measure behavioral and emotional problems. The SDQ is parent administered and has been validated in Pakistan (Syed et al., 2009). The questionnaire consists of 20 questions about the child's difficulties in four areas (emotional, conduct problems, hyperactivity, and peer problems) and a positive prosocial domain. The SDQ total difficulties score is generated by addition of the problem scale scores and ranges from 0 to 40. Higher values indicate more behavioral and emotional problems.
Stroop	The Stroop test is considered to measure selective attention, cognitive flexibility and processing speed, and it is used as a tool in the evaluation of executive functions. An increased interference effect is found in disorders such as attention-deficit hyperactivity disorder, or a variety of mental disorders such as schizophrenia, addictions, and depression. A Stroop-like Day/Night test was administered and is measured as the number correct out of 16.
Grooved Pegboard	The Grooved Pegboard is a manipulative dexterity test. This unit consists of 25 holes with randomly positioned slots. Pegs, which have a key along one side, must be rotated to match the hole before the can be inserted. This test requires more complex visual-motor coordination than most pegboards. The measure used in this paper is a factor score of the time (in minutes) to complete the task using both the dominant and nondominant hands, the number of pegs dropped, and the number of peg not placed. Results are similar using the time to complete task using the dominant hand (or nondominant hand), however more meaningful variation, assessed by how the measure varying with key covariates, was generated using the factor score.

Table B.5 – Correlates of Parental Investment Behavior at Age 7

	Time investment index			Monetary investment index			Parenting style index		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Girl	0.01	0.01	0.04	−0.38***	−0.35***	−0.33***	0.04	0.05	0.06
	(0.11)	(0.11)	(0.09)	(0.08)	(0.08)	(0.07)	(0.11)	(0.11)	(0.09)
Age of index child	0.14	0.16	0.28	−0.13	−0.07	−0.08	0.52*	0.55*	0.57
	(0.27)	(0.27)	(0.25)	(0.37)	(0.38)	(0.41)	(0.30)	(0.29)	(0.34)
Wealth score (at baseline)	0.06**	0.06**	0.08***	0.08**	0.08**	0.10***	0.00	0.00	0.02
	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
Mother's years of education	0.05***	0.05***	0.03**	0.07***	0.07***	0.06***	0.05***	0.05***	0.04**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Father's years of education	0.04**	0.03**	0.01	0.07***	0.06***	0.06***	0.01	0.01	−0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Mother's age	0.06	0.06	0.01	0.03	0.03	−0.01	0.18**	0.18**	0.12*
	(0.05)	(0.05)	(0.05)	(0.08)	(0.07)	(0.07)	(0.08)	(0.07)	(0.07)
Mother's age^2	−0.00	−0.00	0.00	−0.00	−0.00	0.00	−0.00**	−0.00**	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
No. kids (at baseline)	−0.00	−0.00	0.01	−0.02	−0.01	0.00	0.01	0.01	0.05
	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)	(0.04)	(0.03)	(0.03)	(0.03)
Grandmother at baseline	0.10	0.08	0.03	−0.04	−0.08	−0.13	0.02	−0.01	−0.08
	(0.10)	(0.10)	(0.09)	(0.12)	(0.11)	(0.10)	(0.10)	(0.10)	(0.12)
Mother depressed (at 7-year followup)		−0.16	0.03		−0.42***	−0.37***		−0.26**	−0.11
		(0.11)	(0.07)		(0.12)	(0.11)		(0.12)	(0.14)
Baseline depression severity		0.03	0.06		0.03	0.06*		0.07	0.09
		(0.06)	(0.04)		(0.04)	(0.03)		(0.05)	(0.06)
Mother play (at 1-year followup)			0.74***			0.23*			0.30**
			(0.11)			(0.13)			(0.13)
Father play (at 1-year followup)			0.59***			0.30*			0.51***
			(0.11)			(0.16)			(0.11)
Diarrhea (at 1-year followup)			−0.10			−0.04			0.00
			(0.10)			(0.10)			(0.09)
Breastfeeding (at 6-month followup)			0.03			0.18			0.32***
			(0.15)			(0.22)			(0.11)
ARI (at 1-year followup)			0.09			−0.08			−0.00
			(0.10)			(0.10)			(0.07)
Observations	295	295	276	295	295	276	295	295	276
R^2	0.44	0.44	0.65	0.31	0.35	0.40	0.23	0.24	0.33

* p $<$ 0.1, ** p $<$ 0.05, *** p $<$ 0.01.

Notes: This table shows associations of parenting behavior with potential mediating infant inputs and key demographic and socioeconomic characteristics (which were used as controls in the main analysis). The sample consists only of mothers in the control group. Column 1 shows the associations by regressing the child development outcome on baseline demographic/socioeconomic characteristics. Column 2 adds mother's depressed status at the 7-year followup and her baseline depression severity. Column 3 adds mediating infant inputs and infant health. The parental behavior indicators are measured using three broad domains and calculated as a summary index following Anderson (2008). All regressions control for interviewer fixed effects. Heteroskedasticity robust standard errors are clustered at the Union Council level.

Table B.6 – Correlates of Child Development at Age 7

	Cognitive development index			Physical development index			Socio-emotional development index		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Girl	0.10	0.10	0.09	−0.03	−0.02	−0.06	−0.25**	−0.21*	−0.24*
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.14)	(0.11)	(0.11)	(0.12)
Age of index child	0.31	0.33	0.22	0.45	0.46	0.54	0.46	0.50	0.47
	(0.39)	(0.39)	(0.42)	(0.53)	(0.53)	(0.54)	(0.57)	(0.58)	(0.53)
Wealth score (at baseline)	0.06*	0.06*	0.06	0.02	0.02	−0.00	−0.01	−0.03	−0.05
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Mother's years of education	0.05***	0.05***	0.04***	−0.00	−0.00	−0.01	0.02	0.01	0.02
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Father's years of education	0.05***	0.05***	0.05***	−0.00	−0.00	−0.00	0.03*	0.03*	0.04**
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Mother's age	0.16***	0.16**	0.14**	0.23**	0.23**	0.22**	0.02	0.02	0.03
	(0.06)	(0.06)	(0.05)	(0.08)	(0.08)	(0.08)	(0.07)	(0.06)	(0.06)
Mother's age^2	−0.00**	−0.00**	−0.00**	−0.00**	−0.00**	−0.00**	−0.00	−0.00	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
No. kids (at baseline)	−0.09**	−0.08**	−0.09**	−0.02	−0.02	−0.06	−0.00	−0.00	−0.02
	(0.04)	(0.04)	(0.03)	(0.05)	(0.05)	(0.04)	(0.04)	(0.03)	(0.04)
Grandmother at baseline	0.04	0.02	−0.01	0.09	0.08	0.09	−0.06	−0.09	−0.14
	(0.09)	(0.08)	(0.08)	(0.12)	(0.12)	(0.12)	(0.14)	(0.14)	(0.17)
Mother depressed (at 7-year followup)		−0.23**	−0.17		−0.06	−0.01		−0.19	−0.19
		(0.10)	(0.12)		(0.16)	(0.17)		(0.13)	(0.13)
Baseline depression severity		0.06	0.06		−0.05	−0.03		−0.16**	−0.17**
		(0.05)	(0.05)		(0.07)	(0.06)		(0.06)	(0.07)
Mother play (at 1-year followup)			−0.03			0.04			−0.08
			(0.13)			(0.17)			(0.19)
Father play (at 1-year followup)			0.35***			0.15			−0.14
			(0.07)			(0.14)			(0.17)
Diarrhea (at 1-year followup)			−0.31***			−0.08			−0.12
			(0.09)			(0.17)			(0.14)
Breastfeeding (at 6-month followup)			−0.01			−0.11			−0.16
			(0.11)			(0.18)			(0.17)
ARI (at 1-year followup)			−0.07			−0.19			0.06
			(0.09)			(0.12)			(0.09)
Observations	295	295	276	295	295	276	295	295	276
R^2	0.23	0.24	0.29	0.09	0.09	0.12	0.12	0.16	0.17

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: This table shows associations of child development with potential mediating infant inputs and key demographic and socioeconomic characteristics (which were used as controls in the main analysis). The sample consists only of mothers in the control group. Column 1 shows the associations by regressing the child development outcome on baseline demographic/socioeconomic characteristics. Column 2 adds mother's depressed status at the 7-year followup and her baseline depression severity. Column 3 adds mediating infant inputs and infant health. The child development indicators are measured using three broad domains and calculated as a summary index following Anderson (2008). All regressions control for interviewer fixed effects. Heteroskedasticity robust standard errors are clustered at the Union Council level.

C Robustness tests

Table C.7 – Sensitivity analysis of controls

		Controls		
	(1)	(2)	(3)	(4)
Panel A: Time invest.				
Treat	0.32*	0.20***	0.17**	0.20***
	(0.16)	(0.07)	(0.07)	(0.07)
Individ. controls p-val.			0.00	0.00
UC controls p-val.				0.00
Panel B: Monetary invest.				
Treat	0.31***	0.31***	0.29***	0.28***
	(0.10)	(0.08)	(0.06)	(0.08)
Individ. controls p-val.			0.00	0.00
UC controls p-val.				0.45
Panel C: Parenting style				
Treat	−0.08	−0.04	−0.06	−0.11*
	(0.08)	(0.06)	(0.06)	(0.07)
Individ. controls p-val.			0.00	0.00
UC controls p-val.				0.00
Panel D: Cognitive Dev.				
Treat	−0.03	−0.01	−0.05	0.01
	(0.10)	(0.09)	(0.08)	(0.08)
Individ. controls p-val.			0.00	0.00
UC controls p-val.				0.28
Panel D: Physical Dev.				
Treat	0.12	0.14	0.15	0.24***
	(0.12)	(0.10)	(0.09)	(0.07)
Individ. controls p-val.			0.00	0.00
UC controls p-val.				0.01
Panel D: Socio-emotional Dev.				
Treat	−0.15	−0.12	−0.09	−0.11
	(0.12)	(0.10)	(0.08)	(0.07)
Individ. controls p-val.			0.00	0.00
UC controls p-val.				0.00

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Three index variables were created using factor analysis, with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. Column 1 reports treatment effects without any covariates. Column 2 only includes controls for interviewer fixed effects. Column 3 reports treatment effects controlling for interview fixed effects, and baseline values of age, age-squared, mother's height, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and interview date. Column 4 further includes controls UC-level averages for age, mother's height, family structure, grandmother, mother and father education, parity, wealth, Hamilton score, and MSPSS score.

Table C.8 – Wild-t bootstrapped clustering

	(1) Coeff (s.e.)	(2) Naive p-value	(3) Wild bootstrapped p-value	(4) FWER p-value
Panel A: Parenting behavior				
Time investment index	0.20	0.01	0.03	0.02
	(0.07)			
Monetary investment index	0.28	0.00	0.01	0.00
	(0.08)			
Parenting style index	−0.11	0.11	0.16	0.11
	(0.06)			
Panel B: Child development outcomes				
Cognitive development index	−0.01	0.88	0.87	0.87
	(0.09)			
Physical development index	0.24	0.00	0.01	0.00
	(0.07)			
Socio-emotional development index	−0.12	0.11	0.12	0.22
	(0.07)			

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: N=585. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heterogeneity robust standard errors, clustered by Union Council, in parentheses. Controls include the full baseline controls described in the main text. Columns 2 shows naive p-values using the clustered sandwich estimator for standard errors, column 3 shows the p-values based on Cameron et al. (2008)'s wild-t bootstrap method, and column 4 calculates the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table C.9 – Effects of maternal depression: 2SLS Results

	First Stage	2SLS					
	(1) Depressed (1-year)	(2) Cognitive Dev.	(3) Physical Dev.	(4) Socio-emo. Dev.	(5) Parenting Time	(6) Parenting Money	(7) Parenting Style
Treated	−0.32***						
	(0.055)						
Depressed (1y)		0.037	−0.74***	0.37	−0.63***	−0.88***	0.33
		(0.24)	(0.28)	(0.23)	(0.18)	(0.25)	(0.21)
Control mean (dep. var)	0.58	−0.00	0.01	0.00	−0.00	−0.01	−0.00

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: N= 584. Column 1 shows the effect of treatment on depression at the 1-year followup. Columns 2-7 show the effects of perinatal depression, measured at the 1-year followup, on child outcomes and parenting behavior at age 7, instrumenting for depression using treatment assignment. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and date of the interview. Heterogeneity robust standard errors, clustered by Union Council, in parentheses.

Table C.10 – Depression trajectories and outcomes

	Parenting			Child Development		
	(1) Parenting Time	(2) Parenting Money	(3) Parenting Style	(4) Cognitive Development	(5) Physical Development	(6) Socio-emotional Development
Panel A: Girls						
Currently depressed	−0.35***	−0.56***	−0.04	−0.36**	−0.13	0.05
	(0.12)	(0.14)	(0.12)	(0.16)	(0.15)	(0.11)
Baseline depressed	0.01	−0.01	−0.02	0.07	−0.27*	−0.24**
	(0.08)	(0.09)	(0.08)	(0.10)	(0.14)	(0.11)
Panel B: Boys						
Currently depressed	−0.15	−0.25*	−0.44***	−0.17	−0.06	−0.43**
	(0.12)	(0.13)	(0.11)	(0.15)	(0.15)	(0.17)
Baseline depressed	−0.31***	−0.11	0.07	0.10	−0.20	−0.06
	(0.10)	(0.11)	(0.10)	(0.11)	(0.12)	(0.13)
Panel C: Combined						
Currently depressed	−0.28***	−0.45***	−0.24***	−0.27**	−0.08	−0.19*
	(0.08)	(0.09)	(0.09)	(0.11)	(0.12)	(0.10)
Baseline depressed	−0.12*	−0.05	0.07	0.10	−0.21**	−0.13
	(0.07)	(0.08)	(0.07)	(0.08)	(0.09)	(0.08)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: N= 596. Sample includes baseline non-depressed mothers from both treatment and controls clusters (N=300) and baseline depressed mothers from control clusters only (N=296). Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, mother's education, father's education, parity, date of the interview, and cluster-average controls.

D Attrition

Table D.11 – Attrition corrected treatment effects: Inverse Probability Weights and Bounds

			All Baseline Controls		Lee Bounds CI	
	(1) Coeff (s.e.)	(2) FWER p-value	(3) Coeff (s.e.)	(4) FWER p-value	(5) Lower	(6) Upper
Time investment index	0.21***	0.02**	0.22***	0.01***	0.07	0.61
	(0.07)		(0.07)			
Monetary investment index	0.30***	0.00***	0.30***	0.00***	0.04	0.59
	(0.08)		(0.08)			
Parenting style index	−0.03	0.51	−0.10	0.11	−0.37	0.19
	(0.06)		(0.06)			
			All Baseline Controls		Lee Bounds CI	
	(1) Coeff (s.e.)	(2) FWER p-value	(3) Coeff (s.e.)	(4) FWER p-value	(5) Lower	(6) Upper
Cognitive development index	−0.02	0.93	−0.01	0.87	−0.34	0.22
	(0.09)		(0.08)			
Physical development index	0.13	0.47	0.21***	0.01***	−0.19	0.35
	(0.10)		(0.08)			
Socio-emotional development index	−0.11	0.47	−0.12	0.19	−0.44	0.13
	(0.10)		(0.07)			

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. Columns 1-4 replicate the main results using IPW (Inverse Probability Weighting) to account for attrition. Column 1 report baseline effects controlling only for interview fixed effects. Column 3 includes additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and interview date. Columns 2 and 4 calculate the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method. Columns 5 and 6 attrition bounds based on Lee (2009), using the starting sample of $N = 704$.

Table D.12 – Characteristics at Baseline, 6-month, & 1-year followups by LTFU (Attrition) Status

Sample Characteristics at THP Baseline:	(1) 7-year followup sample	(2) LTFU	(3) P-value
Mother's characteristics at baseline			
Mother's age	26.87	26.34	0.29
Mother's education	4.06	4.11	0.89
Mother's height (cm)	156.40	156.07	0.54
Mother's BMI	23.18	23.50	0.42
Mother's Mental Health at baseline			
Depression score (Hamilton)	14.49	14.97	0.24
Disability score (BDQ)	8.12	8.40	0.31
Perceived Social Support score (MSPSS)	46.01	42.38	0.02**
Family characteristics at baseline			
Joint/extended family structure	0.59	0.55	0.46
Grandmother lives with	0.50	0.49	0.84
No. member per room	3.64	3.79	0.33
Father's education	7.09	7.39	0.43
Father employed	0.90	0.90	1.00
Father's occupation non-manual worker	0.29	0.32	0.54
Household income and SES at baseline			
SES (1=Rich, 5=Poor)	3.59	3.71	0.24
Has debt	0.55	0.65	0.06*
Household assets at baseline			
Electricity	0.95	0.92	0.37
TV	0.61	0.55	0.24
Refrigerator	0.36	0.29	0.11
Bicycle	0.30	0.25	0.26
Car	0.07	0.03	0.05**
Flush toilet	0.27	0.29	0.67
Brick/concrete walls	0.87	0.90	0.33
Mother's outcomes at 6-month followup			
Mother depressed	0.36	0.37	0.89
Depression score (Hamilton)	6.31	6.31	1.00
Disability score (BDQ)	3.13	2.89	0.50
Perceived Social Support score (MSPSS)	47.75	45.31	0.12
Mother's outcomes at 1-year followup			
Mother depressed	0.42	0.41	0.90
Depression score (Hamilton)	7.84	8.15	0.69
Disability score (BDQ)	3.65	3.45	0.64
Perceived Social Support score (MSPSS)	47.06	46.15	0.51
Child weight (km)	8.19	8.25	0.61
Child height (cm)	72.09	72.05	0.92
Sample size	585	119	704

* $p < .10$, ** $p < .05$, *** $p < .01$

Note: The table shows sample means by attrition status (Column 1 shows the non-attritors, those found for the 2013 survey, and Column 2 shows the attriting women) for selected characteristics and outcomes measured at baseline, 6-month followup, and 1-year followup. Column 3 shows the p-value of the difference in means between attritors and non-attiritors.

Table D.13 – Characteristics at Baseline by Treatment Group (LTFU sample)

Sample Characteristics at THP Baseline:	(1) Treatment	(2) Control	(3) P-value
Mother's characteristics at baseline			
Mother's age	26.09	26.69	0.49
Mother's education	4.53	3.55	0.19
Mother's height (cm)	156.28	155.78	0.64
Mother's BMI	23.10	24.05	0.21
LTFU because moved	0.87	0.90	0.57
Mother's Mental Health at baseline			
Depression score (Hamilton)	14.88	15.08	0.79
Disability score (BDQ)	8.04	8.88	0.09*
Perceived Social Support score (MSPSS)	41.84	43.10	0.63
Family characteristics at baseline			
Joint/extended family structure	0.57	0.53	0.64
Grandmother lives with	0.54	0.41	0.16
No. member per room	3.87	3.69	0.51
Father's education	7.57	7.16	0.61
Father employed	0.87	0.94	0.19
Household income and SES at baseline			
SES (1=Rich, 5=Poor)	3.68	3.75	0.73
Has debt	0.68	0.60	0.40
Household assets at baseline			
Electricity	0.91	0.94	0.55
TV	0.62	0.47	0.11
Refrigerator	0.34	0.22	0.15
Bicycle	0.22	0.29	0.36
Water pump	0.38	0.24	0.09*
Car	0.03	0.02	0.74
Flush toilet	0.35	0.20	0.06*
Brick/concrete walls	0.93	0.86	0.26
Sample size	68	51	119

* $p < .10$, ** $p < .05$, *** $p < .01$

Note: The table shows sample means by Treated and Control groups for characteristics and outcomes measured at baseline for the LTFU mothers. Column 3 shows the p-value of the difference in means between the treated and control groups.

E Baseline non-depressed

Table E.14 – Balance in non-depressed sample: Characteristics by cluster assignment at 7-yr followup

	Non-experimental Sample at 7-year followup					
	Control Mean	(s.d.)	T-C Diff	(s.e.)	*p*-val	N
Age	33.86	(5.2)	0.42	(0.71)	0.56	300
Parity	4.65	(3.0)	−0.23	(0.30)	0.46	300
Mother's education	4.85	(4.3)	1.39	(0.73)	0.07*	300
Father's education	7.89	(3.3)	0.24	(0.47)	0.61	300
Grandmother lives with	0.40	(0.5)	0.09	(0.07)	0.20	300
Adults in house	4.01	(2.6)	0.27	(0.30)	0.38	299
Index child is girl	0.48	(0.5)	−0.03	(0.07)	0.69	300
Age of index child	7.57	(0.1)	0.00	(0.01)	0.80	300
Mother's Financial Autonomy Index	0.27	(1.1)	0.08	(0.14)	0.55	300
Father's Employment Index	0.03	(0.7)	0.04	(0.08)	0.60	299
Household Wealth Index	0.13	(0.8)	0.22	(0.14)	0.12	300
Relationship Quality Index	0.37	(0.8)	0.03	(0.09)	0.73	295
Mother's Health Index	0.14	(1.3)	0.19	(0.16)	0.24	300
Mental health index (7y)	0.52	(0.5)	0.03	(0.06)	0.63	300
Joint test (*p*-value)					0.38	
Observations		150				

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: This table tests for balance in characteristics at the 7-year followup for women screened out (non-depressed) at baseline, by treatment and control clusters.

[a] The wealth index is a PCA-weighted index of household income, health worker SES rating, house materials, water and waste infrastructure, and a number of other assets.

Table E.15 – Characteristics in 2013 by Baseline Depression Status

Sample Characteristics:	(1) Non-depressed	(2) Depressed	(3) P-value
Mother's characteristics			
Mother's age	34.06	34.73	0.10 *
Mother's education	5.54	4.02	0.00 ***
Number of kids	4.00	4.31	0.00 ***
Number of kids born to mother in last 7 years	1.24	0.87	0.00 ***
Avg age if kids born to mother in last 7 yrs	3.68	3.71	0.81
Mother's general health (1=vgood 5=vbad)	2.87	3.14	0.00 ***
Mother's Mental Health			
Currently depressed (MDE)	0.11	0.27	0.00 ***
Perceived social support score (MSPSS)	41.69	37.94	0.00 ***
Recovered permanently	0.00	0.39	0.00 ***
Never recovered	0.00	0.13	0.00 ***
Depressed ever between 2008-2013	0.13	0.31	0.00 ***
Depressed between 2008-2013 (recall only)	0.03	0.14	0.00 ***
Number of recalled depressive episodes	0.03	0.15	0.00 ***
Number of depressive episodes since 2007	0.12	0.33	0.00 ***
Duration of recalled depressive episodes (yrs)	0.03	0.11	0.00 ***
Family characteristics			
Joint/extended family structure	0.60	0.60	0.93
Grandmother lives with	0.44	0.37	0.03 **
Number of adults living with	4.14	3.72	0.01 ***
Father's characteristics			
Father's education	8.01	6.96	0.00 ***
Father employed	0.90	0.87	0.25
Father's occupation non-manual worker	0.09	0.05	0.01 ***
Household income and SES			
SES (1=Rich, 5=Poor)	3.34	3.48	0.01 ***
Has debt	0.56	0.63	0.05 **
Piped drinking water	0.06	0.08	0.28
Flush toilet	0.65	0.57	0.03 **
Sample size	300	585	885

* $p < .10$, ** $p < .05$, *** $p < .01$

Note: The table shows sample means for characteristics for perinatally depressed and perinatally non-depressed mother measure at the time of the 2013 follow-up. Column 3 shows the p-value of the difference in means between the depressed and non-depressed groups.

Table E.16 – Outcomes differences between baseline non-depressed versus depressed controls

	Non-depressed	Dep-NonDep (No controls)		Dep-NonDep (With controls)	
	Mean (s.d.)	β (s.e.)	p-value	β (s.e.)	p-value
Time investment index	0.38	−0.27	0.00***	−0.16	0.02**
	(1.0)	(0.06)		(0.07)	
Monetary investment index	0.35	−0.35	0.00***	−0.12	0.15
	(1.1)	(0.10)		(0.08)	
Parenting style index	0.01	−0.05	0.43	0.04	0.62
	(1.0)	(0.06)		(0.07)	
Cognitive development index	0.12	−0.11	0.26	0.06	0.48
	(1.1)	(0.10)		(0.08)	
WPPSI Full Scale IQ	83.64	−1.23	0.33	1.06	0.26
	(12.9)	(1.25)		(0.93)	
Executive function (Stroop)	14.30	−0.23	0.39	−0.06	0.84
	(3.0)	(0.26)		(0.29)	
Physical development index	0.25	−0.23	0.01**	−0.22	0.02**
	(0.9)	(0.09)		(0.09)	
Weight-for-age (z)	−1.10	−0.02	0.82	0.03	0.75
	(1.1)	(0.10)		(0.08)	
Height-for-age (z)	−0.77	−0.00	0.98	0.06	0.41
	(1.2)	(0.09)		(0.08)	
Not stunted (height>2SD)	0.88	−0.03	0.34	−0.02	0.63
	(0.3)	(0.03)		(0.03)	
Not thin (BMI>2SD)	0.85	−0.04	0.25	−0.03	0.38
	(0.4)	(0.04)		(0.03)	
Motor function	3.39	0.03	0.60	0.06	0.27
	(0.7)	(0.06)		(0.05)	
No hospitalization	0.87	−0.06	0.11	−0.07	0.10*
	(0.3)	(0.04)		(0.04)	
No severe illness	0.77	−0.08	0.00***	−0.09	0.01***
	(0.4)	(0.03)		(0.03)	
No eyesight problems	0.98	−0.04	0.02**	−0.04	0.01**
	(0.1)	(0.02)		(0.02)	
No hearing problems	0.99	−0.01	0.29	−0.02	0.05*
	(0.1)	(0.01)		(0.01)	
Socio-emotional development index	0.12	−0.15	0.06*	−0.16	0.06*
	(0.9)	(0.08)		(0.08)	
SDQ Total Score	10.35	0.90	0.04**	0.74	0.06*
	(5.0)	(0.43)		(0.38)	
Spence Child Anxiety Scale	17.57	2.92	0.01***	2.96	0.01***
	(11.2)	(1.05)		(1.05)	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Table reports means of key outcome variables for child development and parenting for prenatally nondepressed mothers and their children (N=300) and the differences between depressed controls (N=293) and non-depressed. Columns 2 and 3 show the raw differences without any controls. Columns 4 and 5 report adjusted differences using the baseline controls for the difference-in-difference specification (age and its square, mother and father education, parity at baseline, UC-level controls, interview date, and interviewer fixed effects.)

F Heterogeneous treatment effects

Table F.17 – Heterogeneous treatment effects at 7 years: parenting

	(1) Treat	(2) Treat × Grandmother absent	(3) Grandmother absent
Time investment index	0.08	0.18	−0.09
	(0.10)	(0.13)	(0.12)
Monetary investment index	0.28***	0.02	0.06
	(0.09)	(0.13)	(0.12)
Parenting style index	−0.13	0.16	−0.08
	(0.10)	(0.16)	(0.14)
	Treat	Treat × Parents' avg education	Parents' avg education
Time investment index	0.25*	−0.01	0.05*
	(0.14)	(0.02)	(0.03)
Monetary investment index	0.29*	0.00	0.09***
	(0.16)	(0.02)	(0.03)
Parenting style index	−0.04	−0.00	0.05*
	(0.14)	(0.02)	(0.03)
	Treat	Treat × Wealth index	Wealth index
Time investment index	0.18**	−0.01	0.07***
	(0.07)	(0.04)	(0.02)
Monetary investment index	0.29***	0.04	0.08**
	(0.06)	(0.04)	(0.03)
Parenting style index	−0.05	0.01	0.03
	(0.06)	(0.04)	(0.03)
	Treat	Treat × First child	First child
Time investment index	0.20***	−0.22*	0.04
	(0.07)	(0.13)	(0.13)
Monetary investment index	0.29***	−0.03	0.08
	(0.08)	(0.18)	(0.16)
Parenting style index	−0.11	0.33	−0.02
	(0.08)	(0.24)	(0.22)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: N=585. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects. Full set of controls comprises of baseline values of mother's age, age-squared, height, parity, education, family structure, presence of grandmother (mother or mother-in-law of depressed mother), husbands' education, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview, as well as additional controls for cluster-level baseline averages of mother's age, height, parity, family structure, grandmother, wealth, mother and father education, depression severity and social support.

Table F.18 – Heterogeneous treatment effects at 7 years: parenting

	Treat	Treat × Parity	Parity
Time investment index	0.09	0.03	0.01
	(0.14)	(0.03)	(0.03)
Monetary investment index	0.22	0.02	−0.00
	(0.17)	(0.05)	(0.04)
Parenting style index	−0.06	−0.00	0.04
	(0.17)	(0.05)	(0.03)
	Treat	Treat × Mother's education	Mother's education
Time investment index	0.18*	0.01	0.03**
	(0.09)	(0.02)	(0.01)
Monetary investment index	0.23*	0.01	0.05***
	(0.12)	(0.02)	(0.02)
Parenting style index	−0.08	−0.01	0.03*
	(0.09)	(0.02)	(0.02)
	Treat	Treat × Depression severity	Depression severity
Time investment index	0.19***	−0.07	0.02
	(0.07)	(0.07)	(0.05)
Monetary investment index	0.28***	−0.03	−0.00
	(0.06)	(0.06)	(0.04)
Parenting style index	−0.04	−0.09	0.08*
	(0.06)	(0.08)	(0.04)
	Treat	Treat × Mother's age	Mother's age
Time investment index	0.17	0.00	0.01
	(0.37)	(0.01)	(0.01)
Monetary investment index	0.33	−0.00	0.01
	(0.46)	(0.01)	(0.01)
Parenting style index	−0.24	0.01	0.00
	(0.55)	(0.02)	(0.01)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and date of the interview.

Table F.19 – Heterogeneous treatment effects at 7 years: Child development

	(1)	(2)	(3)
	Treat	Treat × Grandmother absent	Grandmother absent
Cognitive development index	−0.08	0.06	−0.05
	(0.09)	(0.15)	(0.11)
Physical development index	0.16	−0.02	−0.16
	(0.12)	(0.16)	(0.13)
Socio-emotional development index	0.02	−0.24	0.10
	(0.12)	(0.15)	(0.14)
	Treat	Treat × Parents' avg education	Parents' avg education
Cognitive development index	0.15	−0.04	0.10***
	(0.17)	(0.02)	(0.03)
Physical development index	0.34**	−0.03	0.02
	(0.13)	(0.02)	(0.02)
Socio-emotional development index	−0.09	−0.00	0.05*
	(0.19)	(0.03)	(0.03)
	Treat	Treat × Wealth index	Wealth index
Cognitive development index	−0.04	−0.01	0.07*
	(0.08)	(0.05)	(0.04)
Physical development index	0.15*	0.01	0.03
	(0.09)	(0.04)	(0.03)
Socio-emotional development index	−0.12	0.08**	−0.02
	(0.08)	(0.04)	(0.03)
	Treat	Treat × First child	First child
Cognitive development index	−0.05	0.01	0.29*
	(0.09)	(0.18)	(0.16)
Physical development index	0.13	0.07	0.13
	(0.09)	(0.21)	(0.19)
Socio-emotional development index	−0.13	0.19	0.08
	(0.09)	(0.20)	(0.19)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: N=585. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview.

Table F.20 – Heterogeneous treatment effects at 7 years: Child development

	(1) Treat	(2) Treat × Parity	(3) Parity
Cognitive development index	−0.16	0.03	−0.09**
	(0.14)	(0.04)	(0.04)
Physical development index	−0.05	0.06	−0.01
	(0.20)	(0.05)	(0.05)
Socio-emotional development index	−0.04	−0.02	0.02
	(0.17)	(0.04)	(0.03)
	Treat	Treat × Mother's education	Mother's education
Cognitive development index	0.04	−0.01	0.05***
	(0.12)	(0.02)	(0.01)
Physical development index	0.32***	−0.02	−0.01
	(0.10)	(0.02)	(0.01)
Socio-emotional development index	−0.08	−0.01	0.01
	(0.12)	(0.02)	(0.02)
	Treat	Treat × Depression severity	Depression severity
Cognitive development index	−0.07	−0.08	0.05
	(0.09)	(0.06)	(0.04)
Physical development index	0.12	0.06	−0.03
	(0.09)	(0.08)	(0.06)
Socio-emotional development index	−0.10	0.03	−0.13**
	(0.09)	(0.08)	(0.05)
	Treat	Treat × Mother's age	Mother's age
Cognitive development index	−0.27	0.01	0.02**
	(0.33)	(0.01)	(0.01)
Physical development index	0.34	−0.01	0.02
	(0.43)	(0.01)	(0.01)
Socio-emotional development index	0.55	−0.02	0.01
	(0.42)	(0.01)	(0.01)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and date of the interview.

Table F.21 – Child outcomes at age 7: Risk game

	Outcome: Risk Tolerant				Risk Averse			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	−0.03	−0.02	0.01	0.01	0.04	−0.03	−0.04	−0.04
	(0.06)	(0.05)	(0.06)	(0.06)	(0.04)	(0.03)	(0.03)	(0.03)
Depr × Treat	0.01				−0.07			
	(0.07)				(0.04)			
Baseline depressed	0.02				0.02			
	(0.05)				(0.03)			
No. people intervened				0.01				−0.01
				(0.02)				(0.01)
How influenced				−0.06				−0.04*
				(0.04)				(0.02)
Time taken (min)				−0.02				0.00
				(0.03)				(0.02)
Observations	885.00	585.00	585.00	584.00	885.00	585.00	585.00	584.00
Dep. var. mean	0.44	0.45	0.45	0.45	0.18	0.18	0.18	0.18

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Outcomes are binary variables based on the level of risk taken is a risky game. The child got 4 tokens and each token corresponded to a single gift of choice from a gift bag with an assortment of small items such as toys, stationary, beads, hair bands etc. The child had a choice of putting tokens in a risky bowl with 50 percent chance of a good outcome where investment tripled and all was lost if outcome was bad. Alternatively, the child could also place tokens in a risk-free bowl where investment returned a sure outcome of one gift. Child was coded as risk tolerant if (s)he placed 3 or 4 tokens in the risky bowl, and risk averse if (s)he placed 0 or 1 tokens in the risky bowl. Heterogeneity robust standard errors, clustered by Union Council, in parentheses.

G Treatment effects within indices

Table G.22 – Parenting Style index

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
PPI: Not harsh	13.53	−0.11	0.95	585	0.80	−1.20
	(8.22)	(0.51)			(0.69)	(0.71)
PPI: Not harsh for age	8.71	−0.16	0.82	585	−0.11	−0.23
	(1.04)	(0.15)			(0.15)	(0.20)
PPI: Consistent	9.60	0.31	0.87	585	0.34	0.24
	(3.64)	(0.35)			(0.43)	(0.42)
PPI: Appropriate	8.74	−0.34	0.87	585	−0.69	0.10
	(4.45)	(0.35)			(0.48)	(0.45)
HOME: Responsivity	8.76	0.31**	0.10	585	0.69***	−0.08
	(1.75)	(0.13)			(0.17)	(0.19)
HOME: Encouragement of maturity	5.24	−0.03	0.95	585	0.10	−0.18
	(1.56)	(0.11)			(0.16)	(0.15)
HOME: Emotional climate	4.53	0.12	0.89	585	0.55**	−0.34
	(1.93)	(0.21)			(0.25)	(0.25)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview. Column 3 calculates the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table G.23 – Parental Time-Intensive Investment index

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
HOME: Enrichment	2.66	0.29**	0.06*	585	0.37**	0.22
	(1.40)	(0.12)			(0.16)	(0.15)
HOME: Family companionship	2.95	0.30**	0.06*	585	0.57***	0.03
	(1.77)	(0.12)			(0.18)	(0.20)
HOME: Family integration	2.62	0.06	0.72	585	0.12	−0.00
	(0.92)	(0.06)			(0.09)	(0.11)
Frequency of mother play	0.68	0.02	0.76	585	0.01	0.03
	(1.25)	(0.07)			(0.09)	(0.11)
Frequency of father play	0.62	0.12	0.72	550	0.05	0.19
	(1.17)	(0.14)			(0.15)	(0.16)
Someone helps with studies	0.53	0.10***	0.02**	585	0.11**	0.08
	(0.50)	(0.03)			(0.05)	(0.05)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview. Column 3 calculates the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table G.24 – Parental Monetary-Intensive Investment index

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
HOME: Learning materials	2.67	0.22	0.25	585	0.19	0.25
	(1.50)	(0.14)			(0.17)	(0.17)
HOME: Physical environment	4.67	−0.01	0.92	585	0.15	−0.18
	(2.39)	(0.14)			(0.20)	(0.22)
Education expend.(100s PKR)	21.87	5.51**	0.14	584	7.93**	3.26
	(27.65)	(2.31)			(3.17)	(3.58)
Expected grade attainment	14.07	0.47*	0.21	583	0.75**	0.23
	(2.73)	(0.23)			(0.35)	(0.23)
Private school	0.39	0.13**	0.17	580	0.17**	0.09
	(0.49)	(0.06)			(0.07)	(0.08)
School quality	−0.16	0.19*	0.24	576	0.34**	0.06
	(0.93)	(0.11)			(0.14)	(0.13)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview. Column 3 calculates the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table G.25 – Child Cognitive Development index

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
WPPSI: Verbal comprehension	85.24	−0.47	0.99	583	0.10	−0.99
	(13.62)	(1.30)			(1.67)	(1.48)
WPPSI: Visual spatial	87.54	−1.61	0.79	584	−0.89	−2.29
	(15.04)	(1.26)			(1.78)	(1.92)
WPPSI: Fluid reasoning	77.67	0.48	0.99	584	2.00	−1.03
	(11.57)	(0.98)			(1.27)	(1.71)
WPPSI: Working memory	99.81	−0.52	0.99	584	0.33	−1.33
	(15.59)	(1.43)			(2.03)	(1.81)
WPPSI: Processing speed	76.51	2.48***	0.00***	581	3.79***	0.92
	(9.58)	(0.61)			(0.96)	(0.93)
Urdu score	6.40	−0.03	0.99	580	−0.15	0.01
	(3.52)	(0.31)			(0.38)	(0.47)
Math score	9.09	−0.15	0.99	579	0.11	−0.45
	(3.58)	(0.33)			(0.42)	(0.44)
Executive function (Stroop)	14.19	−0.16	0.99	585	−0.32	0.02
	(3.06)	(0.29)			(0.46)	(0.33)
Grade	1.95	−0.06	0.98	575	−0.17	0.03
	(0.84)	(0.09)			(0.11)	(0.11)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview. Column 3 calculates the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table G.26 – Child Physical Development index

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
Weight-for-age (z)	−1.12	−0.16	0.52	581	−0.08	−0.25**
	(1.05)	(0.10)			(0.15)	(0.11)
Height-for-age (z)	−0.80	−0.06	0.87	581	−0.23	0.11
	(1.11)	(0.09)			(0.17)	(0.11)
Not stunted (height>2SD)	0.85	0.01	0.89	585	−0.04	0.05
	(0.36)	(0.04)			(0.05)	(0.04)
Not thin (BMI>2SD)	0.82	−0.02	0.87	585	0.02	−0.07
	(0.39)	(0.04)			(0.05)	(0.05)
Motor function	3.39	0.08*	0.40	585	0.21***	−0.04
	(0.68)	(0.04)			(0.07)	(0.06)
No hospitalization	0.81	0.12**	0.23	585	0.12*	0.12**
	(0.39)	(0.05)			(0.06)	(0.06)
No severe illness	0.69	0.04	0.68	585	0.02	0.05
	(0.46)	(0.03)			(0.05)	(0.04)
No eyesight problems	0.95	0.02	0.68	585	0.01	0.04
	(0.23)	(0.02)			(0.03)	(0.03)
No hearing problems	0.98	0.03*	0.52	585	0.03	0.02
	(0.15)	(0.01)			(0.02)	(0.01)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview. Column 3 calculates the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

Table G.27 – Child Socio-emotional Development index

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
SDQ: Emotional	2.35	0.07	1.00	585	−0.17	0.30
	(2.05)	(0.16)			(0.21)	(0.27)
SDQ: Conduct problems	3.31	0.06	1.00	585	−0.37	0.55**
	(2.04)	(0.18)			(0.24)	(0.22)
SDQ: Hyperactivity	3.52	−0.01	1.00	585	0.03	0.02
	(2.56)	(0.21)			(0.29)	(0.34)
SDQ: Peer problems	1.94	0.06	1.00	585	0.06	0.05
	(1.55)	(0.13)			(0.16)	(0.20)
SDQ: Prosocial	7.50	−0.02	1.00	585	0.09	−0.20
	(2.52)	(0.16)			(0.21)	(0.24)
SCAS: Panic and agoraphobia	1.49	0.34	0.92	585	0.33	0.34
	(2.68)	(0.29)			(0.37)	(0.42)
SCAS: Separation	5.90	0.33	0.92	585	−0.14	0.78*
	(4.01)	(0.30)			(0.47)	(0.42)
SCAS: Injury fear	6.01	0.17	1.00	585	0.17	−0.00
	(3.67)	(0.33)			(0.43)	(0.45)
SCAS: Social phobia	2.40	−0.19	0.98	585	−0.71	0.34
	(2.94)	(0.26)			(0.46)	(0.35)
SCAS: Obsessive-compulsive	1.20	0.87***	0.00***	585	1.04***	0.67**
	(1.94)	(0.19)			(0.20)	(0.29)
SCAS: General anxiety	3.37	0.13	1.00	585	−0.12	0.35
	(3.27)	(0.25)			(0.36)	(0.38)

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton, BDQ, MSPSS scores and their squares, and date of the interview. Column 3 calculates the p-values controlling for the family-wise error rate (FWER) using a free step-down resampling method.

H Treatment effects within subscales

Table H.28 – Treatment effects within subcomponents: HOME inventory

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
HOME inventory	34.11	1.26**	0.04**	585	2.74***	−0.27
	(9.05)	(0.61)			(0.90)	(0.84)
HOME: Responsivity	8.76	0.31**	0.12	585	0.69***	−0.08
	(1.75)	(0.13)			(0.17)	(0.19)
HOME: Encouragement of maturity	5.24	−0.03	0.95	585	0.10	−0.18
	(1.56)	(0.11)			(0.16)	(0.15)
HOME: Emotional climate	4.53	0.12	0.89	585	0.55**	−0.34
	(1.93)	(0.21)			(0.25)	(0.25)
HOME: Learning materials	2.67	0.22	0.57	585	0.19	0.25
	(1.50)	(0.14)			(0.17)	(0.17)
HOME: Enrichment	2.66	0.29**	0.11	585	0.37**	0.22
	(1.40)	(0.12)			(0.16)	(0.15)
HOME: Family companionship	2.95	0.30**	0.12	585	0.57***	0.03
	(1.77)	(0.12)			(0.18)	(0.20)
HOME: Family integration	2.62	0.06	0.82	585	0.12	−0.00
	(0.92)	(0.06)			(0.09)	(0.11)
HOME: Physical environment	4.67	−0.01	0.95	585	0.15	−0.18
	(2.39)	(0.14)			(0.20)	(0.22)
Positive parenting (interviewer obs.)	9.19	0.23	0.60	585	0.69***	−0.24
	(2.34)	(0.17)			(0.23)	(0.25)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and date of the interview.

Table H.29 – Treatment effects within subcomponents: Parenting Practices (PPI)

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
Parenting practices inventory	40.58	−0.30	0.62	585	0.34	−1.08
	(9.16)	(0.60)			(0.75)	(1.03)
PPI: Not harsh	13.53	−0.11	0.82	585	0.80	−1.20
	(8.22)	(0.51)			(0.69)	(0.71)
PPI: Not harsh for age	8.71	−0.16	0.70	585	−0.11	−0.23
	(1.04)	(0.15)			(0.15)	(0.20)
PPI: Consistent	9.60	0.31	0.70	585	0.34	0.24
	(3.64)	(0.35)			(0.43)	(0.42)
PPI: Appropriate	8.74	−0.34	0.70	585	−0.69	0.10
	(4.45)	(0.35)			(0.48)	(0.45)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and date of the interview.

Table H.30 – Treatment effects within subcomponents: School quality

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
School Quality	5.62	0.61**	0.03**	576	1.01***	0.21
	(2.05)	(0.27)			(0.35)	(0.32)
School has office	0.77	0.07	0.56	576	0.16**	−0.02
	(0.42)	(0.05)			(0.08)	(0.05)
School has playground	0.81	0.10*	0.29	576	0.10*	0.11*
	(0.39)	(0.05)			(0.06)	(0.06)
School has library	0.39	0.13**	0.19	576	0.20**	0.05
	(0.49)	(0.06)			(0.08)	(0.07)
Library books visably in use	0.36	0.11*	0.29	576	0.18**	0.03
	(0.48)	(0.06)			(0.08)	(0.07)
School has water source	0.89	−0.03	0.71	576	−0.00	−0.05
	(0.32)	(0.03)			(0.04)	(0.03)
School has clean drinking water	0.92	0.01	0.93	576	0.05	−0.04
	(0.26)	(0.03)			(0.05)	(0.04)
School has fencing	0.97	−0.00	0.93	576	0.01	−0.02
	(0.16)	(0.01)			(0.02)	(0.02)
School has computers	0.26	0.11**	0.28	576	0.15*	0.08
	(0.44)	(0.06)			(0.07)	(0.07)
Computersvisably in use	0.24	0.11*	0.29	576	0.16**	0.08
	(0.43)	(0.06)			(0.08)	(0.07)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and date of the interview.

Table H.31 – Treatment effects within subcomponents: WPPSI

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
WPPSI Full Scale IQ	82.13	−0.12	0.88	584	1.20	−1.54
	(11.40)	(0.82)			(1.30)	(1.17)
WPPSI: Verbal comprehension	85.24	−0.47	0.93	583	0.10	−0.99
	(13.62)	(1.30)			(1.67)	(1.48)
WPPSI: Visual spatial	87.54	−1.61	0.55	584	−0.89	−2.29
	(15.04)	(1.26)			(1.78)	(1.92)
WPPSI: Fluid reasoning	77.67	0.48	0.93	584	2.00	−1.03
	(11.57)	(0.98)			(1.27)	(1.71)
WPPSI: Working memory	99.81	−0.52	0.93	584	0.33	−1.33
	(15.59)	(1.43)			(2.03)	(1.81)
WPPSI: Processing speed	76.51	2.48***	0.00***	581	3.79***	0.92
	(9.58)	(0.61)			(0.96)	(0.93)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and date of the interview.

Table H.32 – Treatment effects within subcomponents: Spence Child Anxiety Score

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
Spence Child Anxiety Scale	20.36	1.64	0.13	585	0.56	2.48
	(13.35)	(1.06)			(1.67)	(1.51)
SCAS: Panic and agoraphobia	1.49	0.34	0.68	585	0.33	0.34
	(2.68)	(0.29)			(0.37)	(0.42)
SCAS: Separation	5.90	0.33	0.68	585	−0.14	0.78*
	(4.01)	(0.30)			(0.47)	(0.42)
SCAS: Injury fear	6.01	0.17	0.83	585	0.17	−0.00
	(3.67)	(0.33)			(0.43)	(0.45)
SCAS: Social phobia	2.40	−0.19	0.82	585	−0.71	0.34
	(2.94)	(0.26)			(0.46)	(0.35)
SCAS: Obsessive-compulsive	1.20	0.87***	0.00***	585	1.04***	0.67**
	(1.94)	(0.19)			(0.20)	(0.29)
SCAS: General anxiety	3.37	0.13	0.83	585	−0.12	0.35
	(3.27)	(0.25)			(0.36)	(0.38)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and date of the interview.

Table H.33 – Treatment effects within subcomponents: Strengths and Difficulties Questionnaire

		Treatment effects: full sample			By Gender	
	(1) Control Mean (st.dev.)	(2) Coeff β/(s.e.)	(3) FWER p-value	(4) N	(5) Girls	(6) Boys
SDQ Total Score	11.12	0.18	0.56	585	−0.44	0.93
	(5.23)	(0.31)			(0.43)	(0.65)
SDQ: Emotional	2.35	0.07	0.99	585	−0.17	0.30
	(2.05)	(0.16)			(0.21)	(0.27)
SDQ: Conduct problems	3.31	0.06	0.99	585	−0.37	0.55**
	(2.04)	(0.18)			(0.24)	(0.22)
SDQ: Hyperactivity	3.52	−0.01	0.99	585	0.03	0.02
	(2.56)	(0.21)			(0.29)	(0.34)
SDQ: Peer problems	1.94	0.06	0.99	585	0.06	0.05
	(1.55)	(0.13)			(0.16)	(0.20)
SDQ: Prosocial	7.50	−0.02	0.99	585	0.09	−0.20
	(2.52)	(0.16)			(0.21)	(0.24)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Heterogeneity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects as well as additional controls for baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and date of the interview.

I Alternative indices: Factor scores

Table I.34 – Parenting outcomes by broad domains (Factor)

	Interviewer FE	All baseline controls		By gender		
	(1) Coeff (s.e.)	(2) Coeff (s.e.)	(3) FWER p-value	(4) Girls	(5) Boys	(6) p-value Girl × T
Time investment index	0.16***	0.17***	0.01**	0.19**	0.10	0.38
	(0.06)	(0.06)		(0.08)	(0.09)	
Monetary investment index	0.23***	0.19***	0.01**	0.29***	0.08	0.07
	(0.06)	(0.07)		(0.10)	(0.09)	
Parenting style index	0.08	0.09	0.19	0.30***	−0.21**	0.00
	(0.06)	(0.07)		(0.10)	(0.09)	

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Three index variables were created using factor analysis, with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. Column 1 only includes controls for interviewer fixed effects. Column 3 reports treatment effects controlling for interview fixed effects, and baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and interview date.

Table I.35 – Parenting behavior: Difference-in-difference (Factor)

	(1) Treat	(2) Treat × Prenatally Depressed	(3) Prenatally Depressed
Time investment index	−0.12	0.22*	−0.18**
	(0.10)	(0.12)	(0.08)
Monetary investment index	−0.11	0.27**	−0.17**
	(0.10)	(0.11)	(0.08)
Parenting style index	−0.26**	0.29**	−0.21**
	(0.12)	(0.12)	(0.09)

	Girls (N=436)			Boys (N=449)		
	(1) Treat	(2) Treat × Prenatally Depressed	(3) Prenatally Depressed	(4) Treat	(5) Treat × Prenatally Depressed	(6) Prenatally Depressed
Time investment index	−0.21	0.49**	−0.22*	−0.02	0.11	−0.18
	(0.15)	(0.18)	(0.12)	(0.12)	(0.18)	(0.14)
Monetary investment index	−0.27	0.55***	−0.27**	−0.02	0.16	−0.08
	(0.17)	(0.17)	(0.13)	(0.15)	(0.15)	(0.13)
Parenting style index	−0.36***	0.68***	−0.52***	−0.17	−0.10	0.06
	(0.12)	(0.13)	(0.11)	(0.15)	(0.16)	(0.12)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Sample includes children of mothers who were depressed at baseline as well those who were not depressed at baseline, in both treatment and control clusters. Index variables were created with factor analysis, with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects, age of mother and its square, father's and mother's education, parity, and the date of interview.

Table I.36 – Child development outcomes by broad domains (Factor)

	Interviewer FE	All baseline controls		By gender		
	(1) Coeff (s.e.)	(2) Coeff (s.e.)	(3) FWER p-value	(4) Girls	(5) Boys	(6) p-value Girl × T
Cognitive development index	0.02	−0.01	0.90	0.04	−0.00	0.49
	(0.09)	(0.07)		(0.13)	(0.10)	
Physical development index	−0.08	−0.07	0.61	−0.10	−0.03	0.63
	(0.08)	(0.08)		(0.15)	(0.09)	
Socio-emotional development index	−0.11	−0.09	0.46	0.01	−0.21	0.28
	(0.07)	(0.07)		(0.13)	(0.14)	

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Three index variables were created using factor analysis, with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. Column 1 only includes controls for interviewer fixed effects. Column 3 reports treatment effects controlling for interview fixed effects, and baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and interview date.

Table I.37 – Child development: Difference-in-difference (Factor)

	(1) Treat	(2) Treat × Prenatally Depressed	(3) Prenatally Depressed
Cognitive development index	−0.03	−0.07	0.04
	(0.10)	(0.13)	(0.09)
Physical development index	0.14	−0.27*	0.07
	(0.11)	(0.15)	(0.11)
Socio-emotional development index	0.04	−0.18	−0.18*
	(0.10)	(0.14)	(0.10)

	Girls (N=436)			Boys (N=449)		
	(1) Treat	(2) Treat × Prenatally Depressed	(3) Prenatally Depressed	(4) Treat	(5) Treat × Prenatally Depressed	(6) Prenatally Depressed
Cognitive development index	−0.17	0.20	−0.20	0.06	−0.23	0.19
	(0.21)	(0.27)	(0.20)	(0.14)	(0.17)	(0.13)
Physical development index	−0.03	−0.14	−0.05	0.25	−0.38	0.17
	(0.16)	(0.20)	(0.14)	(0.19)	(0.24)	(0.18)
Socio-emotional development index	−0.12	0.12	−0.27	0.07	−0.17	−0.26*
	(0.18)	(0.24)	(0.17)	(0.14)	(0.16)	(0.13)

* p < 0.1, ** p < 0.05, *** p < 0.01.

Notes: Sample includes children of mothers who were depressed at baseline as well those who were not depressed at baseline, in both treatment and control clusters. Index variables were created with factor analysis, with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects, age of mother and its square, father's and mother's education, parity, and the date of interview.

Table I.38 – Treatment effects at 7 years: IPW (Factor)

			All Baseline Controls		Lee Bounds CI	
	(1) Coeff (s.e.)	(2) FWER p-value	(3) Coeff (s.e.)	(4) FWER p-value	(5) Lower	(6) Upper
Time investment index	0.16***	0.02**	0.18***	0.02**	0.05	0.54
	(0.06)		(0.06)			
Monetary investment index	0.22***	0.00***	0.21***	0.02**	0.03	0.45
	(0.06)		(0.07)			
Parenting style index	0.09	0.22	0.09	0.22	−0.15	0.34
	(0.06)		(0.07)			
			All Baseline Controls		Lee Bounds CI	
	(1) Coeff (s.e.)	(2) FWER p-value	(3) Coeff (s.e.)	(4) FWER p-value	(5) Lower	(6) Upper
Cognitive development index	0.01	0.84	0.00	0.88	−0.25	0.25
	(0.09)		(0.07)			
Physical development index	−0.09	0.56	−0.08	0.61	−0.33	0.17
	(0.09)		(0.09)			
Socio-emotional development index	−0.10	0.34	−0.06	0.44	−0.44	0.09
	(0.07)		(0.06)			

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Three index variables were created using factor analysis, with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. Column 1 only includes controls for interviewer fixed effects. Column 3 reports treatment effects controlling for interview fixed effects, and baseline values of age, age-squared, family structure, presence of grandmother (mother or mother-in-law of depressed mother), mother's education, father's education, parity, log of HH income, PCA-weighted wealth index, Hamilton score, Hamilton-squared, BDQ score, BDQ-squared, MSPSS score, and MSPSS-squared, and interview date. For columns (1) and (3), observations are weighted inversely by the predicted probability of being observed at the 7-year followup based on baseline covariates. Attrition bound 95% confidence intervals following Lee (2009) are presented in columns (5) and (6).

Table I.39 – Do measures of parental investment predict child development?

	Cognitive development				Physical development				Socioemotional development			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Parenting at Infancy index	0.08*		0.04		0.09*		0.09*		0.06		0.04	
	(0.04)		(0.04)		(0.05)		(0.05)		(0.04)		(0.05)	
Time investment index		0.09	0.06	0.04		−0.02	−0.05	−0.04		0.02	0.06	0.01
		(0.07)	(0.08)	(0.06)		(0.08)	(0.08)	(0.07)		(0.06)	(0.07)	(0.05)
Monetary investment index		0.31***	0.31***	0.28***		0.13**	0.07	0.14**		0.13**	0.10	0.08*
		(0.06)	(0.06)	(0.05)		(0.06)	(0.07)	(0.06)		(0.06)	(0.06)	(0.04)
Parenting style index		0.08*	0.11**	0.13***		0.04	0.06	0.05		0.10*	0.08	0.13**
		(0.04)	(0.05)	(0.04)		(0.06)	(0.06)	(0.04)		(0.06)	(0.06)	(0.05)
Baseline depressed				0.03				−0.03				−0.26***
				(0.06)				(0.06)				(0.06)
Observations	471	534	451	804	478	536	452	811	483	540	456	817
R^2	0.26	0.33	0.34	0.31	0.06	0.06	0.07	0.07	0.15	0.16	0.17	0.14

* p $<$ 0.1, ** p $<$ 0.05, *** p $<$ 0.01.

Notes: Sample includes children of mothers who were depressed at baseline as well those who were not depressed at baseline, in both treatment and control clusters. Index variables were created following Anderson (2008), with positive values always associated with positive outcomes for all indices. Heteroskedasticity robust standard errors, clustered by Union Council, in parentheses. All regressions control for interviewer fixed effects, age of mother and its square, father's and mother's education, parity, the date of interview, child gender and age at interview, and an indicator for treated cluster.

J Excerpt from THP Manual

EXCERPT FROM THINKING HEALTHY PROGRAMME MANUAL

(By: Atif Rahman)
email: atif.rahman@liverpool.ac.uk

4. The 3 steps to THINKING HEALTHY

4.1 Objective: To introduce the basic principles of Cognitive Behaviour Training that will be used in each session.

4.2 Instructions:

- Explain that every action starts as a thought in our mind. The thought usually determines our feelings, actions and behaviour. The behaviour then has consequences.
- Explain that stresses of everyday life, especially around pregnancy and birth, can affect the thinking patterns of many mothers, so that coping with life problems may seem difficult. These "negative" thinking patterns especially affect the 3 areas discussed, viz., personal health, mother-baby interaction, and relationship with others. When it becomes difficult to change these patterns of thinking and the resulting feelings and behaviour starts to have negative effects on these three areas, help may be required.
- This programme can help mothers try to change these negative patterns of thinking and behaving into positive ones so that coping with life tasks, especially those of bringing up the baby, becomes easier. This is done in 3 steps:

A

Step 1: Learning to identify negative thoughts: Ask mother to focus on picture A, the symbol for this step. Explain that in order to promote healthy thinking, it is important to be aware of the common types of negative or unhealthy thinking styles. By conducting research on many thousand ordinary people like us, scientists have defined the following types of negative or unhealthy thinking styles. Make the mother familiar with the symbol below for learning to identify negative thoughts and go through the following examples in Box 1. Tell mother

that we will talk a bit more about such thoughts and their effects later in the session.

Symbol	Unhealthy thinking style	Typical thoughts
	**Blaming oneself** If things go wrong, it is always your fault	If my child falls ill, it is always my fault, I am not a good mother
	**Not giving oneself credit** If things go well, its luck or somebody else's doing	Its only luck that my children are healthy
	**Gloomy view of future** Believing or predicting that bad things are going to happen	Nothing can stop my children from getting diarrhea this summer
	**Mind reading** Negative view of how others see you	I often think that others think badly of me
	**Thinking in extremes** If things can't be perfect there's no point trying	As I am uneducated, I will never be a capable mother
	**Not believing in one's capability**	I can never achieve this task
	**Giving up before trying**	I am no good at this

Box 1

B

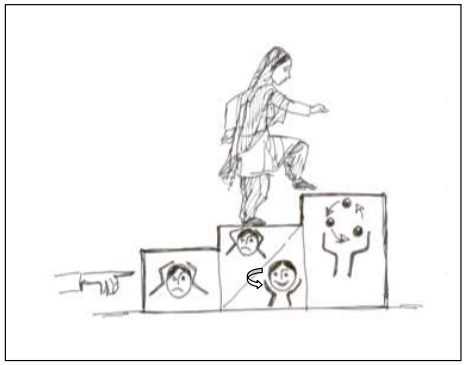
- **Step 2:** Learning to replace negative or unhealthy thinking with positive or healthy thinking: Ask mother to focus on picture B. Explain that identifying the above unhealthy thinking styles enables us to examine how we feel and what actions we take when we think in this way. The programme will help the mother question the accuracy of such thoughts and suggest alternative thoughts that are

healthier. With practice the mother can learn to challenge and replace unhealthy thinking with healthy thinking. Make the mother familiar with the symbol for learning to replace negative or unhealthy thinking with positive or healthy thinking.

C

- **Step 3:** Practice healthy thinking and acting: Ask mother to focus on picture C. Explain that the programme suggests activities and homework to help mothers to practice thinking and acting healthy. Carrying out these activities is essential for the success of the programme. Mothers will receive health education and other materials tailored to their individual needs to help them progress between sessions. Make the mother familiar with the symbol for learning to practice healthy thinking and behaviour.

The Three Steps to Thinking Healthy



D

Now show the mother picture D. Summarise the 3 steps and ask if she understands the concept. Explain that the same 3 steps will be used for each of the 3 areas throughout the programme.

Ask mother and other family members if they have any questions. Then ask if they agree to take part in the programme. Read out the 'informed consent form'.

Training Module 1: PREPARING FOR THE BABY
Session 2 – Mother's personal health

Learning objectives of this session

The purpose of this session is to review the principles of THINKING HEALTHY and to apply the approach to the mother's personal health. This session is important because for the first time, you will be helping the mother in practical application of the concepts learned in the first session.

Instruments required:

A) Activity Workbook 1: Preparing for the baby
B) Health Monitoring Calendar

1. Review of previous session:

- Briefly summarise the concepts discussed in the first session.
- Do this sequentially, using the pictures on the Health Calendar as the focus of discussion. When this is done repetitively, the family will start to associate the pictures with the concepts and these will serve as visual cues between sessions, helping the mother form her own mental images which can be discussed.
- Encourage the family to use the terms 'Health Corner' and 'Health Calendar', so that these terms get accepted into everyday usage.

2. Check Homework

- Go through the Mood Chart with mother. Ask if she had had noticed any particular negative thoughts about her personal health in the last week. If yes, praise her for successfully completing the first step. Note these down. Ask her how these thoughts made her feel and act. Listen attentively and sympathetically.
- Now ask if she had tried to replace these with alternative thoughts. If not, discuss, and encourage her and other family members to come up with suggestions.
- Again, briefly explain the importance of the mother's personal physical and psychological health for the baby therefore this is the area you would like to address first of all.

3. THINKING HEALTHY about personal health

STEP1

Learning to identify unhealthy thoughts about one's personal health

Instructions:

- Using the relevant section of **Activity Workbook 1**, ask mother to focus on the woman in picture A and describe the caption that reads out her thoughts.
- Discuss what these circumstances might be, eg., poverty, illiteracy, domestic problems.

Due to my circumstances there is nothing I can do to improve my health

A

- Now ask mother to focus on Picture B. Discuss how these problems have induced a state of despondency and helplessness in the woman.

There is no point in making an effort

B

- Now focus on Picture C. Discuss the consequences of giving up.
- Do not blame the woman in the picture. Say that this is a very natural human response to stresses and problems. However, it is important to identify the thinking styles and related feelings early, so that the actions and consequences can be changed.

Greater probability of poor mother & infant health

C

- Now ask mother if she has had such thoughts. Note these down in the space provided in the activity workbook.
- If necessary, prompt the mother with the examples of negative thoughts, actions, and consequences given below.

Thought	Feeling/action	Consequence
Being ill is in my fate	Helplessness, sadness I will not get vaccinated, as there is no point.	Greater risk of illness (tetanus) for both mother and baby
What does an illiterate person like me know about health matters	Poor confidence, self-esteem. No effort made to learn about health matters	Greater risk of poor health for both mother and family
Poor folk like us are born to be unhealthy	Hopelessness. No attempt made to make maximum use of whatever resources are available	Greater risk of poor health
If I have a problem with my general health or pregnancy, only a doctor can find it out	Not paying attention to one's symptoms or signs of poor health	Greater risk of serious health problems developing

STEP 2

Learning to replace unhealthy thinking with healthy thinking

Instructions:

- Focusing on the woman in picture D, read out the caption. Discuss if the thought in Picture D is a better alternative to the one in Picture A.
- If one is despondent, it may become difficult to identify resources that may already exist. Ask mother if she can think of resources available to improve her health.

D

I can try to do something for my health and nutrition, whatever the circumstances

- Picture B: If the mother is unable to think of any resource, challenge her gently by saying that your (health worker's) availability to discuss her nutrition is an example of one such resource. Say that later on, you will discuss other such resources to improve her nutrition.

E

I can consult my health worker about my nutrition considering what is available

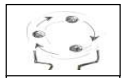
- Discuss that it's important not to think in terms of 'all or none'. Even small changes (such as those to be discussed in this programme) can make big differences to health of the whole family.

F

Small changes can lead to a healthier you and baby

- Now discuss the negative thoughts about personal health that mother may have described in step 1. Ask the mother to think of alternative thoughts. Note down her suggestions.
- Ask mother to think of alternative thoughts for examples described in step 1.
- If mother is unable to think of any, prompt her with the following alternative thoughts, feelings/actions, and consequences.

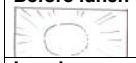
Thought	Feeling/action	Consequence
Looking after my health, to a large extent, is in my control	Making an effort to do positive things for one's health, e.g. vaccination	Protection against a potentially fatal illness
It is not necessary to be educated to learn about health matters	Active effort to learn about and follow health principles, e.g. balanced diet.	Better health for mother and baby
Even a poor person can make an effort to stay healthy	Making an effort to make the best use of available resources	Better health for mother and baby
Looking out for problems in pregnancy and getting help early is my responsibility and will help the doctors help me	Looking out for early problem signs and actively seeking help	Decreased risk of pregnancy related problems



STEP 3

Practicing healthy thinking and acting (Activities and Homework)

Activity 1: Refer to your training manual page xx (advice about nutrition). Tell mother that you would like to prepare a balanced diet chart from foodstuff easily available in the household. Engage the whole family in this exercise. Use the diet chart template provided in the activity workbook. An example of a diet chart is given below. Include only those items that are available in the household. Explain that balanced diet does not mean expensive or excessive diet.

Time	Choice of food items	Daily Monitoring						
		1	2	3	4	5	6	7
Breakfast 	▪ A glass of milk or lassi or dahi or one egg ▪ One paratha or 4 slices or 1 roti with butter							
Before lunch 	▪ Any fruit or fruit juice/lassi/gannay ka rus ▪ handful of channas or gurr							
Lunch 	▪ Two rotis or serving of rice ▪ one bowl of daal or piece of meat ▪ a piece of raw vegetable or fruit ▪ glass of lassi							
Tea time 	▪ One cup of tea or milk ▪ Biscuit or piece of roti							
Dinner 	▪ two rotis or rice, daal ▪ meat curry ▪ salad,							
Bedtime 	▪ One glass of milk							

Now attach this diet-monitoring chart to the health calendar in the space provided.

Activity 2: Refer to your manual page xx (relaxation techniques). Educate mother and family about the importance of rest and relaxation for the health of the unborn baby. Teach the mother deep breathing and relaxation techniques. Discuss with mother and family members how to organize everyday chores in a way that the mother gets time for rest and relaxation. Note down these periods in the activity workbook. Remind the mother and family that a small amount of time spent on your personal health everyday means a healthier you and a healthier baby.

Type of activity	Frequency	Daily Monitoring						
		1	2	3	4	5	6	7
Deep breathing 	2-3 times daily for 10-15 minutes							
Walking 	Once daily 15-20 minutes							
Sleep 	Full night's sleep and a nap in the afternoon							

Attach this rest and relaxation chart to the to the health calendar in the space provided.

Activity 3: Refer to your training manual page xx (advice during pregnancy). Educate mothers about problems that may occur in last trimester of pregnancy. Instruct her on how to seek appropriate help for such problems.

Give directions to the nearest primary care centre and how to reach it

K Maternal Depression and Child Development: A discussion and literature review of mechanisms

We outline a number of mechanisms by which maternal perinatal depression may impact child development. Evidence suggests that there are critical periods in child development and exposure to shocks would have different impacts on the child depending on when they were realized. Thus, we summarize the potential mechanisms, based on the review by Sohr-Preston and Scaramella (2006), for three time periods: prenatal, postpartum, and later infancy onwards. While the mothers in our sample were all depressed prenatally, the experiment only changed the likelihood of postpartum depression onwards. There is strong autocorrelation in depression, such that many of the mothers who experience depression prenatally will continue to have depressive episodes postpartum. For example, Rahman et al. (2003) find antenatal depression rates of 25%, and that in more than 90% of women, postnatal depression was a continuation of a depressive episode during pregnancy.

During the prenatal period, maternal depression may influence the fetus through direct physiological effects as well as behavioral effects. Depression may effect mothers' behavior by altering sleep patterns and nutritional intake. For example, depressed mothers may not gain enough weight (Walker, Cooney, and Riggs 1999). Furthermore, they are less likely to seek prenatal care (Miller 1992). Physiological effects of depression are likely as well, as maternal depression and stress is associated with elevated cortisol, which has been linked to slower fetal growth and premature birth, and prenatal maternal cortisol levels play a role in mediating these outcomes (Diego et al., 2009). Moreover, the level of cortisol which fetuses are exposed to during pregnancy may affect the development of the hypothalamic-pituitary-adrenal (HPA) axis, which is the system responsible for modulating cortisol. Thus, depression during pregnancy may program the fetal HPA axis to be more receptive to stress, resulting in children becoming easily over-aroused in nonthreatening situations (Sohr-Preston and Scaramella, 2006).

Depression during the postpartum period, defined roughly as the first six weeks after birth, may also have distinct effects on child development apart from those in the prenatal period. Depression in the postpartum period may also have both physiological and behavioral effects. Newborn infants of depressed mothers have distinct biological response patters: lower cardiac vagal tone and concerning patterns of electrical brain activity, which are associated with reduced self-regulation and emotional expression in later development.Depressed mothers are likely to experience more stress and anxiety, which is associated with chronically elevated cortisol levels, which are passed through to the infant via breastmilk (CITES). Behaviorally, mothers suffering from postpartum depression are less behaviorally consistent, less positive, more negative, and use too little or overly excessive levels of stimulation (Sohr-Preston and Scaramella, 2006). They also breastfeed significantly less frequently (Campbell and Cohn 1997, Field 2002). To the extent that breastfeeding improves the development of the infant's immune system, postpartum depression may also impact the child's frequency of illness and physical health.[30] Mothers who are more

[30]Interestingly, reduced breastfeed and touch activate the release of oxytocin, commonly referred to as the bonding hormone, making it more difficult for mothers to bond with her infant. Furthermore, the infant may also be more

severely depressed in the newborn period express more negative affect, touch their infants significantly less (thereby reducing bonding and oxytocin release, Apter-Levy et al. (2013); Feldman et al. (2010)), and use infant directed speech less effectively, which are important for early child learning.[31] Furthermore, early touch appears to have lasting effects on cognitive development, possibly by stimulating cortical growth and synaptic proliferation in the brain (Caulfield 2000, Weiss, Wilson, and Morrison 2004).

Depression may persist beyond the postpartum period, thus directly influencing parenting behavior in later infancy. Chronically depressed mothers may experience greater depletion of energy to cope with the everyday demand of parenting. For example, they exhibit a drop in observed sensitivity, or responsiveness to the child, from 15 to 24 months. Maternal sensitivity accounts for differences in school readiness and verbal competency between children of depressed and non-depressed mothers (NICHI Early Child Care Research Network 1999). The mother may be inconsistent with her responding, failing to provide children with opportunities to perceive order and predictability in their environment (Hay 1997). Furthermore, depressed mothers are less able to engage in effective play (Tingley 1994) and other learning interactions with the child. More broadly, maternal depression may influence the home environment. Mothers may invest less in stimulating toys for the child. Additionally, relationships between the mother and her husband, older children, and mother-in-law may become strained.

From the perspective of decision theory, maternal depression may affect mothers' risk and time preferences, aspirations, and cost of effort, which in turn would decrease investment (actions, like those described in the above paragraphs, that the mother must take to ensure the optimal development of her child) in the human capital of her child at all stages of development. In addition, the optimal investment decisions of the parents might change if they believe the prenatal and postpartum depression negatively affected the human capital endowment of the child. Parents may display compensatory behavior (by investing more in their child) if they are inequality averse, or may display reinforcing investment behavior (and invest less) because of static complementarity (Becker and Tomes, 1986).

Maternal depression may impact household bargaining if depression reduces the mothers' capacity to bargain effectively. Thus, investment allocations by gender may differ between depressed and non-depressed mothers if mother's and father's preferences are not the same.

Finally, maternal depression may affect child development by changing the patterns of fertility: either through the channel of breastfeeding, reducing spacing between births if depressed mothers breastfeed less, or by reducing sex drive, which would have the opposite effect. Furthermore, maternal depression may impact contraceptive use through effort costs, bargaining power, or time preferences.[32]

irritable, unpredictable, and more difficult, potentially intensifying or maintaining maternal depressed mood.

[31] For example, infants may be more vulnerable to learning difficulties because increased maternal negative affect elevates infants' arousal in a way that interferes with early learning efforts (Sohr-Preston and Scaramella, 2006).

[32] Ifcher and Zarghamee (2011) show that mood affects time preferences. Thus depression, which is accompanied by more negative affect and less positive affect, may increase the mother's discount rate or make her more present-biased.