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**Father involvement in the first year of life: Associations with maternal**

**mental health and child development outcomes in rural Pakistan**

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**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. We used data 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, cognitive, language, motor scales). Maternal depression was assessed at 3, 6, and 12 months postpartum. Most mothers reported that fathers were involved in some way: for example, approximately 40% reported that the father plays with the baby on a typical day. Additionally, roughly 20% of the fathers were temporarily non-resident. Three month father involvement was not associated with child growth at any time point; however, 12 month father involvement was cross-sectionally inversely associated with child growth. Socioemotional development at 6 months was predicted by father involvement at 3 months. Finally, the cognitive, and fine motor scales were cross-sectionally associated with high levels of 12-month father involvement. Both greater father involvement and father temporary non-resident status were associated with lower levels of maternal depression, an association partially explained by lower prevalence of intimate partner violence among women with more involved or temporarily non-resident husbands. Taking advantage of 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 and 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, 2010a).

The majority of 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 and 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, Maccoby and Martin 1983). Explication of why, specifically, *father* involvement in these domains should impact child outcomes has received relatively less attention (Pleck, 2010a). 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, 2010b). 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 (Pleck, 2010b) 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 2010b). 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. Consistent with the literature, 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 low and middle income countries (LMIC), as well as non-Western settings, only a handful of cross-sectional studies report findings that associate father involvement with child outcomes; and one longitudinal study connected father presence with child stunting (Dearden et al., 2013). Furthermore, there is often a lack of a clear distinction between fathers who are physically present at home and involved, those who are present at home and not involved, vs. those who may be temporarily migrating for work, which results in low levels of direct 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*

Our 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), with data from 38 countries, Jeong and colleagues reported that higher levels of paternal stimulation (characterized by activities such as 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, in which paternal stimulation did not predict the overall child development index in a model adjusting for maternal stimulation(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 be different across developmental domains and region. For example, contrary to the above cited studies, 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), although the study did not measure other domains of child developmental milestones (Abate & Belachew, 2017). A separate analysis of six Caribbean countries participating in the MICS 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 study in a middle income country that examined the association between paternal involvement and child outcomes longitudinally. Dearden and colleagues in Peru collected data when children were approximately 1 and 5 years old; they found that children who saw their fathers at least weekly at both time points 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). However, these results may have been driven by the strong correlation between concurrent father presence and child growth at age 5. Furthermore, there are 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 where fathers are more engaged with healthy and active children, longitudinal studies are necessary to begin to test the causal relationship between father involvement and various domains of child development.

*Father involvement and maternal mental health*

In addition to the potential direct impact on child development, father involvement is also source of support to the mother, which may, in turn, have a positive influence on her mental health. In addition to this maternal positive outcome, a link with maternal mental health points to another potential pathway through which father involvement impacts child development. There is some evidence of this link. For example, a study in Korea reported that both the perceived availability of the father to help and their actual involvement 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 (vs. mothers employed outside the 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 as reported by at least two US based studies among vulnerable groups; in these paternal involvement predicted lower future depression and stress symptoms (Nomaguchi et al., 2015; Smith & Howard, 2008). While this evidence from high income countries is suggestive, it’s not clear if the relationship is the same in lower income country contexts, where high levels of adversity are common, or where there are larger families with more adults in the household.

*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 (Short et al., 2001). 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 months 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 (Bank", 2017). Our study takes place in a rural area south-east of the city of Rawalpindi, Pakistan (Kallar Syedan, a sub-district 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 Intternational, 2012-3). Living in extended families is the norm (i.e. three generations, usually one or both parents with married sons, their wives, and children), 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 household sizes (average 6·9 persons per household) with fairly traditional gender based 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, 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, and child development indicators at 3, 6, and 12 months, alongside 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 (each village cluster based on 2,400-3,600 population) 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; Sikander et al., 2015; Turner et al., 2016). 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 program based on principles of Cognitive Behavioral Therapy, which was delivered by trained 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., (in press)). 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 responsivity, 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 (3-point Likert scale: 0: rarely/never, 1: sometimes, 2: often) and (2) enjoys spending time with the baby (on a 3 point Likert scale: 0: not at all, 1: not that much, 2: a lot). 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 a typical day), asking 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 Likert 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 two Likert style 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 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 in multiple international settings and has been found to be reliable and valid across diverse settings (Ivarsson et al., 2017; 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 skill domains. 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, 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

First looking at growth indicators, father involvement at 3 months was not associated with weight or length-for-age z scores, either contemporaneously or with future z scores (Panels A and B in Table 3). Greater father involvement at 12 months was cross-sectionally associated with lower length and weight-for-age z scores (weight-for-age z score beta= -0.26, 95% confidence interval [CI] -0.48 to -0.03 and length-for-age z score beta= -0.24, 95% CI -0.46 to -0.02 comparing the high to low tertiles of father involvement).

For socioemotional development, father involvement at 3 months predicted better (lower) ASQ-SE scores at 6 months (Panel C, beta= -3.66 (95% CI -7.14 to -0.18 comparing high to low levels of involvement).

Turning to developmental milestone indicators, in Table 4, although not precisely estimated with 95% confidence intervals often including the null, high levels of father involvement (when compared with low levels) tended to be associated with higher cognitive, receptive/expressive language, and fine/gross motor indicators. This positive association appeared to be stronger in the cross sectional association between high levels of father involvement at 12 months and the cognitive and fine motor scales: children of fathers with the high level of involvement scored 0.74 points higher on the cognitive scale than those whose fathers were in the low category of involvement (95% CI: 0.22 to 1.25); this difference was 0.56 points on the fine motor scale (95% CI: 0.21 to 0.91). Associations between 3 month father involvement and 12 month Bayley scales were weaker.

Father involvement and maternal mental health

We find a protective association between the father being temporarily non-resident and maternal depression (Table 5). For example, the prevalence of depression at 3 months was a third lower for women whose husbands were temporarily non-resident (PR=0.63; 95% CI 0.38 to 1.04) 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).

 Among fathers who were resident, higher levels of father involvement were associated with better maternal mental health. The likelihood of meeting diagnostic criteria for depression, based on the SCID, is lower for women whose husbands were more involved, even after adjusting for baseline depression during pregnancy and baseline IPV. This association holds not only cross-sectionally, with 3 and 12 month father involvement being associated with lower prevalence of depression at 3 and 12 months, respectively, but also over time: High 3-month father involvement is associated with a 40% reduction in prevalence of depression at 12 months for the highest level of father involvement vs. the lowest (prevalence ratio [PR] for high tertile level of involvement= 0.60; 95% CI 0.41 to 0.89). Although the estimates for 3 month involvement and depression at 6 months are in the same protective direction, they are not as precise.

**Discussion**

This paper contributes to our understanding of father involvement in the first year of a child’s life and how father involvement links to maternal mental health and child overall development in a low resource, South Asian context. We found that most fathers are involved in some way, and that this involvement predicts contemporaneous and future child socioemotional and overall development outcomes, as well as maternal mental health. We also found a weak, inverse, cross-sectional association with growth at 12 months.

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 that suggest 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 in father involvement changing 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, as measured through assets, to consistently predict father involvement. Others who have found SES to be a stronger predictor of involvement have noted that a key reason that poverty can lead to lower apparent paternal involvement is because fathers are out of the house seeking any employment they can find (Cabrera et al., 2007; Garfield & Mesman, 2016; J. Jeong et al., 2016). Our findings also support this idea that fathers who are temporarily not in the home may provide indirect support and may be qualitatively different from uninvolved fathers who are present in the home. The majority of temporarily non-resident fathers were away because of work, although we did not have complete information on the occupational status of all fathers. These families tended to have 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). 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 Low and Middle Income countries by showing a longitudinal association between father involvement in early infancy, 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. By using the Bayley Scales of Infant and Toddler Development 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 diverse domains of development, including fine motor skills and cognitive function, although some of these estimates were not very precise. It is difficult, however, to address the varying findings across developmental domains, such as why fathers significantly impact cognitive development, but not language. It could 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 no 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, or 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 would help better understand these findings. An inverse finding 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, such as those by McCoy and colleagues who reported a null association between father involvement and child growth (J. Jeong et al., 2016). In another study by Yildririm and colleagues, fathers cognitive engagement was linked with child literacy skills in only two of the six Caribbean countries in the study (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 is more difficult to isolate the specific contribution of any one individual (Roopnarine et al., 2013). Additionally, father involvement is very multidimensional; and any measure might miss a component that may be contributing in that 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 father involvement with the child supports maternal mental health. Mothers whose husbands were more involved at 3 months had lower depression levels both at 3 and at 12 months, after adjusting for prior depression symptoms, but not at the middle, 6 month, time point. This finding hints at the possibility that father involvement may influence child development through supporting maternal mental health, but the lack of association at 6 months does not fully support this hypothesis.

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. We partially control for this by adjusting for the responsivity 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 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.

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| **Table 1. Baseline demographics and maternal and child outcomes over time\*** |
|  | baseline | 3 months | 6months | 12 months |
|  | (N =996\*\*) | (N=879) | (N=821) | (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** (% yes)  |  |  |  |  |
| **Currently depressed (SCID)**  | 25.4% | 13.1% | 10.7% | 15.7% |
|  |  |  |  |  |
| **Child Outcomes (**Mean (SD)) |  |  |  |  |
| **Growth** Weight-for-age z-score  |  | -1.13 (1.28) | -0.91 (1.19) | -0.79 (1.12) |
|  Length/height-for-age z-score  |  | 0.04 (1.71) | 0.02 (1.61) | -0.73 (1.24) |
|  |  |  |  |  |
| **Socioemtional 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 |

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| **Table 2. Father Involvement at 3 and 12 months post-partum \*** |
|  | 3 months | 12 months |
|   | (N = 879) | (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% |
|  |  |  |
| **Aggregate Father involvement score** |  |  |
|  Low (0-3) | 16.0% | 12.5% |
|  Medium (4) | 32.4% | 34.9% |
|  High (5-10) | 33.6% | 29.3% |
|  |  |  |
|  |  |  |
| **Predictors of Father Involvement\*\* (Mean score (SD))** |  |  |
| 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 familyExtended/multiple | 5.02 (2.19)4.64 (2.08)^ | 5.16 (2.55)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 childMale child | 4.72 (2.20)4.67 (2.02) | 5.00 (2.38)5.19 (2.54) |
| \* Results based on weighted data; \*\*excluding absent fathers; ^p<.05 from mixed models that incorporate clustering and weights |  |  |
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| **Table 3. Father involvement at 3 and 12 months and child growth and socioemotional outcomes\*** |
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|  |  | **Follow-Up Time Point** |  |
| **PANEL A: Weight-for-Age z Score** |
|  | **3 months** | **6 month** | **12 month** |
|  | *Estimate (95% CI)*  | *Estimate (95% CI)*  | *Estimate (95% CI)*  |
| Father Involvement at 3 months  |  |  |  |
|  Low (0-3) | reference  | reference  | reference  |
|  Medium (4) | 0.12 (-0.12, 0.37)  | 0.07 (-0.19, 0.32)  | 0.04 (-0.15, 0.22)  |
|  High (5-10) | 0.02 (-0.21, 0.26)  | 0.13 (-0.14, 0.39)  | -0.04 (-0.28, 0.19)  |
|  Temporarily non-resident Fathers | 0.04 (-0.24, 0.31)  | 0.13 (-0.14, 0.40)  | 0.005 (-0.23, 0.24)  |
| Father Involvement at 12 months  |  |  |   |
|  Low (0-3) |  |  | reference  |
|  Medium (4) |  |  | -0.34 (-0.55, -0.13)  |
|  High (5-10) |  |  | -0.26 (-0.48, -0.03)  |
|  Temporarily non-resident Fathers |  |  | -0.14 (-0.38, 0.11)  |
| **PANEL B: Length-for-Age z Score** |
|   | **3 month** | **6 month** | **12 month** |
|   | *Estimate (95% CI)*  | *Estimate (95% CI)*  | *Estimate (95% CI)*  |
| Father Involvement at 3 months  |  |  |  |
|  Low (0-3) | reference  | reference  | reference  |
|  Medium (4) | 0.13 (-0.23, 0.48)  | 0.10 (-0.26, 0.46)  | 0.13 (-0.09, 0.35)  |
|  High (5-10) | -0.13 (-0.44, 0.18)  | 0.01 (-0.33, 0.35)  | 0.07 (-0.21, 0.34)  |
|  Temporarily non-resident Fathers | 0.23 (-0.13, 0.58)  | -0.10 (-0.47, 0.26)  | 0.16 (-0.15, 0.48)  |
| Father Involvement at 12 months  |  |  |   |
|  Low (0-3) |  |  | reference  |
|  Medium (4) |  |  | -0.25 (-0.53, 0.02)  |
|  High (5-10) |  |  | -0.24 (-0.46, -0.02)  |
|  Temporarily non-resident Fathers |  |  | -0.005 (-0.26, 0.25)  |
|  |  |  |  |
| **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** |
|   | *Estimate (95% CI)*  | *Estimate (95% CI)*  | *Estimate (95% CI)*  |
| Father Involvement at 3 months  |  |   |   |
|  Low (0-3) |  | reference  |   |
|  Medium (4) |  | -2.54 (-6.23, 1.16)  |   |
|  High (5-10) |  | -3.66 (-7.14, -0.18)  |   |
|  Temporarily non-resident Fathers  |   | -3.19 (-7.60, 1.22)  |   |
| \*Models adjust for family structure (nuclear, non-nuclear), child's gender; baseline asset-based SES, and treatment arm (treatment, control, non-depressed) |
|  |

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|   **Table 4. Father involvement at 3 and 12 months and 5 subscale of the Bayley Scales of Infant Development (BSID) scores at 12 months\*** |
|   | Cognitive | Receptive | Expressive |  Fine Motor |  Gross Motor  |
| *Predictor* | *Estimate (95% CI)*  | *Estimate (95% CI)*  | *Estimate (95% CI)*  | *Estimate (95% CI)*  | *Estimate (95% CI)* |
|   |  |  |  |  |   |
| **Father Involvement at 3 months** |
|  Low (0-3) | reference  | reference  | reference  | reference  | reference  |
|  Medium (4) | 0.24 (-0.31, 0.78)  | 0.10 (-0.31, 0.51)  | 0.38 (0.07, 0.69)  | 0.22 (-0.27, 0.71)  | 0.46 (-0.09, 1.02)  |
|  High (5-10) | 0.42 (-0.01, 0.86)  | 0.13 (-0.23, 0.48)  | 0.37 (0.03, 0.72)  | 0.31 (-0.11, 0.73)  | 0.25 (-0.38, 0.89)  |
|  Temporarily non-resident Fathers | 0.21 (-0.38, 0.79)  | 0.13 (-0.29, 0.56)  | 0.37 (-0.03, 0.77)  | 0.05 (-0.43, 0.53)  | 0.43 (-0.13, 0.99)  |
|  **Father Involvement at 12 months** |
|  Low (0-3) | reference  | reference  | reference  | reference  | reference  |
|  Medium (4) | 0.26 (-0.27, 0.79)  | -0.08 (-0.46, 0.29)  | -0.06 (-0.47, 0.34)  | 0.48 (0.12, 0.83)  | 0.10 (-0.50, 0.70)  |
|  High (5-10) | 0.74 (0.22, 1.25)  | 0.32 (-0.06, 0.69)  | 0.17 (-0.16, 0.51)  | 0.56 (0.21, 0.91)  | 0.35 (-0.18, 0.88)  |
|  Temporarily non-resident Fathers | 0.38 (-0.10, 0.87)  | 0.06 (-0.32, 0.44)  | 0.14 (-0.22, 0.51)  | 0.34 (0.07, 0.61)  | 0.51 (-0.00, 1.02)  |

\*Models adjust for family structure (nuclear, non-nuclear), child's gender; baseline asset-based SES, and treatment arm (treatment, control, non-depressed)

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| **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 |
|  | *Prevalence Ratio (95% CI)* | *Prevalence Ratio (95% CI)* | *Prevalence Ratio (95% CI)* |
|  Low (0-3) | reference | reference | reference |
|  Medium (4) | 0.49 (0.33, 0.72) | 0.95 (0.58, 1.53) | 0.56 (0.38, 0.82) |
|  High (5-10) | 0.84 (0.51, 1.39) | 0.85 (0.52, 1.40) | 0.60 (0.41, 0.89) |
|  Temporarily non-resident Fathers | 0.63 (0.38, 1.04) | 0.79 (0.45, 1.39) | 0.78 (0.45, 1.33) |
| **PANEL B: Father Involvement at 12 months**  |
|   | 3 month | 6 month | 12 month |
|   |  *Prevalence Ratio (95% CI)*  |  *Prevalence Ratio (95% CI)*  | *Prevalence Ratio (95% CI)* |
|  Low (0-3) |  |  | reference |
|  Medium (4) |  |  | 0.87 (0.62, 1.23) |
|  High (5-10) |  |  | 0.66 (0.40, 1.07) |
|  Temporarily non-resident Fathers |   |   | 0.79 (0.46, 1.37) |
| \*Models adjust for family structure (nuclear, non-nuclear), child's gender; baseline asset-based SES, treatment arm (treatment, control, non-depressed) and baseline IPV. |