

Father involvement in the first year of life: Associations with maternal mental health and child development outcomes in rural Pakistan

Joanna Maselko, Ashley K. Hagaman, Lisa M. Bates, Sonia Bhalotra, Pietro Biroli,

John A. Gallis, Karen O'Donnell, Siham Sikander, Elizabeth L. Turner, Atif Rahman

Accepted, Social Science and Medicine. Published issue 237, 112421 in 2019

Abstract

The contribution of fathers to child development and maternal mental health is increasingly acknowledged, although research on this topic outside of high income countries is limited. Using longitudinal data, we characterized father involvement in a rural setting in Pakistan and investigated the link between father involvement in the first year of life and child development and maternal depression. Data come from the Bachpan study, a birth cohort established in the context of a perinatal depression intervention. Father involvement was mother reported at 3 and 12 months postpartum and covered domains such as playing with or soothing the infant. Child outcomes included growth at 3, 6 and 12 months postpartum, socioemotional development at 6 months (Ages and Stages Questionnaire-socioemotional), and developmental milestones at 12 months (Bayley Scales of Infant and Toddler Development, BSID)). Maternal depression was assessed at 3, 6, and 12 months postpartum. Roughly 20% of the fathers were temporarily non-resident. Among the rest, most mothers reported that fathers were involved: for example, approximately 40% reported that the father plays with the baby on a typical day. We observed no clear pattern of association between 3-month father involvement and child growth at any time point; however, 12-month father involvement was cross-sectionally inversely associated with child growth. We observed a protective pattern of association between 3-month father involvement and 6-month child socioemotional development. For the BSID domains, while almost all effect estimates suggested a protective association with higher levels of father

involvement/father being temporarily non-resident, the magnitude of the estimates was smaller and most 95% confidence intervals crossed the null. Finally, there was a trend toward greater father involvement/being temporary non-resident predicting lower levels of maternal depression. Using longitudinal data, these results provide new evidence about the association between father involvement, and both child development and maternal mental health.

Keywords: child development; father involvement; maternal depression; mental health; LMIC

Introduction

In the early years of a child's life, a father is in a unique position to influence both maternal well-being and his child's physical, cognitive, and socioemotional development. The father's contribution has been increasingly of interest in both high and lower income settings and is seen as a potential key 'resource' that may buffer the impact of vulnerabilities such as those due to maternal depression or poverty (Black et al., 1999; Child Welfare Information Gateway, 2006; J. Jeong et al., 2016; C. Lewis & Lamb, 2003). A growing body of research has linked father involvement with various child and maternal health outcomes (Allport et al., 2018; J. Jeong et al., 2016; C. Lewis & Lamb, 2003). The majority of the literature conceptualizing father involvement and empirically testing its effects on child outcomes has been generated in high-income countries focused on social disadvantaged populations. As a result, much of the long-standing research (and policy) attention has been paid to low-income, unmarried and/or nonresident fathers and the implications of father absence for children's health and development (Adamsons & Johnson, 2013). More recent research on the nature and effects of father engagement (versus mere presence) has been dominated by efforts to characterize and categorize domains of father involvement, and estimate their associations with child development, with less attention to theorizing and testing specific mechanisms of causal effects (Pleck, 2010).

Theoretical background

Research about the role of fathers in early child development has roots in the initial studies of attachment security (Bowlby, 1969), initially focused on mother versus father attachment security. Subsequent investigations emphasized child attachment to mothers and fathers as not competitive but rather complementary, offering the child different resources for security. Family systems theory now emphasizes constructs such as levels of mother and father involvement in caring for the child, taking a view of the family system as a whole supportive role. An example of the latter includes studies of how father involvement can affect maternal mood disorders, contributing to improved mother-child interactions and child outcomes (e.g., (Mezulis et al., 2004)). The majority of recent studies reflect some version of Lamb and Pleck's theoretical approach whereby father involvement comprises domains of *positive engagement* activities, *warmth and responsivity*, *control*, as well as *indirect care* and *process responsibility* (Pleck, 2010). In this approach, positive engagement includes playing together and as well as instrumental support such as bathing; warmth/responsivity includes expressions of affection and feeling close; control covers domains of discipline; indirect care reflects financial contribution; and process responsibility includes providing general support to the mother. A slightly different focus is taken by Gettler, whose approach to father involvement is comprised of dedication, attitude, duration, and salience (Gettler, 2016). The relevance of different domains of interest changes with the specific family and child context, for example the age of the child where the control domain applies more to older children than to infants. Furthermore, a growing number of measures aim to capture domains most relevant across different contexts, such as for infants (Singley et al., 2018) or low and middle income country (LMIC) contexts (J. Jeong et al., 2016). Though operationalized across studies variously, some combination of these broad domains of parenting are widely understood to be important for child development in diverse theories of parental influence (Carlson & Magnuson, 2011). For example, "authoritative" parenting,

characterized by optimal levels of the two domains of “warmth” and “control,” has long been considered beneficial to healthy child development by balancing a high degree of responsivity to children’s emotional needs while also setting and consistently enforcing boundaries (Baumrind, 1966). Explication of why, specifically, *father* involvement in these domains should impact child outcomes has received relatively less attention (Pleck, 2010). Overall, the extant evidence, from high-income Western settings, suggests that independent beneficial effects of fathers may stem from their role as a second parent rather than their maleness per se (Pleck, 2010). Some gender differences in parenting behaviors may exist, and shared parenting behaviors may have differential effects when exhibited by mothers or fathers, though the evidence is mixed and likely to be highly dependent on contextual norms. The mechanisms of these effects may also be influenced by child gender (e.g., father as gender-role model) and age as a result of reciprocal dynamics (Pleck, 2010). The present study explores the impact of father involvement in a context of exclusively marital parenting where father absence is temporary and circumstantial (e.g., episodic migratory work), and where gendered cultural norms and division of labor result in a dominant role of mothers in childrearing. We hypothesize that father involvement may positively impact a) child outcomes directly (e.g., through engagement) and indirectly (e.g., through maternal support) and b) maternal outcomes as a result of this second, indirect pathway.

Empirical evidence on father involvement and maternal and child outcomes in Low and Middle Income Countries (LMIC)

Despite variability in definitions of father involvement, empirical evidence shows that the majority of fathers are involved directly with their children, though the type, level, and timing of involvement varies significantly across families and regions (Ellerbe et al., 2018; Joshua Jeong et al., 2017; J. Jeong et al., 2016; S. Lewis et al., 2015; Sun & Roopnarine, 1996; Yildirim & Roopnarine, 2017). However, the vast majority of research on fathers remains focused in high

income countries, where the expectations and nature of involvement reflect higher socioeconomic status on average. In LMIC and non-Western settings, only a handful of cross-sectional studies report associations between father involvement and child outcomes; one longitudinal study connected father presence with child stunting (Dearden et al., 2013). Furthermore, research often lacks a clear distinction between father *presence* and *involvement*. Large gaps remain in our understanding of the nature of father involvement over time, its predictors, and how this involvement may influence both maternal well-being and child cognitive, socio-emotional, and physical development.

Father involvement and child outcomes

Current knowledge of the relationship between father involvement and child outcomes in LMIC comes from only a handful of studies: Using data from the Multiple Indicator Cluster Survey (MICS) in 38 countries, Jeong and colleagues reported that higher levels of paternal stimulation (e.g., reading to, or playing with, the child) were associated with better scores on an overall index of development among 3 and 4 year-olds and not with height-for-age z scores (Joshua Jeong et al., 2017; J. Jeong et al., 2016). The association with child development was independent of maternal stimulation, pointing to a potential unique paternal contribution, although this independent effect was not observed in a similar study in Honduras (Urke et al., 2018). Child psychosocial developmental indicators, but not weight-for-age, were also found to be associated with paternal involvement in a study in India (Vazir et al., 1998), suggesting that the impact of paternal involvement may vary across developmental domains and region. For example, a study from Ethiopia reported that height-for-age z scores for children under 2 were associated with father involvement (feeding, hygiene, and psychosocial support); other domains of child development were not measured (Abate & Belachew, 2017). A separate analysis of MICS data from six Caribbean countries found that paternal engagement (playing, singing,

taking outside) was associated with child literacy skills in only two countries and with social skills in only one (Yildirim & Roopnarine, 2017).

The analyses described so far relied on cross-sectional data. We identified only one LMIC study examining the association between paternal involvement and child outcomes longitudinally.

Dearden and colleagues found that children in Peru who saw their fathers at least weekly at approximate ages 1 and 5 had better height-for-age z scores at age 5 than children who saw their fathers less frequently at both time points (Dearden et al., 2013). There were no data on other important domains of child development, such as cognitive and socioemotional skills.

Given the limitations of cross-sectional data, such as the potential for reverse causality whereby fathers are more engaged with healthy and active children, longitudinal studies are necessary to examine the causal relationship between father involvement and various domains of child development.

Father involvement and maternal mental health

In addition to the direct impact on child development, father involvement is also a potential source of support to the mother, which may, in turn, have a positive influence on her mental health. In addition, a link with maternal mental health points to another potential, indirect pathway through which father involvement impacts child development. There is some evidence of this link in high income countries. For example, a study in Korea reported that both the perceived and actual involvement of fathers is associated with lower maternal stress (Kim et al., 2016). The impact of father involvement may also have persistent effects: a study in Taiwan found that instrumental support from fathers at 1 month postpartum (e.g. helping with childcare) was associated with a 4-fold lower risk of postnatal depression at 6 months among mothers who stayed at home (Lin et al., 2017). Furthermore, paternal involvement may be especially important for maternal mental health among disadvantaged families, in which the mother is at

higher risk of depression (Nomaguchi et al., 2015; Smith & Howard, 2008). While this evidence is suggestive, it's not clear if the relationship holds in LMIC settings, where high levels of adversity and larger families with more adults present are more common.

Predictors of father involvement

Given the positive impact that father involvement may have on both maternal and child health, the predictors of father involvement are of great interest. There is significant variation across countries in levels of involvement: In the study of 38 countries mentioned above, higher levels of paternal education as well as living in wealthy, urban areas were associated with higher paternal involvement (J. Jeong et al., 2016). The link with higher education and SES has been observed in High Income Countries (HIC) in Europe and Asia (Cabrera et al., 2007; Lin et al., 2017; McMunn et al., 2017) as well as in a few lower income country contexts (Ditekemena et al., 2012). In countries like India, social and economic change resulting in a growing middle class and more women in the labor force has also been noted as affecting a changing role of fathers (Roopnarine et al., 2013; Sriram, 2011). Such social and economic changes may also influence factors such as son preference and how fathers interact with their sons as compared to their daughters (Das Gupta, 2009). On the other hand, the presence of other family members, such as other women in larger, extended families may limit men's involvement, especially in the period around childbirth and early postpartum (S. Lewis et al., 2015). Therefore, the child's age might also shape involvement. If this is the case, we might expect fathers in nuclear families or with slightly older children to be more involved. Much remains unknown about how these factors of education, SES, family structure, or child gender affect father involvement.

The Pakistan Context

With a per capita Gross Domestic Product of 1,548 USD (2017), Pakistan is a lower middle income country (World Bank, 2017). The study setting is Kallar Syedan, a rural sub-district south-east of the city of Rawalpindi, with a population of approximately 220,000 (Statistics, 2017). It is a socioeconomically deprived area with poverty rates over 50%; female and male literacy rates of around 40% and 60%, respectively; and high fertility rates (3.8 births per woman)(National Institute of Population Studies - NIPS/Pakistan & ICF International, 2012-3). Living in extended families is the norm, with nuclear families less frequent, although there is some evidence that this may be changing (Farooq et al., 2015). The population consists of close-knit communities living in villages and large households (average 6-9 persons per household) with fairly traditional gendered divisions of labor. Most families depend on subsistence farming, supported by earnings of one or more of the adult male members serving in the armed forces or working as government employees, or semi-skilled or un-skilled labourers in the cities. Health care is provided by village-based community health workers, who focus on maternal and child health, and primary-care facilities across the sub-district; each is staffed by a physician, midwife and a paramedic.

The goal of the current paper is to describe father involvement and its predictors and to examine the association between father involvement, maternal mental health, and child developmental outcomes in a community sample of families living in rural Pakistan. We take advantage of longitudinal data on maternal mental health at multiple time points starting in pregnancy and through 12 months postpartum, child development indicators at 3, 6, and 12 months, and data on father involvement at 3 and 12 months.

Methods

Study Setting and Sample

The data for the current analysis come from a cohort study established as part of a community based perinatal depression intervention trial in Pakistan; sample recruitment and trial details are described elsewhere (Maselko et al., 2018; Sikander et al., 2015; Turner et al., 2016). Briefly, between October 2014 and February 2016, all pregnant women within forty village clusters across a rural sub-district were approached and screened for depression using the Patient Health Questionnaire-9 (Gallis et al., 2018; Kroenke et al., 2001). Women who scored 10 or greater on the PHQ-9 were invited to participate in the trial; the next woman screened in the same village who screened negative for depression was invited to participate in the cohort study only, resulting in an equal number of women who screened positive and negative for depression in the cohort. Since approximately only one of every three non-depressed women was invited to enroll, we use sampling weights to account for the unequal probabilities of selection, and therefore the statistics and model-based results reported are representative of the underlying population of pregnant women in the study area. Baseline interviews with 1,154 women were conducted during the third trimester and women residing in the 20 intervention clusters with PHQ-9 scores of 10 or greater began participating in the intervention. The intervention was the Thinking Healthy Programme, Peer Delivered (THPP), a low intensity psychotherapy program, delivered by peer counselors (Sikander et al., 2015). Intervention sessions began during pregnancy and lasted through 6 months post-partum, and were successful in reducing the duration of the depression episode (Sikander et al., 2019). Follow-up interviews were conducted at 3, 6, and 12 months post-partum. Since father involvement data were collected at the 3 and 12-month interviews and outcome data at various time points (described below), in the analyses we utilized all available outcome data from 996 participants who had father involvement data available at either 3-months or 12-months, and who had child and maternal outcomes available at the same interview. Of these 996 participants, 879 had 3-month data available and 926 had 12-month data available. In total, 158 mother-child dyads with no 3- or 12-month father

involvement data were excluded from the analyses (see appendix table 1 for comparison of missing sample).

Measures

Father involvement. As part of the assessment of general parenting and infant related support provided to the mother, several items were specific to the involvement of other family members, including the father. The items broadly reflect the domains that Pleck outlines for low-resource contexts with infants including: positive engagement, warmth and responsiveness, and process responsibility (Pleck, 2010; Singley et al., 2018). Two items inquired directly whether the father (1) is able to help the mother in taking care of the baby rarely/never (0), sometimes (1), often (2) and (2) enjoys spending time with the baby not at all (0), not that much (1), a lot (2). All questions also included a 'not applicable' response option (coded together with 'don't know' and 'refuse to answer'.) The remaining three items concerned the engagement of all family members with the infant on a typical day (specifically yesterday if it was typical), asking the mother to narrate the day. As part of this conversation, mothers were asked which family members (3) play with the baby, (4) help to soothe the baby when crying/upset, and (5) the baby likes being held by. These questions did not prompt about the participation of specific family members but were left open for the mother to volunteer individuals who engaged in that particular way. Based on conversations by the field team with the women as part of the overall cultural adaptation and piloting of our measures, fathers were only mentioned spontaneously if their involvement was quite noticeable and significant. Thus, when coding these items, we weighted a 'father' response equivalent to an 'often' and 'a lot' on the frequency scale items by assigning 2 points. We also distinguished uninvolved fathers who consistently resided with the mother and child, from fathers who often traveled away for work for extended periods. Approximately 154 (18%) mothers at 3 months and 206 (23%) mothers at 12 months endorsed the 'not applicable' response option on the first two questions on father's involvement, and never mentioned the

father in the daily activity questions. These women also reported during the baseline interview that their husbands travel away for work for at least 1 month at a time, and therefore we categorized these fathers separately as ‘temporarily non-resident’.

For the remaining fathers, the points were added for a total possible score of 0 to 10; a higher score representing more frequent and more diverse involvement by the father in the child’s daily life. Questions capturing father involvement were included in the 3 and 12-month postpartum interviews and were answered by the mother. For the main analyses, we allowed for a non-linear relationship between father involvement score and outcomes of interest by dividing the score into tertiles based on the distribution across all father involvement data at 3 and 12 months, representing low (0 to 3), medium (4) and high (5-10) levels of involvement. The temporarily non-resident group was the fourth group.

Maternal depression. For the present analysis, the Structured Clinical Interview for DSM disorders (SCID) was used to generate diagnosis of current Major Depressive Episode (Spitzer et al., 1992) and was administered at baseline, 3-, 6-, and 12-month interviews. The PHQ-9 was used at screening to determine eligibility for the trial(Sikander et al., 2015)

Child Development. Physical development was captured with child length-for-age and weight-for-age Z-scores, which were calculated at 3, 6, and 12 months.

Socio-emotional developmental was assessed at 6 months with the Ages and Stages Questionnaire Socio-Emotional scale (ASQ-SE) (J. Squires et al., 1997; J. K. Squires et al., 1998). The ASQ-SE consists of 25 caregiver (maternal in our case) reported questions on age appropriate behaviors such as whether the child liked to be picked up and held or whether the child let the mother know when they are hungry or not well (J. K. Squires et al., 2002). Options

are most of the time (0 points), sometimes (5 points), or never (10 points). Responses are summed so that a higher score is interpreted as more socio-emotional difficulties. The ASQ-SE has been used internationally and has been found to be reliable and valid across diverse settings (Velikonja et al., 2017). Developmental milestones were assessed at 12 months with the Bayley Scales of Infant and Toddler Development, Third Edition (BSITD-III) (Bayley & Reuner, 2006). The BSITD was administered in the family's home by trained assessors and included five domains: cognitive; receptive and expressive language; and gross and fine motor skills. Scaled scores for each domain were calculated using the child's chronological age following the BSITD manual protocol. The BSITD has been widely used and validated internationally and has been found to be reliable and valid in contexts similar to the present study ((Azari et al., 2017; Ranjitkar et al., 2018)).

Other covariates collected at baseline include paternal education, gender of child, family structure (nuclear vs. extended or multiple families), baseline depression/intervention status (depressed treatment, depressed control, prenatally non-depressed), past year exposure to physical, psychological or sexual intimate partner violence (IPV) (WHO, 2001), and a household asset-index score as an indicator of overall household socioeconomic status (SES) (Kolenikov & Angeles, 2009), and village cluster. We also included in the models scores for the responsivity and acceptance subscales of the HOME Inventory (combination of maternal report and assessor observation), which was included as part of the 3 and 12 months post-partum interviews, as proxies for quality of maternal involvement (Bradley, 2015; Linver et al., 2004).

Analysis

In order to make the analytical sample representative of the population from which it was drawn, we accounted for the study sampling strategy in descriptive and model-based analyses: Non-depressed women were up-weighted with cluster-specific weights, which were computed as the

inverse of the probability of inclusion for non-depressed women in each cluster. Descriptive analyses present means, standard deviations, and percentages of key variables across time points. Regression-based analyses were used to examine the predictors of father involvement as well as the relationship between father involvement score and maternal and child outcomes.

We estimated the association of 3-month father involvement and each of the longitudinal child and maternal outcomes by fitting a single model for each outcome that simultaneously modeled all follow-up time points whilst allowing for different associations between 3-month father involvement score and the outcome at each of the different follow-up time points. To do so, we included the father involvement score at 3 months as a predictor of the outcomes (outlined above) at all three time points (3, 6, and 12 months), as well as time point as a factor variable (i.e. coded as dummy variables), and time point interacted with father involvement. We used linear mixed models (LMMs) for continuous outcomes and generalized linear mixed models (GLMMs) for depression measured using the SCID (the only binary outcome analyzed in this study). The GLMM was fit using a log link and Poisson distribution, so that the resulting exponentiated coefficients are interpreted as prevalence ratios. The specific random effects structure used in each model included two random intercepts: a random intercept for time to account for correlation across time within individual (where we note that allowing for a random slope does not improve the model fit), and a random intercept for cluster to account for correlation within clusters as a result of the study design.

We also examined the effects of the father involvement score at 12 months on 12-month outcomes. This cross-sectional model included a random intercept for cluster; all models were adjusted for family structure, child gender, baseline asset score, baseline depression/intervention status (depressed treatment, depressed control, non-depressed) and IPV for models of maternal depression. Finally, we conducted a sensitivity analysis rerunning all

models using alternate coding approaches for the father involvement scores (see Appendix). All analyses were conducted using SAS 9.3 (SAS Institute, Cary, NC, USA).

Results

Following the application of population representative weights, the mothers at the start of the study were on average 27 years old and 30% were pregnant with their first child (Table 1). Half of mothers (50%) and almost two-thirds of fathers (63%) had completed secondary education and 21% lived in a nuclear household. At 12 months of age, the infant mean length-for-age z score was -0.73 (standard deviation [SD] = 1.24). While a quarter of mothers were depressed during pregnancy (i.e. at baseline) this dropped to 13% at 3 months and 16% at 12 months postpartum.

About a fifth of the fathers were temporarily non-resident at the 3 and 12-month interviews (Table 2, 18% and 23%, respectively). Of the resident fathers, mothers reported fairly high levels of their involvement; around 40% reported that the father plays with the baby, and roughly 85% of mothers reported that the fathers enjoyed spending time with the baby 'a lot'. While at both 3 and 12 months, 70% said that that father is often able to help with taking care of the child, a much smaller proportion (11% at 3 months and 23% at 12 months) mentioned the baby likes to be held by the father. Similarly, 6% of mothers at 3 months and 17% at 12 months reported that the father helps soothe the baby. The mean father involvement score increased slightly between 3 and 12 months, from 4.7 to 5.2.

Predictors of father involvement

We first examined socioeconomic and family-level variables hypothesized to predict father absence and father involvement. For father being temporarily non-resident, the asset index

(SES) emerged as one of the strongest predictors; higher SES families were more likely to have temporarily non-resident fathers. For example, relative to the lowest asset quintile, fathers in the highest quintile were over twice as likely to be temporarily non-resident at 3 months (10% vs. 24%). Nuclear families were also less likely to have a temporarily non-resident father at 3 months, at 10% having a non-resident father vs. 19% of non-nuclear families.

Among the fathers who were resident, asset index was only weakly associated and only at the highest levels at 3 months: households with the highest quintile had father involvement scores that were 0.37 points higher than those in the next quintile, with little difference among the remaining quintiles (bottom panel of table 2). There was no clear pattern at 12 months. There was no consistent evidence of paternal education or child sex predicting father involvement score. Nuclear families had more involved fathers at 3 months but this difference diminished by 12 months.

Finally, maternal depression during pregnancy was associated with a 0.43 point lower father involvement score at 3 months. While we found that father involvement may help women recover from perinatal depression, we note that fathers are less likely to be involved if the woman is prenatally depressed.

Father involvement and child outcomes

Figures 1 to 4 and tables 3 through 5 present the results from regression models of father involvement at 3 and 12 months postpartum with the child development (figure 1-3, tables 2, 3, and 4; and maternal depression outcomes (figure 4 and table 5). Overall, although the vast majority of effect estimates suggest a protective association between father involvement and outcomes of interest, many of 95% Confidence Intervals cross the null, revealing that the results are not very precise. For example, looking at growth indicators in Figure 1 and Table 3, father involvement, or temporary non-resident status, when the infant was 3 months old was not

associated with weight or length-for-age z scores, either contemporaneously or with future z-scores (Panels A-B, Table 3). Unexpectedly, the results suggest that medium and high levels of father involvement when the infant was 12 months old may be cross-sectionally associated with lower length and weight-for-age z scores when compared with low involvement (right most panel in figure 1 and bottom models of Panels A-B in Table 3). Figure 2 and Panel C in Table 3 show the association between father involvement at 3 months and socioemotional development at 6 months. Children whose fathers were highly involved had better ASQ-se scores when compared with those whose fathers had low levels of involvement. The results also suggest that children of fathers who were temporarily non-resident or those with middle levels of involvement had better ASQ-se scores, although the 95% confidence interval for these estimates crosses the null.

Associations with multiple development domains as measured by the Bayley (BSID) at 12 months of age are presented in Figure 3 and Table 4. Again, while almost all effect estimates are in the protective direction of higher levels of father involvement, or father being temporarily non-resident, being associated with higher development scores, the size of the estimates is small and most 95% confidence intervals cross the null. This protective association appears to be the most robust in the cross-sectional association between father involvement at 12 months (right panel in Figure 3, bottom panel in table 4) and the fine motor scale, where children of fathers who were highly involved scored 0.59 points higher (95% CI: 0.24 to 0.93). Children of fathers who were temporarily non-resident similarly scored better on the fine mother scale.

Associations between 3-month father involvement and Bayley scale domains were on the whole weaker. The imprecision of the estimates across so many models limits the ability to make inferences about the relative impact of father involvement at some assessments and on some domains versus others.

Father involvement and maternal mental health

We also find a trend towards protective association between father involvement, or the father being temporarily non-resident, and maternal depression based on the SCID (Figure 4 and Table 5). All of the Prevalence Ratio (PR) estimates are below 1 in the models that adjust for baseline depression during pregnancy and baseline IPV, although roughly half of the 95% confidence intervals cross the null. For example, high father involvement when the infant was 3 months old is associated with a 41% reduction in prevalence of depression at 12 months for the highest level of father involvement vs. the lowest (PR for high tertile level of involvement = 0.59; 95% CI 0.41 to 0.86). However, similar to the child outcome models, overall imprecision in the estimates make it difficult to draw specific conclusions about differential patterns with 3 vs. 12 month father involvement or longitudinal vs. cross-sectional associations.

Additionally, maternal depression appears also to be somewhat lower in families where the fathers were temporarily non-resident, especially at 3 months where the prevalence of depression was a third lower for women whose husbands were temporarily non-resident (PR=0.62; 95% CI 0.39 to 0.96) when compared with those who were resident but not very involved. At least some of this association appears to be attributed to the fact that mothers living in households where the fathers are temporarily non-resident are less likely to experience IPV (past year prevalence at baseline of 6.5% when fathers reported temporarily non-resident at 3 months vs. 12.8% when they are resident). The estimates for father being temporarily non-resident and father involvement presented in Table 5 became attenuated and less precise once IPV was included in the model (results without IPV adjustment not shown).

Discussion

This paper contributes to our understanding of father involvement in the first year of a child's life and how father involvement relates to child overall development and maternal mental health in a low resource, South Asian context. We found that most fathers are involved in some way, and that, although many of the estimates were imprecise, this involvement often predicts contemporaneous and future child socioemotional and several development outcomes, as well as maternal mental health. We also found a weak, inverse, cross-sectional association with growth at 12 months. When present, associations between father's temporary non-resident status and child and maternal outcomes also tended to be protective.

Predictors of father involvement

We found overall relatively high levels of father involvement, especially with general help, but less involvement with more concrete behaviors such as soothing the child. We also found that fathers in extended households were less involved at 3 months than those living in a nuclear arrangement, suggesting that their involvement may sometimes be substituted by grandmothers or others in the household, especially in the early infancy period. The observed pattern may reflect traditional gender role distinctions, but is also consistent with findings from South Asia and elsewhere suggesting that many fathers wish to be more involved but find that gender or family norms reflecting expectations that mothers are 'better' caregivers can be barriers to greater engagement (S. Lewis et al., 2015; Maken et al., 2017; Sriram, 2011). Research from India and Nepal also suggests that norms and desires related to father's involvement are changing in the region and so the snapshot in our study reflects contemporary and complex family relationships and dynamics (S. Lewis et al., 2015; Roopnarine et al., 2013).

We did not find a clear pattern of change in father involvement between the 3- and 12-month periods. One might expect father involvement to increase over time since 1 year olds 'can do more', and so it may be a bit easier for fathers to engage through play. On the other hand,

others have reported slight decreases in father involvement over time, hypothesizing that the mother is in greater need of support in the first few months of an infants' life (Smith & Howard, 2008). It is possible that both of these processes are occurring in parallel. We plan to continue to examine how father involvement changes over time as the children in our cohort get older.

We did not find SES to consistently predict father involvement. Poverty is thought to lead to lower paternal involvement because fathers are out of the house seeking any employment they can find (Cabrera et al., 2007; Garfield & Mesman, 2016; Hamadani & Tofail, 2014; J. Jeong et al., 2016). Our findings also support the idea that temporarily non-resident fathers may provide indirect support and be qualitatively different from uninvolved fathers who are present in the home. The majority of temporarily non-resident fathers were away because of work and hence likely fulfilling the 'provider' role (J. Jeong et al., 2018). These families tended to be slightly higher SES and more likely to be living in an extended household arrangement – hence they were very different from the co-resident and uninvolved fathers. Families as a whole make decisions about the best strategies to contribute to overall family welfare, and it may not be correct to assume that a co-resident father is always more beneficial for the child and mother, as compared to a father who is away but still provides and cares for them. Such differences point to the importance of treating non-resident fathers separately when studying father involvement and not grouping them together with fathers who are co-resident and score low on specific involvement items (more discussion on this group of fathers below with the maternal depression findings).

We did not find paternal education itself to predict involvement. It is possible that paternal education may predict specific aspects of engagement that our measure did not capture, such as reading to the child (Joshua Jeong et al., 2017; J. Jeong et al., 2018). This would be consistent with a study in the US focused on specific paternal involvement domains, such as

sensitivity or stimulation and found that paternal education only predicted some domains but not others (Tamis-LeMonda et al., 2004).

Child results

Our findings extend previous literature on father involvement and child development conducted in LMIC by showing a longitudinal association between father involvement at 3 months and child development at 12 months. Our measure of father involvement captured both overall engagement as well as more specific involvement, such as through play or soothing. Separating out temporarily non-resident fathers from those who are at home but not involved further revealed that the children of these non-resident fathers are more like those who are highly involved than those with otherwise low levels of involvement. By using the Bayley Scales in which the child is directly assessed, our findings are also not biased by maternal perceptions of the child's development (although father involvement was reported by mothers) (J. Jeong et al., 2016; Yildirim & Roopnarine, 2017). It is noteworthy that father involvement, especially when the child was 1 year old, was associated with several domains of development, especially fine motor skills and cognitive function, although the estimates were not very precise, limiting inferences about differential effects across domains. To the extent suggested differences such as fathers significantly impacting cognitive development, but not language prove robust, it may be that fathers stimulate children through structured play, rather than conversation. However, given that the finer domains of child development are complex, and their determinants are not fully understood, more work is needed. Extending these results, we also saw evidence of father involvement at 3 months predicting better socioemotional development at 6 months. These findings are independent of potential confounders such as baseline maternal depression symptoms, socioeconomic status, and a proxy for the quality of maternal involvement (HOME subscales). Although there was no longitudinal association between father involvement at 3 months and later weight/length-for-age-z-scores, greater father involvement at 12 months was

cross-sectionally associated with lower z-scores. Although our findings were not driven by the temporarily non-resident fathers, Dearden and colleagues reported somewhat similar findings in that children whose fathers were not present in infancy (but were present later in childhood) had higher growth z-scores than those whose fathers were present during both infancy and childhood (Dearden et al., 2013). A better understanding of how/whether fathers are contributing to overall household well-being may help explain these findings. An inverse association could reflect the dynamic nature of involvement if fathers perhaps become more involved if the child is not doing well. Such dynamic processes may, in part, also explain other null findings in the literature (J. Jeong et al., 2016) (Yildirim & Roopnarine, 2017). Several other reasons could explain the divergent findings. For example, in larger households where there are multiple family members taking care of the infant, a pattern common in South Asia, it may be more difficult to isolate the specific contribution of any one individual (Roopnarine et al., 2013). Additionally, father involvement is very multidimensional and any one measure might miss a component that is contributing in a specific family environment. There is debate about the relevant aspects of father involvement, as well as how they should be measured (Gettler, 2016). Our measure captured more global involvement while other studies have information on specific shared activities, such as reading or telling stories. Finally, publication bias likely has also likely contributed to an underreporting of null or counterintuitive findings; and yet such results may be just as informative to the understanding of the impact of father involvement as are positive results.

Mother results

Our results are consistent with the idea that fathers support mothers when in need and hence support maternal mental health (J. Jeong et al., 2018). Although the overall trends were in the protective direction, we did not see consistent evidence of a dose-response relationship and it's not clear why father involvement at 3 months would be associated with lower depression levels

at 3 and 12 months postpartum, but not 6 months. This finding hints at the possibility that father involvement may influence child development through supporting maternal mental health, a hypothesis that could be tested in future research.

There has also been some discussion in the literature about how initial levels of maternal mental health may influence paternal involvement. In our sample, we found that depression symptoms during pregnancy were weakly associated with lower father involvement at 3 months, even as the 3-month involvement level predicted fewer future depression symptoms. This is in contrast to a 'buffering hypothesis', where father involvement increases when the mother is not able to engage fully, e.g. due to illness. Although this pattern is supported by some studies, a more common pattern is similar to what we observed in which higher maternal depression symptoms correlate with lower levels of father involvement (Goodman et al., 2014). In a US based study, Goodman and colleagues found evidence for both patterns: in the first 6 months postpartum, increased maternal depression symptoms predicted higher levels of father involvement. However, as depression symptoms persisted longer, they began to predict a drop in father involvement, leading to an observed inverse association between depression and father involvement (Goodman et al., 2014). In our study, we are unable to determine how long the mother had been feeling depressed at the first interview or to untangle the more complex relationship between maternal depression and father involvement.

Interestingly, mothers whose husbands were not in the households and husbands who were highly involved had some of the lowest levels of depression symptoms. Several factors might contribute to the finding with the temporarily non-resident fathers: Mothers whose husbands were temporarily non-resident reported lower prevalence of IPV, which is in turn a strong predictor of maternal mental health. Our models account for baseline (pregnancy) reported IPV, but likely do not capture the full impact of conflict in the family or other sources of violence on maternal mental health. In other words, lingering effects of IPV exposure prior to pregnancy may

exert a negative effect on women whose husbands are still present in the home, and conflict with husbands or marital dissatisfaction that does not rise to level of reported IPV exposure may also increase the risk of depression. Second, families with temporarily non-resident fathers were on average of higher SES than those with present fathers. Although our models adjusted for an asset-based SES score, it is possible that part of the positive association results from the increased resources that temporarily non-resident fathers provide. Third, the vast majority of households where the father was temporarily non-resident were larger, extended households. Therefore, it is possible that these mothers were supported by an extended family network that more than compensated for the fathers' lack of involvement. This finding reflects the complexity shaping fathers' involvement in the context of economic opportunities away from home and the presence of other support networks.

Strengths and limitations

Key strengths of our study are the community based population representative sample, the quality and the depth of maternal and child measurements, and a longitudinal design from pregnancy through 12 months post-partum in a rural, low resource, South Asian context. The longitudinal design allowed us to determine whether father involvement in the early childhood months predicted future outcomes, while also adjusting for factors such as baseline characteristics and prenatal depression (Raskin et al., 2015). Nonetheless, there are also several limitations. Our measure of father involvement is based on maternal report, which may be susceptible to social desirability bias as well as maternal depression symptoms (Raskin et al., 2015). Maternal expectations for father involvement may also influence her responses, independent of the objective amount of paternal involvement. In addition to studies that directly gather information from fathers, research is needed to assess the validity of maternal reporting of paternal involvement. A better understanding of the validity of maternal reporting will strengthen inference from studies, especially those set in low resource settings where the vast

majority of studies to date rely on maternal report (such as those from the Multiple Indicator Cluster Surveys (MICS) studies, for example (J. Jeong et al., 2016)). We also conducted sensitivity analyses (see Appendix) with different approaches to scoring the father involvement items and our findings were robust to these different specifications.

Although most of our analyses are longitudinal, reverse causality remains a possibility in that fathers may engage more with healthy, active children because they are more responsive. The father involvement measure also does not capture all of the potential ways in which the father may be engaged with the infant. The measure, with a focus on infancy, also does not enable us to separate out the independent contributions of maternal and paternal involvement and we acknowledge that maternal and paternal behaviors are not equivalent. We partially control for this by adjusting for the responsiveness and acceptance domains of the HOME inventory, which refer to the mother's parenting practices. Additionally, although maternal and paternal engagement is likely to be correlated, differentiation in impact may become easier as the children get older (Bornstein & Putnick, 2016).

Conclusion

In this study set in a low resource, South Asian context, we found that fathers are involved with their young children and that this involvement predicts some future developmental milestones and indicators socioemotional development, as well as better maternal mental health. We also found evidence of heterogeneities in this relationship, revealing that there is much we do not yet understand about the various domains of father involvement and their impact on child development. Much of the current attention in early childhood development focuses on parental involvement, yet fathers' involvement is not routinely included in research or intervention design. Future work would benefit from examining this relationship and how it interacts with sociocultural aspects of child rearing, which varies significantly across different parts of the

world(Cabrera et al., 2014). Finally, our research findings also point to the fact that mothers are most common respondents in widely used surveys in empirical research on child development. Relatively few datasets present information on fathers' reports on their own involvement. To fully understand the nature of parental involvement and study the effect of engagement of both or either parent on child outcomes, information would ideally be collected directly from each parent. Ultimately, child development, and perhaps maternal mental health, programs are likely to benefit from engaging fathers in order to maximize potential impact on the child.

References

- Abate, K.H., & Belachew, T. (2017). Women's autonomy and men's involvement in child care and feeding as predictors of infant and young child anthropometric indices in coffee farming households of Jimma Zone, South West of Ethiopia. *PLoS One*, 12, 16.
- Adamsons, K., & Johnson, S.K. (2013). An updated and expanded meta-analysis of nonresident fathering and child well-being. *J Fam Psychol*, 27, 589-599.
- Allport, B.S., Johnson, S., Aqil, A., Labrique, A.B., Nelson, T., Kc, A., et al. (2018). Promoting Father Involvement for Child and Family Health. *Acad Pediatr*, 18, 746-753.
- Azari, N., Soleimani, F., Vameghi, R., Sajedi, F., Shahshahani, S., Karimi, H., et al. (2017). A Psychometric Study of the Bayley Scales of Infant and Toddler Development in Persian Language Children. *Iranian journal of child neurology*, 11, 50-56.
- Baumrind, D. (1966). Effects of Authoritative Parental Control on Child Behavior. *Child Development*, 37, 887-907.
- Bayley, N., & Reuner, G. (2006). *Bayley scales of infant and toddler development: Bayley-III*: Harcourt Assessment, Psych. Corporation.
- Black, M.M., Dubowitz, H., & Starr, R.H. (1999). African American fathers in low income, urban families: Development, behavior, and home environment of their three-year-old children. *Child Development*, 70, 967-978.
- Bornstein, M.H., & Putnick, D.L. (2016). IV. MOTHERS' AND FATHERS' PARENTING PRACTICES WITH THEIR DAUGHTERS AND SONS IN LOW- AND MIDDLE-INCOME COUNTRIES. *Monographs of the Society for Research in Child Development*, 81, 60-77.
- Bowlby, J. (1969). *Attachment and loss. Vol. 1: Attachment*. New York: Basic Books.
- Bradley, R.H. (2015). Constructing and Adapting Causal and Formative Measures of Family Settings: The HOME Inventory as Illustration. *Journal of Family Theory & Review*, 7, 381-414.
- Cabrera, N.J., Fitzgerald, H.E., Bradley, R.H., & Roggman, L. (2014). The Ecology of Father-Child Relationships: An Expanded Model. *Journal of Family Theory & Review*, 6, 336-354.
- Cabrera, N.J., Shannon, J.D., & Tamis-LeMonda, C. (2007). Fathers' influence on their children's cognitive and emotional development: From toddlers to pre-K. *Applied Developmental Science*, 11, 208-213.
- Carlson, M.J., & Magnuson, K.A. (2011). "Low-Income Men and Fathers' Influences on Children?". *Ann Am Acad Pol Soc Sci*, 635, 95-116.
- Child Welfare Information Gateway (2006). *The importance of fathers in the healthy development of children*. Washington DC: Department of Health and Human Services, Children's Bureau.
- Das Gupta, M. (2009). Family systems, political systems, and Asia's 'missing girls': the construction of son preference and its unraveling. Policy Research Working Paper. Washington DC: World Bank.
- Dearden, K., Crookston, B., Madanat, H., West, J., Penny, M., & Cueto, S. (2013). What difference can fathers make? Early paternal absence compromises Peruvian children's growth. *Maternal and Child Nutrition*, 9, 143-154.
- Ditekemena, J., Koole, O., Engmann, C., Matendo, R., Tshetu, A., Ryder, R., et al. (2012). Determinants of male involvement in maternal and child health services in sub-Saharan Africa: a review. *Reproductive Health*, 9, 32.
- Ellerbe, C.Z., Jones, J.B., & Carlson, M.J. (2018). Race/Ethnic Differences in Nonresident Fathers' Involvement after a Nonmarital Birth. *Soc Sci Q*, 99, 1158-1182.

- Farooq, A., Kayani, A.K., & Ahmad, K. (2015). Marriage and family structures in the rural Punjab: A shift from conservative to contemporary patterns. *International Journal of Sociology and Social Policy*, 35, 306-324.
- Gallis, J., Maselko, J., O'Donnell, K., Song, K.E., Saqib, K., Turner, E.L., et al. (2018). Criterion-related validity and reliability of the Urdu version of the patient health questionnaire in community-based women in Pakistan. *PeerJ*, 6.
- Garfield, C.F., & Mesman, J. (2016). Time and Money: Extending Fathers' Role in Economically Challenging Contexts. *Pediatrics*, 138, 2.
- Gettler, L.T. (2016). Becoming DADS Considering the Role of Cultural Context and Developmental Plasticity for Paternal Socioendocrinology. *Current Anthropology*, 57, S38-S51.
- Goodman, S.H., Lusby, C.M., Thompson, K., Newport, D.J., & Stowe, Z.N. (2014). MATERNAL DEPRESSION IN ASSOCIATION WITH FATHERS' INVOLVEMENT WITH THEIR INFANTS: SPILLOVER OR COMPENSATION/BUFFERING? *Infant Mental Health Journal*, 35, 495-508.
- Hamadani, J.D., & Tofail, F. (2014). Childrearing, Motherhood and Fatherhood in Bangladeshi Culture. In H. Selin (Ed.), *Parenting Across Cultures*. Dordrecht: Springer.
- Jeong, J., McCoy, D.C., & Fink, G. (2017). Pathways between paternal and maternal education, caregivers' support for learning, and early child development in 44 low- and middle-income countries. *Early Childhood Research Quarterly*, 41, 136-148.
- Jeong, J., McCoy, D.C., Yousafzai, A.K., Salhi, C., & Fink, G. (2016). Paternal Stimulation and Early Child Development in Low- and Middle-Income Countries. *Pediatrics*, 138, 10.
- Jeong, J., Siyal, S., Fink, G., McCoy, D.C., & Yousafzai, A.K. (2018). "His mind will work better with both of us": a qualitative study on fathers' roles and coparenting of young children in rural Pakistan. *Bmc Public Health*, 18, 1274.
- Kim, M., Kang, S.K., Yee, B., Shim, S.Y., & Chung, M. (2016). Paternal involvement and early infant neurodevelopment: the mediation role of maternal parenting stress. *BMC Pediatr*, 16, 212.
- Kolenikov, S., & Angeles, G. (2009). Socioeconomic Status Measurement with Discrete Proxy Variables: Is Principal Component Analysis a Reliable Answer? *Review of Income and Wealth*, 55, 128-165.
- Kroenke, K., Spitzer, R.L., & Williams, J.B.W. (2001). The PHQ-9 - Validity of a brief depression severity measure. *Journal of General Internal Medicine*, 16, 606-613.
- Lewis, C., & Lamb, M.E. (2003). Fathers' influences on children's development: The evidence from two-parent families. *European Journal of Psychology of Education*, 18, 211-228.
- Lewis, S., Lee, A., & Simkhada, P. (2015). The role of husbands in maternal health and safe childbirth in rural Nepal: a qualitative study. *BMC Pregnancy and Childbirth*, 15, 162.
- Lin, W.-C., Chang, S.-Y., Chen, Y.-T., Lee, H.-C., & Chen, Y.-H. (2017). Postnatal paternal involvement and maternal emotional disturbances: The effect of maternal employment status. *Journal of Affective Disorders*, 219, 9-16.
- Linver, M.R., Brooks-Gunn, J., & Cabrera, N. (2004). The Home Observation for Measurement of the Environment (HOME) Inventory: The Derivation of Conceptually Designed Subscales. *Parenting-Science and Practice*, 4, 99-114.
- Maken, Z.H., Nasir Idrees, I., Zahid, A., Zulfiqar, A., Munib, A., Hassan, F., et al. (2017). Factors influencing father's antenatal and perinatal involvement in maternal health care. *J Matern Fetal Neonatal Med*, 1-7.
- Maselko, J., Bates, L., Bhalotra, S., Gallis, J.A., O'Donnell, K., Sikander, S., et al. (2018). Socioeconomic status indicators and common mental disorders: Evidence from a study of prenatal depression in Pakistan. *SSM - Population Health*, 4, 1-9.
- McMunn, A., Martin, P., Kelly, Y., & Sacker, A. (2017). Fathers' Involvement: Correlates and Consequences for Child Socioemotional Behavior in the United Kingdom. *Journal of Family Issues*, 38, 1109-1131.

- Mezulis, A.H., Hyde, J.S., & Clark, R. (2004). Father involvement moderates the effect of maternal depression during a child's infancy on child behavior problems in kindergarten. *J Fam Psychol*, 18, 575-588.
- National Institute of Population Studies - NIPS/Pakistan & ICF International. (2012-3). Pakistan Demographic and Health Survey 2012-2013. Islamabad: NIPS/Pakistan and ICF International.
- Nomaguchi, K., Brown, S., & Leyman, T.M. (2015). Fathers' Participation in Parenting and Maternal Parenting Stress: Variation by Relationship Status. *Journal of Family Issues*, 38, 1132-1156.
- Pleck, J. (2010). Paternal involvement: Revised conceptualization and theoretical linkages with child outcomes. In M. Lamb (Ed.), *The Role of the Father in Child Development* pp. 67-107). Hoboken, NJ: Wiley.
- Ranjitkar, S., Kvestad, I., Strand, T.A., Ulak, M., Shrestha, M., Chandyo, R.K., et al. (2018). Acceptability and Reliability of the Bayley Scales of Infant and Toddler Development-III Among Children in Bhaktapur, Nepal. *Frontiers in Psychology*, 9, 1265-1265.
- Raskin, M., Fosse, N.E., & Easterbrooks, M.A. (2015). INFLUENCE OF MOTHER'S DEPRESSION ON HER REPORTS OF FATHER INVOLVEMENT AND CHILD BEHAVIORAL PROBLEMS: A LATENT STATE-TRAIT APPROACH. *Infant Mental Health Journal*, 36, 88-103.
- Roopnarine, J.L., Krishnakumar, A., & Vadgama, D. (2013). Indian Fathers: Family Dynamics and Investment Patterns. *Psychology and Developing Societies*, 25, 223-247.
- Sikander, S., Ahmad, I., Atif, N., Zaidi, A., Vanobberghen, F., Weiss, H.A., et al. (2019). Delivering the Thinking Healthy Programme for perinatal depression through volunteer peers: a cluster randomised controlled trial in Pakistan. *Lancet Psychiatry*, 6, 128-139.
- Sikander, S., Lazarus, A., Bangash, O., Fuhr, D.C., Weobong, B., Krishna, R.N., et al. (2015). The effectiveness and cost-effectiveness of the peer-delivered Thinking Healthy Programme for perinatal depression in Pakistan and India: the SHARE study protocol for randomised controlled trials. *Trials*, 16, 14.
- Singley, D.B., Cole, B.P., Hammer, J.H., Molloy, S., Rowell, A., & Isacco, A. (2018). Development and psychometric evaluation of the Paternal Involvement With Infants Scale. *Psychology of Men & Masculinity*, 19, 167-183.
- Smith, L.E., & Howard, K.S. (2008). Continuity of paternal social support and depressive symptoms among new mothers. *Journal of Family Psychology*, 22, 763-773.
- Spitzer, R.L., Williams, J.B., Gibbon, M., & First, M.B. (1992). The Structured Clinical Interview for DSM-III-R (SCID). I: History, rationale, and description. *Archives of General Psychiatry*, 49, 624-629.
- Squires, J., Bricker, D., & Potter, L. (1997). Revision of a parent-completed developmental screening tool: Ages and stages questionnaires. *Journal of Pediatric Psychology*, 22, 313-328.
- Squires, J.K., Bricker, D.D., & Twombly, E. (2002). *Ages and Stages Questionnaire: Social-Emotional (ASQ:SE), A parent-completed, child-monitoring system for social-emotional behaviors*. Baltimore, MD: Paul H Brookes Publishing.
- Squires, J.K., Potter, L., Bricker, D.D., & Lamorey, S. (1998). Parent-completed developmental questionnaires: Effectiveness with low and middle income parents. *Early Childhood Research Quarterly*, 13, 345-354.
- Sriram, R. (2011). Evidence of Change and Continuity in Fathering: The Case of Western India. *Marriage and Family Review*, 47, 625-647.
- Statistics, P.B.o. (2017). District Census Report of Rawalpindi.
- Sun, L.-C., & Roopnarine, J.L. (1996). Mother-infant, father-infant interaction and involvement in childcare and household labor among Taiwanese families. *Infant Behavior and Development*, 19, 121-129.

- Tamis-LeMonda, C.S., Shannon, J.D., Cabrera, N.J., & Lamb, M.E. (2004). Fathers and mothers at play with their 2- and 3-year-olds: contributions to language and cognitive development. *Child Development, 75*, 1806-1820.
- Turner, E.L., Sikander, S., Bangash, O., Zaidi, A., Bates, L., Gallis, J., et al. (2016). The effectiveness of the peer-delivered Thinking Healthy PLUS (THPP+) Program for maternal depression and child socioemotional development in Pakistan: study protocol for a randomized controlled trial. *Trials, 17*, 442.
- Urke, H.B., Contreras, M., & Matanda, D.J. (2018). The Influence of Maternal and Household Resources, and Parental Psychosocial Child Stimulation on Early Childhood Development: A Cross-Sectional Study of Children 36–59 Months in Honduras. *International Journal of Environmental Research and Public Health, 15*, 926.
- Vazir, S., Naidu, A.N., & Vidyasagar, P. (1998). Nutritional status, psychosocial development and the home environment of Indian rural children. *Indian Pediatr, 35*, 959-966.
- Velikonja, T., Edbrooke-Childs, J., Calderon, A., Slead, M., Brown, A., & Deighton, J. (2017). The psychometric properties of the Ages & Stages Questionnaires for ages 2-2.5: a systematic review. *Child Care Health Dev, 43*, 1-17.
- WHO. (2001). Multi-Country Study on Women's Health and Domestic Violence Study Protocol Geneva: WHO.
- World Bank. (2017). Pakistan GDP per capita (current US\$).
- Yildirim, E.D., & Roopnarine, J.L. (2017). Paternal and maternal engagement across six Caribbean countries and childhood outcomes. *Journal of applied developmental psychology.*

Table 1. Baseline demographics and maternal and child outcomes over time*

| | baseline (N =996**) | 3 months (N=879) | 6months (N=821) | 12 months (N=926) |
|---|------------------------|---------------------|--------------------|----------------------|
| Demographic Characteristics | | | | |
| Maternal Age | | | | |
| Mean (SD) | 26.6 (4.40) | | | |
| Asset-based SES (at baseline) | | | | |
| Mean (SD) | 0.2 (1.56) | | | |
| Grades husband has passed, categorized | | | | |
| None (0) | 6.9% | | | |
| Primary (1-5) | 9.2% | | | |
| Middle (6-8) | 20.0% | | | |
| Secondary (9-10) | 45.5% | | | |
| Higher Secondary (11-12) | 10.8% | | | |
| Tertiary (>12) | 6.5% | | | |
| Husband's Occupation | | | | |
| Manual worker | 86.5% | | | |
| Non-manual worker | 8.3% | | | |
| Other | 2.2% | | | |
| Grades mother has passed, categorized | | | | |
| None (0) | 12.7% | | | |
| Primary (1-5) | 17.9% | | | |
| Middle (6-8) | 18.5% | | | |
| Secondary (9-10) | 25.6% | | | |
| Higher Secondary (11-12) | 10.2% | | | |
| Tertiary (>12) | 14.0% | | | |
| Nuclear Family | 21.3% | | | |
| Pregnant with first child | 30.0% | | | |

Any physical IPV ever 13.7%

Child Gender: Female 47.9%

Maternal Outcomes

| | | | | |
|------------------------------------|-------|-------------|-------|-------------|
| Currently depressed (SCID), % yes | 25.4% | 13.1% | 10.7% | 15.7% |
| HOME responsivity score, mean (SD) | | 8.28 (2.07) | | 9.78 (1.29) |
| HOME acceptance score, mean (SD) | | 6.52 (0.97) | | 6.15 (1.26) |

Child Outcomes (Mean (SD))

| | | | |
|-------------------------------|--------------|--------------|--------------|
| Growth | -1.13 (1.28) | -0.91 (1.19) | -0.79 (1.12) |
| Weight-for-age z-score | | | |
| Length/height-for-age z-score | 0.04 (1.71) | 0.02 (1.61) | -0.73 (1.24) |

Socioemotional development

ASQ Total Score 9.36 (11.99)

Bayley Scales of Infant Development

| | |
|-------------------|-------------|
| Cognitive Score | 9.39 (2.08) |
| Expressive Score | 9.16 (1.49) |
| Receptive Score | 7.96 (1.40) |
| Fine Motor Score | 9.02 (1.70) |
| Gross Motor Score | 8.14 (2.27) |

* Results based on weighted data; **Includes only those with father involvement data at either 3 or 12 months post-baseline

Table 2. Father Involvement at 3 and 12 months post-partum *

| | 3 months (N = 879) | 12 months (N = 926) |
|--|-----------------------|------------------------|
| Father temporarily non-resident (%) | 18.1% | 23.2% |
| Father is able to help mother in taking care of child** | | |
| Rarely/never | 10.5% | 7.2% |
| Sometimes | 19.4% | 20.5% |
| Often | 70.1% | 72.1% |
| Father enjoys spending time with the child** | | |
| Not at all | 3.0% | 0.3% |
| Not that much | 12.0% | 9.8% |
| A lot | 85.0% | 89.9% |
| Plays or interacts with the child** (% yes) | 41.8% | 38.9% |
| The child likes to be held by** (% yes) | 11.0% | 22.7% |
| Helps to soothe the child when restless/crying** (% yes) | 6.1% | 17.1% |
| <hr/> | | |
| Aggregate Father involvement score | | |
| Low (0-3) | 16.0% | 12.5% |
| Medium (4) | 32.4% | 34.9% |
| High (5-10) | 33.6% | 29.3% |
| <hr/> | | |
| <u>Predictors of Father Involvement** (Mean score (SD))</u> | | |
| Asset index quintile | | |
| 1 | 4.64 (2.30) | 5.13 (2.62) |
| 2 | 4.83 (2.04) | 5.18 (2.33) |
| 3 | 4.66 (2.10) | 4.98 (2.47) |

| | | |
|---------------------------|--------------|-------------|
| 4 | 4.35 (1.96) | 5.10 (2.50) |
| 5 | 5.01 (2.09) | 5.10 (2.44) |
| Nuclear family | 5.02 (2.19) | 5.16 (2.55) |
| Extended/multiple | 4.64 (2.08)^ | 5.08 (2.44) |
| Paternal education | | |
| None | 4.47 (2.02) | 5.10 (2.86) |
| Primary | 4.73 (2.43) | 4.71 (2.33) |
| Middle | 4.83 (2.23) | 5.21 (2.41) |
| Secondary | 4.77 (2.11) | 5.17 (2.45) |
| Higher secondary | 4.26 (1.82) | 4.83 (2.43) |
| Tertiary | 4.68 (1.63) | 5.32 (2.50) |
| Depressed at baseline | 4.38 (2.09) | 4.98 (2.46) |
| Not depressed at baseline | 4.81 (2.10)^ | 5.14 (2.47) |
| Female child | 4.72 (2.20) | 5.00 (2.38) |
| Male child | 4.67 (2.02) | 5.19 (2.54) |

* Results based on weighted data; **excluding temporarily non-resident fathers; ^p<.05 from mixed models that incorporate clustering and weights

Table 3. Father involvement at 3 and 12 months and child growth and socioemotional outcomes*

| | Follow-Up Time Point | | |
|----------------------------------|---------------------------------|--------------------------|--------------------------|
| | PANEL A: Weight-for-Age z Score | | |
| | 3 months | 6 month | 12 month |
| | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> |
| Father Involvement at 3 months | | | |
| Low (0-3) | reference | reference | reference |
| Medium (4) | 0.14 (-0.11, 0.39) | 0.05 (-0.21, 0.31) | 0.03 (-0.16, 0.22) |
| High (5-10) | 0.05 (-0.19, 0.29) | 0.13 (-0.14, 0.40) | -0.05 (-0.28, 0.18) |
| Temporarily non-resident Fathers | 0.03 (-0.24, 0.31) | 0.12 (-0.15, 0.39) | -0.004 (-0.24, 0.23) |
| Father Involvement at 12 months | | | |
| Low (0-3) | | | reference |
| Medium (4) | | | -0.30 (-0.51, -0.09) |
| High (5-10) | | | -0.23 (-0.47, 0.01) |
| Temporarily non-resident Fathers | | | -0.13 (-0.38, 0.13) |
| | PANEL B: Length-for-Age z Score | | |
| | 3 month | 6 month | 12 month |
| | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> |
| Father Involvement at 3 months | | | |
| Low (0-3) | reference | reference | reference |
| Medium (4) | 0.14 (-0.24, 0.51) | 0.08 (-0.30, 0.45) | 0.13 (-0.09, 0.35) |
| High (5-10) | -0.11 (-0.42, 0.20) | 0.01 (-0.34, 0.36) | 0.07 (-0.20, 0.34) |
| Temporarily non-resident Fathers | 0.21 (-0.14, 0.56) | -0.11 (-0.48, 0.25) | 0.16 (-0.15, 0.47) |
| Father Involvement at 12 months | | | |
| Low (0-3) | | | reference |
| Medium (4) | | | -0.23 (-0.51, 0.04) |
| High (5-10) | | | -0.22 (-0.44, 0.00) |
| Temporarily non-resident Fathers | | | 0.01 (-0.24, 0.26) |

Table 3 cont. Father involvement at 3 and 12 months and child growth and socioemotional outcomes*

| | PANEL C: Ages and Stages Socioemotional Score | | |
|----------------------------------|---|--------------------------|--------------------------|
| | 3 month | 6 month | 12 month |
| | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> |
| Father Involvement at 3 months | | | |
| Low (0-3) | | reference | |
| Medium (4) | | -2.49 (-5.93, 0.95) | |
| High (5-10) | | -3.63 (-6.97, -0.28) | |
| Temporarily non-resident Fathers | | -3.18 (-7.45, 1.09) | |

*Models adjust for family structure (nuclear, non-nuclear), child's gender; baseline asset-based SES, treatment arm (treatment, control, non-depressed); and the responsivity and acceptance subscales of the HOME score at 3 months (for 3- or 6-month outcomes) and 12 months (for 12-month outcomes).

Table 4. Father involvement at 3 and 12 months and 5 subscale of the Bayley Scales of Infant Development (BSID) scores at 12 months*

| <i>Predictor</i> | Cognitive | Receptive | Expressive | Fine Motor | Gross Motor |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> | <i>Estimate (95% CI)</i> |
| Father Involvement at 3 months | | | | | |
| Low (0-3) | reference | reference | reference | reference | reference |
| Medium (4) | 0.16 (-0.40, 0.71) | 0.06 (-0.36, 0.48) | 0.31 (-0.00, 0.62) | 0.15 (-0.36, 0.65) | 0.32 (-0.23, 0.87) |
| High (5-10) | 0.40 (-0.05, 0.84) | 0.10 (-0.26, 0.46) | 0.34 (-0.02, 0.69) | 0.29 (-0.14, 0.72) | 0.23 (-0.39, 0.86) |
| Temporarily non-resident Fathers | 0.16 (-0.44, 0.76) | 0.10 (-0.32, 0.52) | 0.32 (-0.10, 0.73) | 0.01 (-0.48, 0.49) | 0.36 (-0.19, 0.91) |
| Father Involvement at 12 months | | | | | |
| Low (0-3) | reference | reference | reference | reference | reference |
| Medium (4) | 0.32 (-0.23, 0.87) | -0.02 (-0.41, 0.36) | 0.01 (-0.39, 0.40) | 0.53 (0.15, 0.90) | 0.14 (-0.44, 0.72) |
| High (5-10) | 0.77 (0.27, 1.27) | 0.35 (-0.01, 0.72) | 0.22 (-0.10, 0.53) | 0.59 (0.24, 0.93) | 0.37 (-0.16, 0.91) |
| Temporarily non-resident Fathers | 0.39 (-0.10, 0.88) | 0.07 (-0.29, 0.44) | 0.15 (-0.22, 0.52) | 0.35 (0.07, 0.64) | 0.52 (0.00, 1.03) |

*Models adjust for family structure (nuclear, non-nuclear), child's gender; baseline asset-based SES, treatment arm (treatment, control, non-depressed); and the responsivity and acceptance subscales of the HOME score at 3 months (for 3- or 6-month outcomes) and 12 months (for 12-month outcomes).

Table 5. Father involvement at 3 and 12 months and maternal depression (SCID) at 3, 6, and 12 months postpartum.*

| | Follow-Up Time Point | | |
|---|----------------------------------|----------------------------------|----------------------------------|
| PANEL A: Father Involvement at 3 months | | | |
| | 3 month | 6 month | 12 month |
| | <i>Prevalence Ratio (95% CI)</i> | <i>Prevalence Ratio (95% CI)</i> | <i>Prevalence Ratio (95% CI)</i> |
| Low (0-3) | reference | reference | reference |
| Medium (4) | 0.47 (0.33, 0.68) | 0.85 (0.49, 1.46) | 0.51 (0.35, 0.75) |
| High (5-10) | 0.79 (0.49, 1.26) | 0.80 (0.48, 1.33) | 0.59 (0.41, 0.86) |
| Temporarily non-resident Fathers | 0.62 (0.39, 0.96) | 0.67 (0.38, 1.18) | 0.73 (0.43, 1.23) |
| PANEL B: Father Involvement at 12 months | | | |
| | 3 month | 6 month | 12 month |
| | <i>Prevalence Ratio (95% CI)</i> | <i>Prevalence Ratio (95% CI)</i> | <i>Prevalence Ratio (95% CI)</i> |
| Low (0-3) | | | reference |
| Medium (4) | | | 0.76 (0.54, 1.08) |
| High (5-10) | | | 0.58 (0.37, 0.90) |
| Temporarily non-resident Fathers | | | 0.67 (0.41, 1.08) |

*Models adjust for family structure (nuclear, non-nuclear), child's gender; baseline asset-based SES, treatment arm (treatment, control, non-depressed); and the responsiveness and acceptance subscales of the HOME score at 3 months (for 3- or 6-month outcomes) and 12 months (for 12-month outcomes).

Figures

Figure 1. Father involvement and child weight-for-age and height-for-age z-scores

Figure 2. Three-month father involvement and child 6-month ASQ-se score

Figure 3. Father involvement and child BAYLEY scaled scores

Figure 4. Father involvement and maternal depression (SCID)

Figure 1. Father involvement and child weight-for-age and height-for-age z-scores

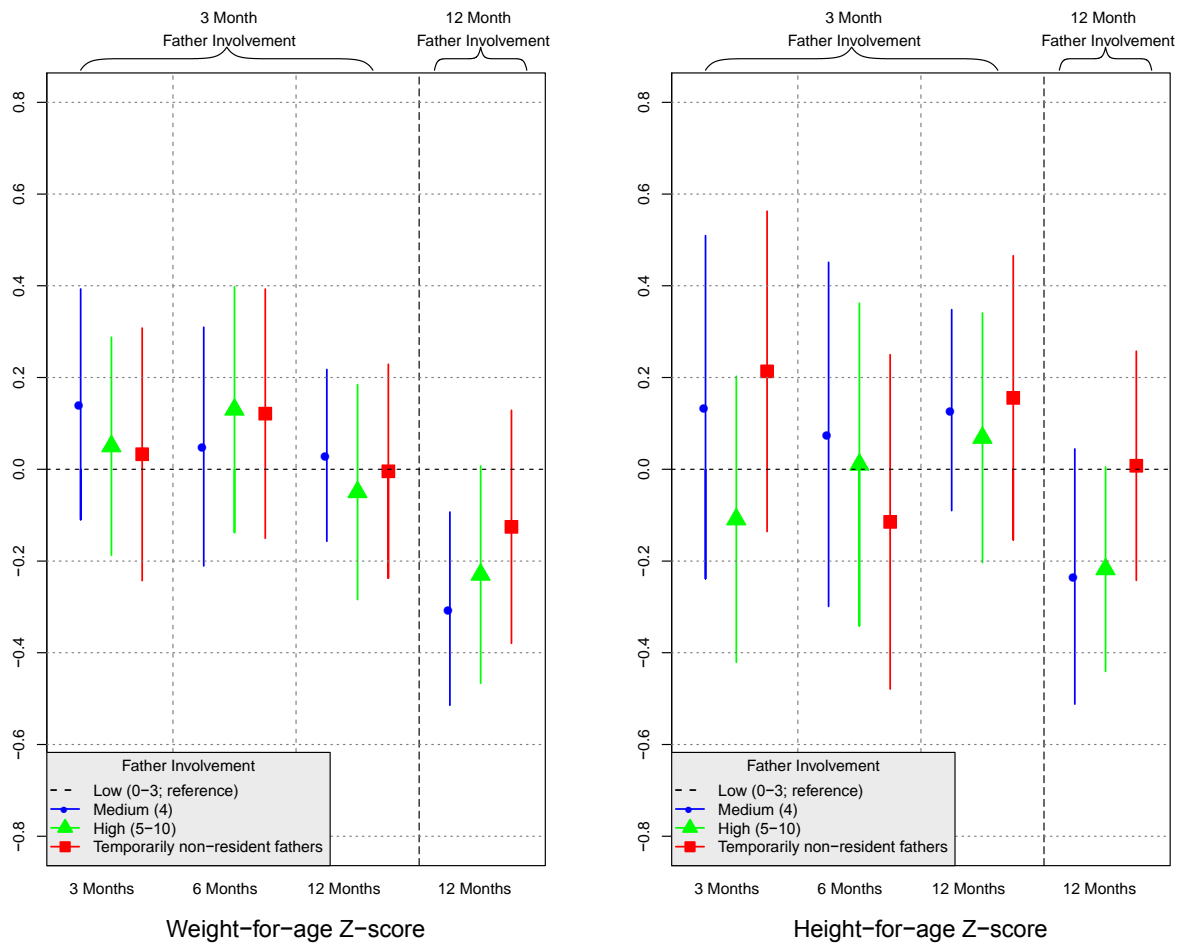
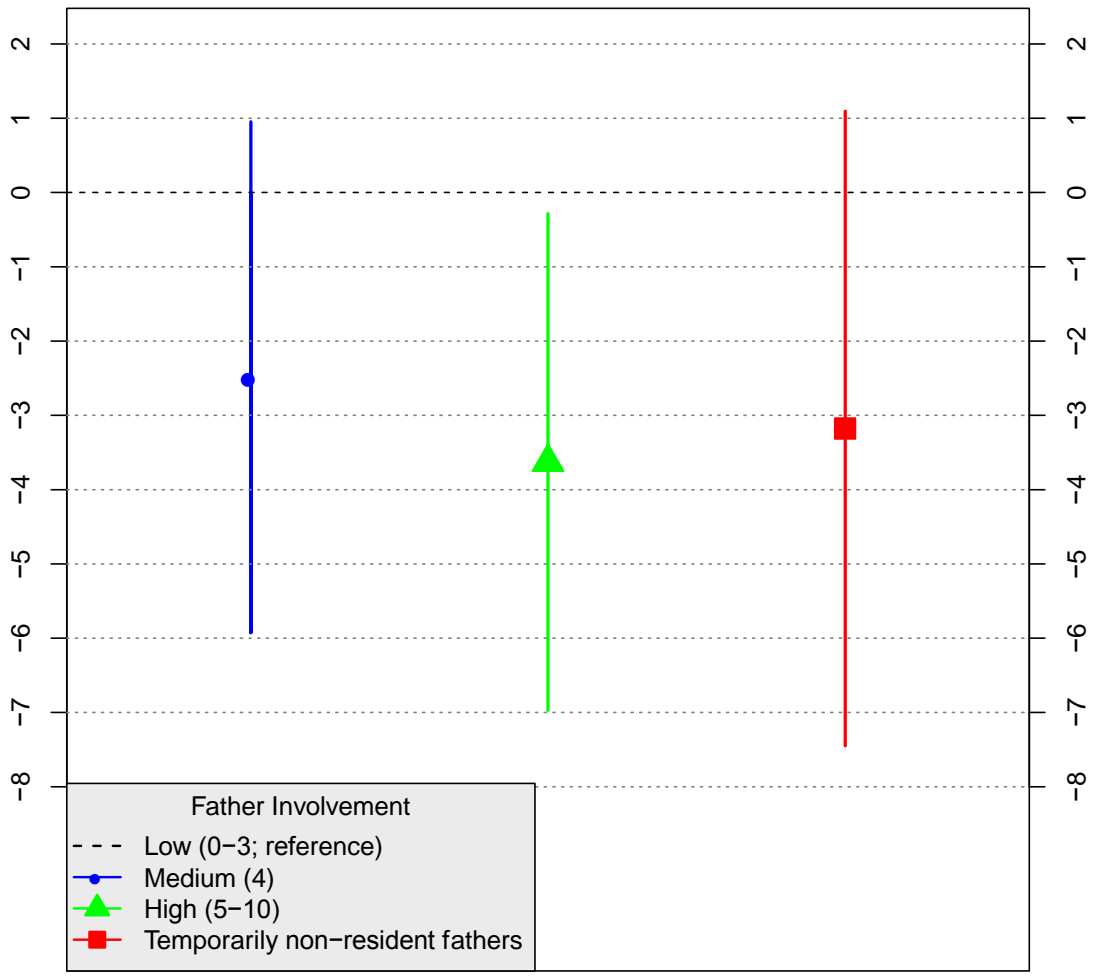


Figure 2. Three-month father involvement and child 6-month ASQ-se score

3 Month
Father Involvement



6 Months

ASQ Total Score

Figure 3. Father involvement and child BSID scaled scores

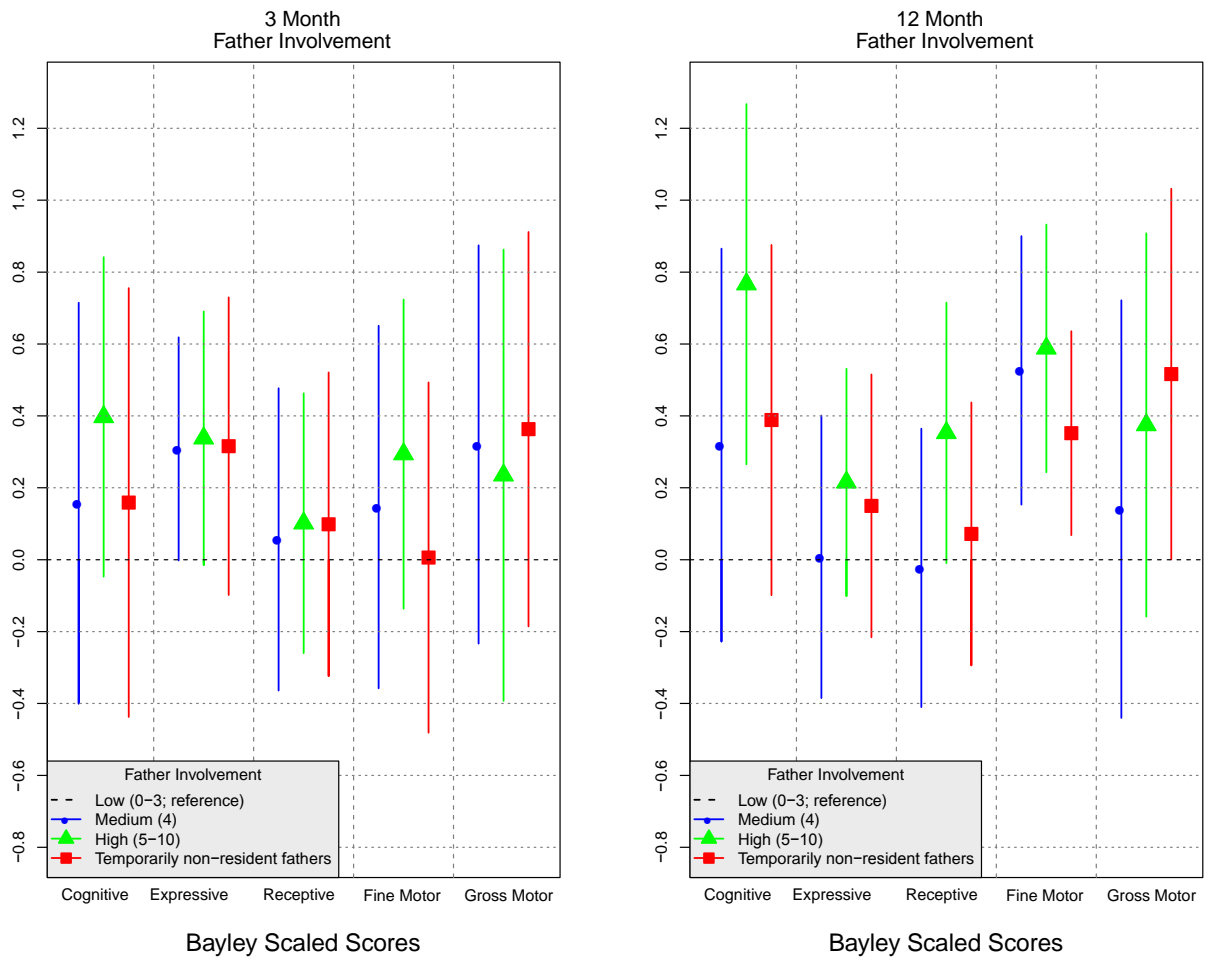


Figure 4. Father involvement and maternal depression (SCID)

