Influence of father-infant relationship on infant development: A father-involvement intervention in Vietnam

Lynn A. Rempel

Brock University

John K. Rempel

St. Jerome's University

Toan Nang Khuc

Hanoi National University of Education

Le Thi Vui

Hanoi School of Public Health

Author Note.

Lynn A. Rempel, Department of Nursing, Brock University, St. Catharines, ON, Canada; John K. Rempel, Department of Psychology, St. Jerome's University, Waterloo, ON, Canada; Toan Nang Khuc, Department of Developmental Psychology, Hanoi National University of Education, Hanoi, Vietnam; Le Thi Vui, Department of Demography, Hanoi School of Public Health, Hanoi, Vietnam.

This study was supported by a grant from the Grand Challenges Canada Saving Brains Program (0345-03). Sincere thanks to our team members at Hanoi School of Public Health: co-project lead, Dr. Tran Huu Bich, collaborator Dr. Dinh Thi Phuong Hoa, Mrs. D. T. Nghia, B. N. Linh, T. K. Long, D. K. Tuan, C. T. Quynh, N. T. Kien, H. T. T. Thuy, N. T. Van, T. T. T., and Brock University research assistant, Kelsea Levesque. Thuy, data collectors and supervisors. We

also thank partners at the Ministry of Health, Department of Maternal Child Health, the Hải Dương Health Department, the local government and district health centers of Kim Thành and Cẩm Giàng.

A summary of results of this study were presented at the October 2015 Grand Challenges Meeting in Beijing China. A full report was submitted to Grand Challenges Canada in November 2015.

Correspondence concerning this article should be addressed to Lynn A. Rempel, Department of Nursing, Brock University, 1812 Sir Isaac Brock Way, St. Catharines, ON, L2S 3A1. Email: lrempel@brocku.ca

Abstract

We examined the extent to which fathers can be taught and encouraged to develop positive relationships with their children, especially in infancy, and the effects of this fathering intervention on infant development. A multi-faceted relationally-focused intervention was used to assist fathers in Vietnam to engage in responsive direct and indirect involvement with their infants and work together with the mother as part of a parenting team. Fathers and mothers from 13 communes in a rural and semi-urban district were recruited to the intervention group. Intervention fathers received group and individual counseling before and after birth, an interactive print resource, community messages about fathering, and the opportunity to participate in a Fathers Club. Couples from 12 comparable communes in a non-contiguous district were recruited to the control group. Fathers and mothers completed questionnaires at the pre-birth recruitment and at 1, 4, and 9-months post-birth. Intervention fathers demonstrated greater increase in knowledge and attitudes regarding father-infant relationships. Both fathers and mothers reported that fathers engaged in more affection, care-taking, and play in the early months of their infants' lives and fathers felt more attached to their infants right from birth. A developmental assessment at 9 months showed that intervention infants demonstrated higher levels of motor, language, and personal/social development. This study demonstrated that fathers can be taught to interact more sensitively, responsively, and effectively with their newborn infants. Their increased interaction and emotional attachment appears to lay the foundation for enhanced infant development.

Keywords: fathers, father child relations, infant development, intervention, parenting skills

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Infant development is embedded in context of social relationships. Although the bulk of developmental research has focused on the mother-child relationship, a growing body of work is showing that fathers have substantial direct and indirect effects on their children's development (Allen, Daly, & Ball, 2012). However, relatively few parenting interventions directly address father involvement in promoting child development, and robust evaluations testing the effects of increasing father involvement are rare, especially in the Global South (McAllister, Burgess, Kato, & Barker, 2012). This study was conducted to test the effects of a multi-faceted intervention designed to assist Vietnamese fathers to engage in responsive direct and indirect involvement with their infants right from birth on infant development.

Traditionally, Vietnamese fathers were ultimately responsible for the well-being of all family members, which included making family decisions and providing for the family (Hunt, 2005). However, fathers traditionally played a less direct role during infancy and young childhood and would only have significant involvement with their children during the schooling and adolescent years (Locke, Hoa, & Tam, 2012). In contemporary Vietnam, these childrearing practices have begun to change. As in many other low and middle-income countries, evolving cultural norms have resulted in a continuum of fathering roles that range from traditional expectations to more contemporary involvement with mothers and children (Kuyper & Dewey, 2012; Bich, 2006). Fathers continue to be seen as primary family providers, but they are now expected to be more involved in providing care to their infants and young children right from birth (Bich, 2006, Nguyen, 2011, Hoang & Yeoh, 2011).

However, because these cultural shifts are relatively recent, many fathers may have

limited information and experience in how to interact with their infants (UNICEF, 2010). Additionally, despite remarkable economic growth and rapid reductions in poverty, Vietnam remains one of the countries with the highest rates of child undernutrition and the lowest prevalence of exclusive breastfeeding (UNICEF, 2010). In order to begin to address this problem, the first fathering intervention in Vietnam taught fathers to successfully support exclusive breastfeeding in the first 6 months (Bich, Hoa, & Målqvist, 2014; Bich, Hoa, Ha, Vui, Nghia, & Målqvist, 2015). This current study built on that original intervention by providing fathers with more effective ways to engage in direct involvement with their infants starting at birth.

The Value of Father Involvement

Reviews of father involvement suggest that children of fathers who are more highly involved demonstrate increased cognitive competence, greater empathy, less sex-stereotyped beliefs, and a more internal locus of control (Lamb, 2010). They have higher IQs, stronger verbal skills, are more academically motivated and successful, have fewer emotional and behavioral problems, better emotional regulation, better social and problem-solving skills and greater overall life satisfaction (Allen et al., 2012). Based on their review of longitudinal studies, Sarkadi, Kristiansson, Oberlaid, and Bremberg (2008) concluded that father engagement, including play, reading and caregiving, positively affects children's social, behavioral, psychological and cognitive outcomes in adolescence and into adulthood.

There is also evidence that early father involvement beginning in infancy is associated with positive cognitive outcomes. For example, skin-to-skin care of infants by fathers following cesarean birth has been shown to result in calmer infants who are more prepared to suckle (Erlandsson, Dsilina, Fagerberg, & Christensson, 2007). Infants of fathers who reported more infant caregiving, engagement in more cognitively stimulating activities, and more warm

interactions with their infants were less likely to be cognitively delayed at 9 months (Bronte-Tinkew, Carrano, Horowitz, & Kinukawa, 2008). In a Taiwanese study, fathers who felt more fathering competence had infants who were more likely to have accomplished all expected developmental milestones at 18 months of age (Chiang, Lin, Lee, & Lee, 2015).

Father involvement with toddlers and preschoolers is also associated with positive outcomes. Fathers' positive engagement and supportiveness has been associated with higher cognitive and social emotional development in toddlers and preschoolers (Cabrera, Shannon, & Tamis-LeMonda, 2007; Ryan, Martin, & Brooks-Gunn, 2006). Similarly, fathers supportive play with their preschoolers has been associated with greater cognitive and language development (Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004). Sensitive interactions with both mothers and fathers during infancy and the early years also have been found to independently contribute to the development of secure attachment in later childhood and adolescence (Grossman, Grossman, Fremer-Bombick, Kindler, Scheuerer-Englisch, & Zimmerman, 2002), whereas fathers' controlling behavior was found to be detrimental to the development of executive functioning in preschoolers (Meuwissen & Carlson, 2015).

Based on such evidence, McAllister et al. (2012) have recommended that fathers be encouraged to become involved early in the lives of their children, if possible even before birth, in order to establish enduring positive relationships with their children (Burgess, 2008). They also recommended the establishment of universal father involvement programs that would foster the involvement of all fathers, including those who might otherwise be hard to reach.

Fathering Interventions

A meta-analysis of parenting programs that included 16 studies involving fathers suggested that including fathers in parenting interventions for children with behavioral problems

might enhance the effectiveness of such interventions over those offered only to mothers (Lundahl, Tollefson, Risser, & Lovejoy, 2008). In an assessment of twelve carefully evaluated interventions, Bronte-Tinkew, Burkhauser, and Metz (2012) identified 15 promising practices for interventions with high-risk fathers. Many of their recommendations highlight the importance of proper implementation of appropriately tailored programs by carefully chosen, well trained staff who work intensively with a small number of fathers on a few core issues. Such results provide evidence of the value of father involvement when there are childrearing challenges.

However, Bronte-Tinkew, et al. (2012) also noted that the implementation of father-involvement programs has continued to outpace evaluations of program effectiveness – using strong criteria for study inclusion, these authors found that only 12 of 80 possible studies met the standards of rigorous evaluation. Panter-Brick, Burgess, Eggerman, McAllister, Pruett and Leckman (2014) reach a similar conclusion in their review of 199 publications that provided father-specific data from a wide range of parenting interventions conducted in both the Global South and Global North. Comparatively few of these studies were carefully evaluated and many did not include measures of family functioning or child development outcomes. Given the variability in program evaluation, Panter-Brick et al. (2014) opted to not tabulate and present empirical results in their review. Nonetheless, they did call for a "game-change" in the field such that fathers as well as mothers are engaged in any parenting intervention and that these interventions are organized in ways that facilitate father participation. Along with Bronte-Tinkew et al. (2012), they also strongly argue that these interventions need to be rigorously evaluated with longer term outcome data on couple functioning and child development.

In one of few studies to include developmental outcomes, Roggman, Boyce, Cook, Christiansen & Jones (2004) conducted an experimental evaluation of 74 fathers in Early Head

Start (EHS) programs. Fathers in the EHS program played with their toddlers in more socially and cognitively complex ways and this complex play was associated with improvements in their child's cognitive, language, and emotional development.

A number of interventions also highlight how father involvement can be enhanced when both mother and father are making joint decisions and engaging in positive family interactions as part of parenting team. Doherty, Farell Erickson, and LaRossa (2006) developed and tested an intervention based on systems and ecological frameworks in which mother, father, and child are viewed as functioning within an interdependent system at personal, relational, and community levels. Fathers in the intervention group received four prenatal sessions including an initial home visit and 4 sessions 2 to 5 months after birth. Fathers learned parenting knowledge and skills, but a primary focus was on increasing maternal support for father involvement and fostering co-parental teamwork. Compared to the control group, fathers in the intervention group spent more time interacting with their infants and demonstrated improved quality in their interactional skills.

Cowan and Cowan and their colleagues (Cowan, Cowan, Pruett, Pruett, & Wong, 2009; Cowan, Cowan, Pruett, Pruett, & Gillette, 2014) also addressed couple interaction in a pair of studies in which two interventions were evaluated – a fathering intervention in which only men were present and a couple intervention in which both parents learned the identical material together. In the first study (Cowan, Cowan, Pruett, Pruett, & Wong, 2009), 289 low-income couples participated in a 16-week group for either fathers or couples, or a 1-time low-dose control. In the second study (Cowan, Cowan, Pruett, Pruett, & Gillette, 2014), 236 low-income couples participated in either the fathers' or couples' intervention. In both studies, only partners in the couples' intervention group maintained their relationship satisfaction over the period of the study compared to a low-dose control group. However, fathers in both the fathering and couple

interventions showed comparable increased involvement with their young children and similar declines in harsh authoritarian ideas about parenting and negative feeling towards their child.

In a randomized control intervention study of 42 couples, Frank, Keown and Sanders (2015) focused on the ways to maximize teamwork between mothers and fathers. They provided a version of the Triple P parenting program tailored to the fathers' preferences over the course of 8 weeks. The five 2-hour group sessions and three 30-minute individual telephone sessions addressed parenting challenges identified by fathers and assisted fathers in their goals of enhancing the social competence of their behaviorally challenged young children. Intervention fathers and mothers reported improvements in fathers' parenting practices and improved child behavior that were maintained at a 6-month follow-up assessment.

Taken together, all of these intervention studies show that father-inclusive interventions resulted in improved quality of father-child interactions. In studies where child-related measures were included, these interventions produced improvements in child behavioral outcomes. Moreover, the interventions employed by Doherty et al. (2006), Cowan et al (2008, 2014), and Frank et al. (2015) include a relational emphasis on parenting teamwork, which corresponds conceptually with co-parenting theory (e.g. Feinberg, 2003), and underscores the importance of coordination and mutual support in the parental system.

The Current Fathering Intervention

According to Pleck (2010), the primary components of father involvement include positive direct engagement activities to promote development, warm and responsive interactions, and indirect care, including supporting the mother and participating in decision-making regarding the child. Our intervention sought to influence all of these components by providing counseling and experiences that encouraged fathers to responsively engage directly with their

infants and work with mothers as members of a parenting team. The current study built on and expanded an intervention developed by Bich et al (2014; Bich et al., 2015). The original intervention provided fathers with group and individual counseling before birth and home visits in the first 3 months after birth in which fathers were taught to encourage and support their wives to exclusively breastfeed for six months. A public message about the importance of exclusive breastfeeding was broadcast over the community loudspeakers each week and a fathers contest was held to demonstrate fathers' learning to the community. Results showed that 81% of the intervention group initiated breastfeeding in the first hour after birth, compared to 40% of the control group (Bich et al., 2015). At 4 months, 21% of the intervention group reported having exclusively breastfed since birth, compared to 11% in the control group (Bich et al., 2014).

The current intervention added a focus on teaching fathers to responsively provide the type and amount of support their wives needed to breastfeed successfully and to work together with their wives as part of a parenting team. We also went beyond indirect father involvement via breastfeeding support; health workers counseled fathers on how to engage in responsive and appropriate direct interactions with their newborn infants. As indicated by ecological models (Cabrera, Fitzgerald, Bradley, & Roggman, 2014), we conceptualized that change needed to happen at individual, household, community, and societal levels in order to ultimately promote a population-based normative shift towards greater father involvement.

Individual knowledge and attitudes. At the individual level, models such as the Theory of Planned Behavior (Ajzen & Madden, 1986), suggest that knowledge and related attitudes held by individuals are important determinants of intentions and behavior. Thus, we provided fathers with knowledge about what infants can do and suggestions regarding how to engage with them in responsive caregiving and play. Positive attitudes about the value of engagement for infant

development were encouraged in an antenatal fathers' group learning session, an antenatal individual in-home counseling visit, and three follow-up postpartum in-home counseling visits in which men were given didactic and experiential education on being responsive, involved fathers.

Father-mother and father infant relationship. At the household level, our intervention sought to influence both father-mother and father-child relationships. During the group sessions and home visits, health workers encouraged fathers to be a responsive parenting team partner with his wife. The model of partner coparenting was based on the metaphor of a two-person badminton team. This teamwork analogy from a familiar sporting context in Vietnam allowed health care workers to convey the key elements of effective, supportive cooperation – be sensitive and aware, communicate regularly, coordinate, respond when needed, and otherwise stay out of the way and trust your partner to do his or her part. These key elements are consistent with research showing that effective support must align with the recipient's wants and needs and avoid undermining the recipient's sense of efficacy and personal control (e.g. Collins, Ford, Guichard, Kane, & Feeney, 2010; Rafaeli, & Gleason, 2009). The emphasis on working together with mothers as part of a flexible, dynamic, coordinated team is uniquely important and central in this intervention. The health workers were taught to model teamwork as they worked together with the father, encouraging him to find his own unique way of fathering his infant in consultation with his wife. To the extent that fathers adopted a team mindset, we expected them to create a more positive environment for the child's socio-emotional and cognitive development.

In order to facilitate warm, responsive behavior towards their infants, we sought to leverage father's affectional bonds. As part of his attachment theory, Bowlby (1988) proposed that an infant's attachment system interacts with a parental caregiving system such that providing and receiving the desired sense of security produces an affectional bond between parent and

child. In a recent study of father-to-infant attachment, Condon, Corkindale, Boyce and Gamble (2013) postulated that the "emotional tie" of parents' to their child is a goal-directed feeling state – a motivational experience the corresponds directly to how Rempel and Burris (2005) have defined the concept of love. The attachment of a father to his infant is foundational for facilitating sensitive, responsive caregiving that will promote secure attachment in childhood (Noller & Feeney, 2000; Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2003) and positive relationship functioning in adulthood (Reis, Clark, & Holmes, 2004).

We developed our intervention on the premise that fathers have a strong, naturally occurring affectional bond with their infants (Condon et al, 2013) and would welcome the opportunity to become more involved in their infant's lives. Thus, our goal was to create a permission-giving, supportive context, and provide fathers with the information and tools they need to effectively act on their existing desires for a close emotional connection. Within the first two days after the birth of their infant, fathers were given the opportunity to participate in an interactive session with their infant led by a health worker who engaged them in active learning about and with their infants. Health worker home visits at 7 days, 6 weeks and 3 ½ months after birth included discussions of developmentally appropriate ways to interact with their infants. Fathers were also given a developmentally staged father-infant relationship calendar with ideas for ways that they could interact with their infants throughout the first year. We encouraged fathers to try out the suggestions provided by the health worker and the calendar.

Community context. In line with ecological models, our intervention was also designed to foster support for father involvement within the father's social context at the community level. The provision of initial father involvement education in a group setting allowed fathers to share their perspectives with other new fathers-to-be and feel validated in developing intentions for

greater father involvement. By creating Fathers Clubs within local communes, we further provided fathers with opportunities for ongoing peer support and validation. During Fathers Club meetings fathers had opportunities to discuss their joys, questions, and concerns about being actively involved fathers. We expected greater group engagement to be associated with higher levels of father-infant interaction and increased perceptions of father involvement as normative.

A primary Fathers Club activity was to plan for group participation in a fathers contest held approximately 6 months after the inception of the clubs. The contest involved a friendly competition between Fathers Clubs that was open to community members and specifically invited friends and relatives, politicians, and community leaders. Thus, the contest was expected to not only reinforce the learning of Fathers Club participants, but also increase public awareness about father involvement and begin a shift in social network norms regarding breastfeeding support and direct father engagement with their infants.

Hypotheses

The effects of the father-involvement intervention were examined using a quasi-experimental longitudinal non-equivalent comparison group study using communes from two non-contiguous districts of Hai Duong province. We tested the effects of the intervention on fathers' attitudes and knowledge regarding father-infant interaction, father-infant attachment, and father-infant interaction behavior reported by both fathers and mothers. Measures were taken prenatally and at 1, 4, and 9 months post-birth, with infant development measured at 9 months. First, we hypothesized that, compared to control group fathers, intervention fathers would demonstrate a greater increase in attitudes and knowledge of effective father-infant interaction from baseline before the birth of their infant to following the main counseling components of the intervention. Second, we hypothesized that both intervention fathers and mothers would report

more frequent interactions between fathers and their infants than fathers in the control district. Third, we hypothesized that fathers in the intervention district would report stronger feelings of emotional attachment to their infants than control fathers. Fourth, we hypothesized that infants in the intervention group would demonstrate higher 9-month developmental scores than infants in the control district. Fifth, we hypothesized that developmental differences between the intervention and control groups would be mediated by differences in father-infant interaction and fathers' emotional attachment to their infants. Sixth, we hypothesized that fathers who used the tools and opportunities provided would be more emotionally connected to and engaged with their infants and their infants would have higher developmental scores at 9 months.

Methods

Participants

Selection of intervention communes. Thirteen communes of one district in Hai Duong Province, Vietnam were purposefully selected and assigned to the intervention group, and 12 comparable communes in another non-contiguous district of the province were assigned to the control group. The province was selected because it contains a mix of rural and semi-urban communes, is within a reasonable distance outside of the province of Hanoi, and has a sufficiently high birth rate. In both districts agriculture remains the largest economic sector but there is also a strong industrial influence, with several factories providing a developed transportation infrastructure. Despite not sharing a boundary, both districts have similar geographic features, socio-economic backgrounds, population size and natural population growth. Each district is subdivided into administrative units called communes with populations between 5,000 and 10,000 people. Each commune in both intervention and control districts has a health center with medical personnel who provide primary health care to all commune citizens,

including care for new mothers and infants. Selected communes in each district were required to be accessible, have commune health center facilities in good condition, and be strongly committed to project activities, including data collection, training and counseling.

Participant characteristics. A total of 390 couples in the intervention district and 412 couples in the control district were recruited when the wives were between 12 and 27 weeks gestation. The original sample comprised approximately 90% of eligible couples in each district. Thirty-one couples were lost to follow-up after the baseline survey, resulting in a sample of 368 intervention and 403 control couples with at least one wave of follow-up data. Developmental assessment was completed with 350 intervention infants and 383 control infants. Sixteen children whose parents provided 9-month data did not receive developmental testing because they were not at home at the time of the 9-month assessment (e.g., away at grandparent's home).

Participants in the two districts were quite similar. Fathers' age (intervention $M = 30.32$, $SD = 5.68$; control $M = 30.38$, $SD = 5.48$) and mothers' age (intervention $M = 26.74$, $SD = 5.13$; control $M = 27.20$, $SD = 4.95$) did not differ significantly by district. The majority of fathers and mothers had a middle school or high school level of education. The education level was significantly higher in the control district for mothers (Mann-Whitney U Test, $p = .019$) and marginally higher for fathers (Mann-Whitney U Test, $p = .074$).

Significantly more fathers in the intervention district (61.5%) than in the control district (48.8%) were employed in work usually conducted outside the home, χ^2 (1, N = 802) = 13.16, $p < .001$. Approximately two-thirds of mothers in both districts were employed in occupations that involved working outside the home. More fathers in the control district reported working closer to home, i.e., within the commune or within the district (75.8 % vs. 52.9 %), χ^2 (3, N = 722) = 74.1, $p < .001$, and substantially more fathers in the intervention district worked outside

of the province (34.1 % vs. 8.2 %).

The majority of couples lived in rural rather than semi-urban areas. The proportion of rural couples was higher in the intervention district (93.2%) than in the control district (85.0%), χ^2 (1, N = 767) = 12.84, $p < .001$. Couples in the control district had a higher average household economic status (HES) score as measured by a survey of household structure and contents (intervention z-score, $M = -.59$, $SD = 3.40$, control z-score, $M = .52$, $SD = 1.91$, $t(604.2) = 5.61$, $p < .001$. More couples in the control district were living with extended family members (253 of 389 couples who responded, 65%) compared to the intervention group (203 of 355 couples, 57%), χ^2 (1, N = 744) = 4.83, $p = .03$.

For the majority of couples this was either the first or second child. In terms of the target child, there were more male than female infants overall (54.3% male; 45.7% female), one sample binomial test, $p = .02$. Birth weight was significantly higher in the intervention group than in the control group (intervention, $M = 3188.59$ grams, $SD = 414.18$, control, $M = 3099.01$ grams, $SD = 426.14$, $t(766) = 2.96$, $p = .003$).

Procedures

Recruitment and data collection. Research ethics clearance for the project titled "Fathers' involvement: Saving brains in Vietnam" was obtained from Brock University (13-193-BICH), University of Waterloo (19727), and Hanoi School of Public Health (014-007-DD-YTCC) prior to recruitment. Commune health centers provided a list of mothers in the target communes whose pregnancies were in the target gestation range. With the assistance of a local community guide, research team members and trained data collectors visited the homes of all potential participants, explained the study, obtained written consent, and conducted the baseline survey with fathers and mothers who chose to participate. Data collectors obtained demographic

information and father-infant relationship knowledge by interview. Participants self-administered the remainder of the questionnaire and returned it to the research team member. Research team members provided clarification of the questionnaire items as needed. Commune health center staff informed the research team data collection manager when mothers in the study delivered their infants. A trained data collector visited fathers and mothers at 1 month, 4 months, and 9 months post-birth to complete follow-up questionnaires. A data collector also visited homes at 9 months to complete the developmental assessment. A summary of measures collected at each point can be found in Table S1.

Intervention principles and training. One or two healthcare providers each from 13 local commune health centers were provided with two-day training on how to counsel fathers. The training manual that they were given included background information on the value of father involvement and principles of good quality father involvement, including a teamwork approach. These principles, based on findings in the father-child interaction research and the literature regarding effective social support (see Table 1), were the foundation of the intervention content and were explained on the final page of the father-infant relationship calendar.

The first principle, that fathers need to be part of a team with mothers to jointly care for their infants, undergirded all of the other principles and was a recurring message throughout the training manual. The concept of working together with the mother as a parenting team was based most directly on the breastfeeding team concept (Rempel & Rempel, 2011; Rempel, Rempel, & Moore, 2016), but it is also a fundamental concept in the co-parenting literature (e.g. Feinberg, 2003) and is considered by Pleck (2010) as one of the primary components of father involvement.

Several principles supported positive interaction with infants. We included the principle that fathers need to spend time directly interacting with their infants, and emphasized that fathers

need to spend quality time getting to know their infants (e.g. Gustafsson, Levrero, Reby & Mathevon, 2013). The principle that fathers need to be warm and caring was included because it is considered to be one of the primary components of father involvement (Pleck, 2010). Similarly, the principle that fathers need to pay attention, and be sensitive and responsive to their infants' needs is well-supported as a critical component of secure attachment (e.g. Bakermans-Kranenburg, et al., 2003). To enhance the quality of fathers' contact with their infants, we included principles regarding the need for touch (e.g., Fairhurst, Loken, & Grossman, 2014) and the need to talk to their infants to enhance social and language development (e.g. Pancsofar & Vernon-Feagans, 2010). The principles that fathers should play with their infants and help their infants explore and learn in their own way to do things for themselves focus on processes that help children develop cognitive and social skills in the context of having fun (e.g., Grossmann et al., 2002; Roggman et al., 2004).

We included a principle regarding value of gentle control and correction as the infant develops to inform fathers that young infants do not deliberately try to irritate or defy their parents and to encourage fathers to guide their infants in ways that protect and enhance their well-being (e.g., Lindsay & Caldera, 2005). Two principles regarding protection and provision of basic physical needs were included to recognize that traditional fathering roles also have value.

Intervention activities. Fathers in the intervention district were contacted by a trained counselor from their commune health center approximately two months prior to their wives expected due date and invited to participate in a prenatal group session. In this session, the health worker encouraged fathers to discuss their hopes and dreams for their baby and their role as a father, introduced the concept of the parenting team, and focused on the father's role as a breastfeeding team-member (Rempel & Rempel, 2011). In a follow-up home visit with each

father, the health worker reinforced the concepts and information introduced in the group session.

After the birth of their babies, midwives at the birth facility provided fathers with the opportunity to spend a short time interacting directly with their infants. Midwives were trained to help fathers physically touch their babies and discover the baby's capabilities by eliciting grasping and step reflexes and by attempting to elicit facial mimicking. Fathers were also encouraged to change a diaper. Fathers also received a father-infant relationship calendar. This large wall-hanging includes five pages of developmentally appropriate ways that fathers could potentially interact with their infants in the first month, from 2 to 3 months, 4 to 6 months, 7 to 9 months, and 10 to 12 months. Each page included some spaces for fathers to note some of the developmental milestones that they observed and spots for them to add their own pictures. The last page contained details about the principles of father involvement.

The counselors visited fathers in their homes at 7 days, 6 weeks, and 15 weeks post-birth. Counselors were encouraged to ask fathers what they thought they could do with their infants in the subsequent few weeks and then provide additional suggestions. For example, at 6 weeks, counselors were to suggest that fathers could cuddle, hold, and talk to their baby, imitate their baby's face, do baby massage, and show household objects to their baby. Fathers were told how to recognize actions such as turning away as cues that their baby was getting tired of interacting. At 3 months, counselors advised fathers to pay attention to what their baby likes to do, and discussed play with toys, floor play, and conversational turn-taking with their baby. At each visit, counselors were encouraged to review relevant father-infant relationship calendar pages with the fathers to reinforce ideas for father-infant involvement.

Community actions included posters about the value of father involvement with infants placed in all intervention commune health centers. A weekly 10-minute message about the value

of father-infant interaction was broadcast on outdoor loudspeakers throughout each project commune. Local and district health officials and community leaders were engaged in supporting the project. A Fathers Club was organized in each commune with the assistance of the local Women's Union and Youth Association. A peer father leader was chosen from among the club participants and trained in a one-day club leadership workshop. Clubs met at least monthly over approximately 6 months to allow fathers to share joys and concerns of mutual interest. A group of fathers from each club also prepared for participation in the culminating fathers contest. At this light-hearted community event, these fathers presented the value of father involvement and exclusive breastfeeding in unique and creative ways and competed in a contest of fathering knowledge to demonstrate, according to the title, "Who loves their wives and children the most."

Measures

Father-infant relationship knowledge. Fathers' father-infant relationship knowledge was measured with three open-ended questions asking what a father should do to have a good quality relationship with his baby, why a baby cries, and why it is good for babies to have an involved father. Baseline responses were recorded in point-form by data collectors. After responses were translated into English, a Vietnamese research team member content analyzed the original data and a Canadian research team member independently content analyzed the translated responses to develop response categories. Both authors and Vietnamese co-project lead reviewed and compared the categories and the team developed a comprehensive list of response codes (see Table S2). Data collectors used these categories to code responses at 4 and 9 months post-birth. At 4 months, an additional code (sleepy) was added to reflect responses that did not adequately fit other categories. For each question, the number of responses demonstrating positive father-infant relationship knowledge were summed; responses indicating inappropriate fathering

behavior, such as that infants cry because they are sulking or have an irritable personality, were subtracted from the total. Higher scores indicated greater father-infant relationship knowledge.

Father-infant relationship attitudes. Fathers' attitudes regarding how and how much they should be involved with their child were measured using a 9-item scale developed for this study. Items included "Fathers need to be part of a team with mothers to jointly care for their babies," "It is important for fathers to pay attention to what their baby needs and respond in a way that is best for the baby," and "It is fun to play with my baby." Statements were rated from 1 = *strongly disagree* to 5 = *strongly agree*. A factor analysis resulted in poor factor loadings for two items: "Fathers need to use strict and firm discipline with their babies" and "The most important thing that a father can do is to provide for his baby's basic physical needs." These items were removed, resulting in a 7-item index of the extent to which fathers valued and desired to interact with their infant. Attitudes were measured at baseline, 4 and 9 months (Baseline Cronbach's alpha = .70; 4-month alpha = .61; 9-month alpha = .61).

Father-infant interaction. The extent to which fathers interacted with their infant was measured using a 23-item Father-Infant Interaction Scale (Table S3). This questionnaire was developed based on responses to questions in a qualitative study conducted with 22 couples in Canada regarding the father's role in the breastfeeding family (Rempel & Rempel, 2011). Fathers' and mothers' responses to the question "What should fathers do to develop a relationship with their infant?" were content analyzed and used to develop a list of father-infant interaction behaviours. The scale was pilot tested and refined using a sample of couples in Canada. Vietnamese team members translated and piloted the scale, and Vietnamese and Canadian team members reviewed the back translation for conceptual clarity. A small number of changes were made to the items to reflect Vietnamese cultural differences.

Both fathers and mothers independently rated the extent to which fathers engaged in each of the listed behaviors on a 5-point scale ranging from 0 = *never* to 4 = *very frequently*. One-month responses to the scale were factor analyzed using principle axis factoring with promax rotation for men and women separately. In both cases a scree plot indicated that a 3-factor solution was optimal and the pattern of results for the 3 subscales was essentially the same for fathers and mothers. The three subscales measure: a) *Play* – actively engaging in fun play and learning activities with the infant; b) *Caretaking* – caring for the infant's physical needs; c) *Affection* – demonstrating physical and emotional affection towards the infant. Across all three measurement points, Cronbach's alphas for the three subscales ranged from 0.78 to 0.93 and were similar for fathers and mothers.

Paternal-infant attachment. The strength of the father's emotional connection and attachment to his infant was measured using a 19-item self-report postnatal paternal-infant attachment scale developed by Condon and Corkindale (1998). Following the authors' recommendations, negatively worded scale items were reverse coded and all questions were given equal weighting by recoding response options to be equivalent to responses on a 1 to 5-point scale. Responses to all 19 items were then averaged to create a single Paternal-Infant Attachment score (1-month Cronbach's alpha = .70; 4-month alpha = .69; 9-month alpha = .68).

Developmental status. Developmental status was measured at 9 months of age with the Developmental Milestones Checklist II (DMC II) (Prado et al., 2014). The DMC II includes 3 subscales: the *Motor* subscale, which measures locomotor and fine motor skills; the *Language* subscale, which measures understanding and using words; and the *Personal-Social* subscale, which measures reactions to others, play, dressing, and eating and drinking.

The DMC-II was developed to be a culturally sensitive research tool for use in the

developing world. The original DMC was based largely on the Griffiths Mental Development Scales and the Vineland Adaptive Behavior Scales (Abubakar, Holding, Van de Vijver, Bomu, & Van Baar, 2010). The face validity of the initial pool of scale items were assessed by focus groups of mothers, teachers, and pediatric nurses from a Kenyan community and some additional items were identified. A panel of childhood assessors and two developmental psychologists reviewed the items for age-appropriateness and the ability of items to be clearly understood within the language and cultural context. The resulting DMC scale involved a 66-item questionnaire designed to be administered as a structured interview measuring the development of motor, language, and personal and social skills of children age 3 to 24 months. The DMC-II was modified to use a flexible format of caregiver-reports with additional data-collector observation to verify the presence of reported developmental milestones (Prado et al., 2014). The scale consists of 22 items in the Motor scales associated with developing gross motor skills and 10 items associated with fine motor skills, 16 items including repeating pre-language sounds, responding to verbal communication, communicating with gestures, such as pointing or lifting arms, and communicating with words in the Language scale; and 28 items including reacting to and recognizing others, play, dressing, and eating and drinking in the Personal-social scale.

The DMC II has been assessed in Burkino Faso with 1123 children involved in a nutrient supplement study. Inter-rater reliability with a subset of 15 children ranged from .81 for the language subscale to .93 for the total scale, and test-retest reliability with 16 children ranged from .77 for the language subscale and .96 for the motor and total scores. The DMC-II scores were demonstrated to be sensitive to age progression in the 72 children tested at two time points. As predicted, scores were significantly lower among children who were stunted, wasted, or underweight and scores correlated positively with the number of toys reported in the home, and

reports of the amount of caregiver activity with the child in the previous three days.

The DMC II was translated and adapted for use with Vietnamese infants following the TRAPD model (Harkness, Van de Vijver, & Mohler, 2003), with input from Prado. Three translators with developmental background were identified for the parallel translation of the measure. A committee of five, including developmental, linguistic experts and the author of the measure, reviewed the three translated versions of the measure, discussed discrepancies, adjudicated item translation, and decided on the final version. Pretesting techniques, including extensive review by practitioners and feedback from field staff, were used to ensure that the translated version of the DMC-II was conceptually equivalent to the original and culturally sensitive to the Vietnamese context.

Prior to data collection, all DMC-II data collectors were required to have 8 in-class training hours and 16 supervised hours of in-group practice. For trial cases, one data collector carried out the DMCII while other ones observed and completed their own checklist. When a trial case was finished, data collectors and supervisors discussed and agreed on how to mark the checklist if there were any differences among collectors' ratings. After the three-day training, those who demonstrated good interviewing and observational skills were hired as data collectors.

Data collectors were assigned to different survey sites with a list of study subjects and arranged to assess the children as close as possible to 9 months of age. Data collectors were required to ask specific questions as dictated on each item and also record any observed child responses. Each item on the DMC-II was scored as 0 = *child has not yet started doing the activity*, 1 = *child has been able to do the activity in the past 4 weeks but not continually*, and 2 = *child has been able to do the activity continually for the past 4 weeks*. After each week, completed DMC II forms were obtained from data collectors and the study field-coordinator

called data collectors within the week to clarify information as needed.

No formal inter-rater reliability testing of the DMC II was completed in this current study. Validity was supported with analyses examining the ability of the DMC II to identify differences with some variables that would be expected to affect development. Stunted children in this current study were 0.5 *SD* lower on the motor scale, $p = .003$, 0.31 *SD* lower on the language scale, $p = .17$, and 0.74 *SD* lower on the personal-social scale, $p < .001$. Underweight children were 0.58 *SD* lower on the motor scale, $p = .005$, 0.11 *SD* lower on the language scale, $p = .60$, and 0.48 *SD* lower on the personal-social scale, $p < .008$. Language scores were significantly lower for children of fathers with primary education or lower, compared to those with more education, *Cohen's d* = .43, $p = .03$. No significant effects were found for maternal education.

Data Analysis

Univariate and repeated measures ANOVAs were used to compare means between the intervention and control districts. To control for baseline differences between districts, analyses controlled for potential confounders: sex of the child, maternal and paternal education, household economic status, birth weight, and number of previous children. Partial η^2 was calculated in ANOVA analyses (.01 = small effect; .06 = medium effect; .13 = large effect). Mean differences and correlations were calculated to examine relationships between measures of intervention participation and father-infant relationship, attachment, and developmental outcomes. Multiple regression was used to test mediation of the intervention condition effect on developmental status.

Results

Intervention Reach

By one month postpartum, 339 of the 390 fathers recruited in the intervention communes

had received a group counseling session, 346 received an antenatal individual home visit counseling session, 190 received a guided session with the infant at the birthing center, and 365 had received a 7-day post-partum home visit counseling session. Fathers rated intervention components using 5-point scales. Most father agreed that the home visit session gave them useful information about being an involved father (M = 4.2, SD = .51). By four months postpartum, 363 fathers in the intervention communes had received a 6-week and 358 received a 15-week individual home visit counseling session. At the 4-month measurement point both the 6-week and 15-week counseling visits were perceived by fathers as providing useful information about being an involve father (M = 4.1, SD = 1.04 and M = 4.1, SD = 1.04, respectively). Two hundred ninety-six (85.2 %) of the fathers reported that they used the father-infant relationship calendar. Most fathers agreed they enjoyed using the calendar (M = 4.0, SD = .44) and that it helped them learn how to interact with their baby (M = 4.1, SD = .47). Seventy percent of the fathers (243 of 347 who completed the 9-month questionnaire) reported that they participated in Fathers Club. Fathers reported attending between 1 and 16 meetings (M = 4.0, SD = 2.8) and reported enjoying attending the club meetings (M = 4.1, SD = .50) and learning something useful about being an involved father (M = 4.2, SD = .48). Ninety-four of intervention fathers (27%) reported involvement in the fathers contest and they rated their enjoyment of the experience very highly (M = 4.3, SD =.57).

Father-Infant Relationship Knowledge and Attitude

We hypothesized that, compared to control group fathers, intervention fathers would demonstrate a greater increase in knowledge of and attitudes toward father-infant interaction from before the birth of their infant to following the main intervention counseling components. A repeated measures analysis (controlling for fathers' age, education, HES, and number of previous

children) demonstrated a significant interaction in fathers' knowledge about father-infant interaction over time between groups, F (2, 1060) = 24.25, $p < .001$, partial $\eta^2 = .04$. Fathers in the intervention and control groups did not differ at baseline ($M_{\text{Intervention}} = 5.05$, $SD = 2.17$; $M_{\text{Control}} = 5.40$, $SD = 1.79$). Knowledge scores increased in both groups, but significantly more in the intervention group at 4 months ($M_{\text{Intervention}} = 11.87$, $SD = 4.28$; $M_{\text{Control}} = 10.46$, $SD = 3.98$) and at 9 months (intervention $M = 12.53$, $SD = 3.82$; control $M = 10.05$, $SD = 3.66$). Data collectors from some communes did not record responses to the knowledge questions at baseline, resulting in missing data from 178 fathers. A repeated measures analyses using only the larger 4 and 9 month samples resulted in a similar pattern of means for the comparable times points.

Fathers' baseline attitude regarding how and how much they should be involved with their child was significantly lower in the intervention district ($M = 3.88$, $SD = .53$) than in the control district ($M = 4.00$, $SD = .53$), $t(797) = 3.79$, $p < .001$. The attitude of the intervention group became significantly more positive at 4 months ($M = 4.09$, $SD = .43$), whereas the attitude of the control group remained essentially unchanged ($M = 4.04$, $SD = .42$). Nine-month attitude in both groups remained stable ($M_{\text{Intervention}} = 4.06$, $SD = .60$; $M_{\text{Control}} = 4.00$, $SD = .58$). The interaction was significant in a repeated measures analysis for attitude at baseline, 4, and 9 months controlling for fathers' age, education, HES, and number of previous children, $F(2, 1432) = 7.43$, $p < .001$, *partial* $\eta^2 = .01$.

Father-Infant Interaction

Our second hypothesis, that both fathers and mothers would report more frequent father-infant interactions in the intervention district than in the control district, was partially supported. Means and standard deviations on the Play, Caretaking, and Affection subscales of the Father-Infant Interaction Scale are presented in Table 2. At the 1-month measurement point, fathers in

the intervention district indicated significantly higher ratings on the Play and Affection subscales than fathers in the control district with no significant difference on the Caretaking measure. The same pattern emerged for mothers' ratings of father-infant engagement. At the 4-month measurement point, fathers in the intervention district reported higher levels of play and caretaking with their infants compared to men in the control district. There were no significant differences in mother's reports. At 9 months neither fathers nor mothers reports were significantly different. Additional analyses of father-infant interaction by infant gender found no significant differences.

Paternal-Infant Attachment

Our third hypothesis, that fathers in the intervention district would report stronger feelings of emotional attachment to their infants than control fathers, was supported. Paternal-Infant Attachment means and standard deviations are shown on Table 2. ANOVA analyses of the strength of the father's emotional connection and attachment to his infant (controlling for HES, father's education, mother's education, number of children, delivery method, birth weight, and infant gender) indicated that at 1-month, 4-months, and 9-months, men in the intervention district felt significantly more emotionally attached to their infants than men in the control district.

As demonstrated by significant interactions at 1 and 9 months (marginal at 4 months), fathers in the intervention district were significantly more attached to girl infants than to boy infants, whereas fathers in the control district were somewhat more attached to boy infants. When analyzed using an average of attachment scores over the three time points, there was a significant group by sex interaction, $F\,(1, 731) = 8.86$, $p = .003$, partial $\eta^2 = .01$. Simple effects between girls and boys were also significant. Fathers in the control district were significantly more attached to their boys ($M = 4.26$) than their girls ($M = 4.21$), $p = .05$. In the intervention

district, fathers were more attached to their girls ($M = 4.52$) than their boys ($M = 4.46$), $p = .03$.

Developmental Status

Our fourth hypothesis, that infants in the intervention group would have higher 9-month developmental scores than infants in the control district, was supported. Infants in the intervention group had significantly higher scores on all three DMC II subscales (controlling for the age of the child at the time the test was administered, HES, mother's and father's education level, number of siblings, birth weight, and presence of grandparents in the household). As shown in Table 3, there was a large intervention effect on Language development, and smaller intervention effects on Motor and Personal-Social development.

Our fifth hypothesis, that developmental differences between the intervention and control groups would be mediated by differences in father-infant interaction and fathers' emotional attachment to their infants, was partially supported. Mediation analysis using Hayes' PROCESS bootstrapping procedure were conducted to test for possible intervention-related mediators of the intervention effect (see Table 4). We averaged fathers' 1, 4, and 9-month attachment scores to form an overall index of their emotional bond with their infant. This score was a significant mediator of the intervention group effect on DMC II Language scores. We created similar averaged indices of the Affection, Play, and Caregiving subscales for both the fathers' own ratings as well as the mothers' ratings of father-infant interaction. Fathers' level of affection was also a significant mediator of the intervention group effect on DMC II Language scores. More strikingly, the extent to which mothers observed fathers displays of affection, play, and caregiving with their infants significantly mediated the intervention group effect on Motor, Language, and Personal/Social measures of infant development.

Relationship of Intervention Components to Outcomes

Our sixth hypothesis was that fathers who used the tools and opportunities provided would be more emotionally connected to and engaged with their infants and their infants would be more developed at 9 months. To test relationships with intervention components, we used the averaged indices of Affection, Play, Caretaking, and Paternal-Infant Attachment to compare fathers in the intervention group who had used the Father-Infant Relationship Calendar, participated in a Father's Club, and participated in the fathers contest to intervention group fathers who had not availed themselves of these intervention opportunities. As can be seen in Table 5, intervention fathers who took advantage of the calendar, Fathers Club, or fathers contest were more likely to interact with, and feel more emotionally attached to their infant than intervention fathers who did not avail themselves of these resources and opportunities. We also compared the developmental scores of infants whose fathers had and had not used these resources and opportunities. Participation in a Fathers Club was the only intervention component associated with developmental differences. The infants of fathers who reported having participated in a Fathers Club had higher Personal-Social scores on the DMC II.

To gauge the impact of the 1, 6, and 15-week health worker home visits, for each visit fathers were asked to rate, on a 5-point scale, the extent to which the health worker gave them useful information about being an involved father. We averaged these ratings to create a composite rating for all three home visits and correlated it with the Affection, Play, and Caretaking indices. The higher the reported rating of the home visits, the higher the father's Affection, $r = .20$, $p < .001$, Play, $r = .24$, $p < .001$, and Caretaking, $r = .27$, $p < .001$.

Discussion

The results of this study support the effectiveness of a father involvement intervention and the value of father involvement right from birth for enhancing infant development.

Consistent with the theory of planned behavior (Ajzen & Madden, 1986), as hypothesized, intervention fathers demonstrated a greater increase in attitudes and knowledge of effective father-infant interaction from baseline to following the main counseling components of the intervention. Fathers in both groups started out with similar levels of knowledge before their infants were born but fathers in the intervention group were significantly more knowledgeable at 4 and 9-months than fathers in the control group. A comparable interaction occurred in attitudes towards father-infant involvement but in this case fathers in the intervention district started out with significantly less positive father-infant involvement attitudes than fathers in the control district prior to the intervention. However, following the intervention the attitudes among intervention fathers had increased to match the levels found among fathers in the control condition whose attitudes did not change over time.

It is not clear why fathers in the intervention district originally held more negative attitudes than fathers in the control condition but, even if father involvement attitudes in the intervention district did not ultimately exceed those in the control district this was not the case in terms of actual father behavior. As hypothesized, at the 1-month measurement point both fathers and mothers in the intervention district reported that fathers were more affectionate and played more with their infants than fathers in the control district. By 4 months, the differences between father reports in the intervention and control groups had become less pronounced and for mothers the differences, though trending, were no longer significant. By the 9-month measurement point fathers and mothers in both intervention and control districts reported essentially equivalent levels of father involvement.

The finding that mothers in the intervention district reported higher levels of father involvement than mothers in the control district provides some corroboration for the validity of

the fathers' self-reported involvement. Similar, but not identical patterns of results for mothers and fathers highlight the subtle differences in perspective between parents – mothers observe overt behaviors that occur when the couple is together, whereas fathers' reports include actions that are taken when the mother is not present, or are less obvious to the observer.

Neither fathers or mothers reported greater father involvement in the intervention district at 9 months compared to the control district. In looking at the pattern of means, it appears that the fathers in the intervention group became engaged with their infant early on and this level of involvement remained relatively stable, whereas fathers in the control district were initially less involved with their infants but "caught up" to the intervention fathers as their infants matured. Greater father involvement as children become more interactive and mobile, as seen in the control, is consistent with the traditional pattern of father involvement in Vietnam and may even represent a trend towards earlier involvement than traditionally expected. Our results suggest that improved developmental outcomes in the intervention group are the result of even earlier father-infant involvement. We suspect that the timing of the intervention in the exciting period just before and after the transition to parenthood likely engaged fathers at an optimal teachable stage of their lives. Right from birth intervention fathers started interacting with their infants because they were taught about the value of early infant interaction prior to the birth and were shown how responsive and capable newborn infants can be. In addition, the most intensive components of the intervention occurred in the first 3 months following the birth of their infants. However, any new learning needs reinforcement. Additional phone counseling contacts, perhaps every 3 to 6 months, might be necessary to maintain the intervention advantage for older infants and pre-school children. Similarly, structured content regarding developmentally appropriate involvement with older infants delivered through the Fathers Clubs might also be valuable,

although would only be available to fathers who continued to engage in their local club.

Although our intervention did not result in sustained differences in terms of fathers-infant behavior, this was not the case for the emotional bonds that fathers formed with their infants. Not only were intervention fathers more emotionally attached to their infants at 1, 4, and 9 month than control fathers, these stronger feeling of attachment and self-reported affection right from birth were among the most important effects of the intervention in terms of infant development. This pattern of results supports our contention that an intervention promoting early paternal-infant interaction needs to provide fathers with the opportunity and permission to experience and cultivate the strong affectional bond that they already feel for their infants.

Attachment theorists have argued that a father's attachment to his infant facilitates sensitive, responsive caregiving that will, in turn, promote the child's secure attachment (Noller & Feeney, 2000). Future research using measures of infant attachment to the father would be important to determine whether increasing a father's emotional bond with his infant increases an infant's observed attachment to the father. Freeman, Newland and Coyle (2010) suggest the importance of father-appropriate measures of children's attachment to fathers to more effectively understand the contribution of fathers to children's socioemotional development. This current study supports the value of measuring the father's emotional attachment to the child to further understand the family attachment system.

An interesting, unexpected result of the intervention was greater attachment of fathers to their infant girls. This was the only gender effect we found, but it is potentially important. Consistent with results in the control district, there is evidence of a general son preference in Vietnam that is related to the presence of a patrilineal society and Vietnam's two-child policy (Guilmoto, 2012). Our intervention did not include gender-specific content, yet, it appears that

regularly encouraging sensitive, responsive interactions with every infant, regardless of gender, countered the tendency toward son preference. Valuing of female children has the potential to improve the social, and emotional welfare of women in Vietnamese society (Målqvist, Hoa, & Thomsen, 2012), as well as in other cultures in which son preference is common.

A central goal of our study was to test the effect of the father-involvement intervention on infant development. We assessed development using the DMC II (Prado et al., 2014), a relatively new measure developed for use in low and middle-income countries. As predicted, infants in the intervention group demonstrated higher 9-month motor, language, and personal-social developmental scores than infants in the control district, with the strongest effect being seen in the Language scale. The current study augments a small number of previous studies suggesting that the DMC II is a valid way to assess expected developmental differences between an intervention and control group (Prado et al., 2014). The language domain has the fewest distinct developmental milestone items, but appeared to effectively capture between-group variation in 9-month infants' ability to respond to verbal and non-verbal messages and to use sound and gestures to communicate with others.

Our theory of change suggested that increases in the quantity and quality of father-involvement would be the mechanism by which the intervention would enhance development. The results indicated that fathers reported emotional attachment and affection mediated the intervention effect on language development. Perhaps attached fathers express their emotional connection with more verbal interaction. Further research is needed to determine if the effect of emotional connection on language development can be replicated and to assess potential mechanisms of that relationship. The importance of the father's emotional connection to his infant was further reinforced by results showing that mothers' perceptions of fathers of affection

and play behaviors mediated the intervention effect on *all* aspects of infant development. It appears that mothers may have been even more attuned to the influential ways in which fathers were interacting with their infants than were fathers themselves. We suspect that this is a function of the relational message conveyed throughout the intervention that encouraged fathers to work as partners with mothers as a parenting team. Fathers' enhanced emotional and relational connections appear to have had the greatest impact on infant development and are likely also the most salient aspects of the father's behavior observed by mothers.

We also examined the impact of our intervention by seeing if fathers who took advantage of the tools and opportunities provided would be more emotionally connected to and engaged with their infants. Fathers were quite positive about all components of the intervention. Over 90% of fathers in the intervention group received a home visit by a health care worker at 1, 6, and 15 weeks postpartum and the majority appreciated these visits and felt that they learned valuable information. Fathers also liked using the Father-Infant Relationship Calendar and found that it helped them learn how to interact with their infant. Having a place to record their own experiences in words and pictures may have motivated them to increase their involvement. Most fathers also had some involvement in the Fathers Clubs. This innovative model of father peer support was very positively received, especially by the fathers who were most involved. Such peer support may be an important factor in promoting a general cultural shift towards greater father involvement. A cultural shift may also have been fostered by the fathers contest. The fathers who participated rated this experience very positively and they are likely to have conveyed their enthusiasm to the wider community during the contest.

Overall, within the intervention group, fathers who used the intervention resources and were engaged in the intervention activities were more involved and attached to their infants.

These findings support of the value of a range of intervention activities. Although it is possible that the fathers engaged more with components of the intervention because they were already more inclined to be involved with their infants, it is important to recall that, at the prenatal measurement point, the father-involvement attitudes reported by fathers in the intervention group were significantly less positive than those reported by control group fathers. Thus, it is more plausible that intervention fathers shifted their behaviors because of the influence of the intervention. We also recognize that some fathers may have had a greater readiness than others to become involved and simply needed the permission and confidence to do so. If so, father's strong levels of affirmation for the various intervention components suggests that these activities strengthened and reinforced whatever pre-existing readiness was already present.

Limitations and Future Research

One limitation of the quasi-experimental design of this study is that the developmental differences between districts may be the result of pre-existing differences unrelated to the intervention. However, this is unlikely, given that the parents in the control group where somewhat more advantaged in terms of education and household economic status, which would suggest that infant development might be advantaged among those families (Letourneau, Duffett-Leger, Levac, Watson, & Young-Morris, 2013). Moreover, our results remain significant even after controlling for many of the factors that could potentially account for group differences.

Another limitation is the possibility that fathers in the intervention group could have inflated their responses due to social desirability and demand effects. However, given the length of time between assessments, it is unlikely that they would have been able to deliberately strengthen their responses. Also, fathers in the control group were being reminded of their level of involvement with their children every time they completed the father-infant involvement

questionnaires, so they were also not completely immune to social desirability and demand effects. Nonetheless, future studies could be strengthened by using observational methodologies to assess the nature and quality of father-child interactions over time. There is a similar risk that developmental differences were the result of observer bias because data collectors for the DMC II were not blind to intervention condition. However, measures were taken to reduce that bias. Only data collectors who demonstrated inter-observer reliability during training were employed to collect DMC II data, and the field coordinator regularly verified DMC II data forms. Finally, we note that this study benefitted from strong political and health system support that made it possible to integrate the father-involvement counseling into the health care system. This strong support and collectivist cultural norms are likely responsible for the high rate of father participation and retention in the study. Participation rates may not be replicable in a different cultural context.

In terms of future research, a number of our intervention components such as commune loudspeaker broadcasts, Fathers Clubs, and the fathers contest were all designed to move, not only fathers themselves, but the whole community, towards a greater acceptance of fathers as active partners in the parenting team right from birth. We believe that such community-wide messages are important. Even if they do not immediately create sizeable shifts in community beliefs and attitudes, new fathers will still know that people in their community are hearing about the benefits of father-infant involvement. Widespread exposure to pro-fathering messages can potentially buffer new fathers against the fear of ridicule and give them confidence in defending their increased involvement as something that has tangible cognitive, emotional, and social benefits for their children.

Unfortunately, we did not have the resources in the present study to test how effective our

procedures were in influencing community norms but, were this intervention to be scaled up, our long-term goal would be to foster a shift in societal norms. The initial impact need not be large to be influential – a slow and steady progression that brings more and more people on board over time can ultimately transform a minority into a majority and may encourage legislative support such as paternity leave policies that would further accelerate this process. We see this as one of the major advantages of universal as opposed to targeted programs. Targeted programs for those who are reluctant or ill-prepared to make the shift would continue to be of critical importance, but even the value and effectiveness of targeted programs is likely to be enhanced if they are encouraging people to shift towards, rather than away from, an expanding societal norm.

Conclusion

This project addresses two research gaps identified by McAllister and Burgess (2012) by providing a robust evaluation of a father involvement intervention and demonstrating the value of this intervention in a middle-income country in the Global South. We have shown that fathers can be taught to interact more sensitively, responsively, and effectively with their newborn infants. Compared to similar fathers in the control district, intervention fathers learned more about father-infant relationships, developed more positive attitudes towards father involvement, engaged in more affection, caretaking, and play in the early months of their infants' lives, and experienced greater emotional attachment for boys and girls equally starting at birth and continuing for the duration of the study. Most notably, this emotional attachment and increased interaction appears to have been important in enhancing infant development. The principles underlying this multi-pronged father involvement intervention are not unique to the Vietnamese context and this intervention may be a valid and potentially important tool for improving infant development throughout the Global South and beyond.

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Table 1

Principles of quality father involvement

Fathers need to be part of a team with mothers to jointly care for their infants (Rempel & Rempel, 2011)
Fathers need to spend time directly interacting with their infants (e.g. Gustafsson et al, 2013)
Fathers need to be warm and caring with their infants (e.g. Pleck, 2010)
Fathers need to pay attention, be sensitive to what their infant needs and respond in a way that is best for the infant (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2003)
Fathers need to touch their infants (e.g. Fairhurst, Loken, & Grossman, 2014)
Fathers need to talk to their infants (e.g., Pancsofar & Vernon-Feagans, 2010)
Fathers need to help their infants explore and learn in their own way and do things for themselves
Fathers need to play with their infants (Grossmann, Grossmann, Fremmer-Bombik, Kindler, Scheuerer-Englisch, & Zimmerman, 2002; Roggman et al, 2004)
Fathers need to use *gentle* control and correction as the infant develops (e.g., Lindsay & Caldera, 2005)
Fathers need to protect their infants
Fathers need to ensure that basic physical needs of the infant are met

Table 2

Descriptive statistics and ANOVA comparing Father-Infant Interaction subscales and Paternal-Infant Attachment by district

	District							
	Intervention			Control				
	M	*SD*	n	*M*	*SD*	n	*F*	Partial η^2
1 Month								
Fathers								
Play	2.19	.96	350	1.86	.98	382	21.96***	.03
Caretaking	2.22	.89	350	2.17	.81	382	1.26	
Affection	3.05	.50	350	2.83	.61	382	28.07***	.04
Attachment	4.46	.32	350	4.25	.39	382	55.25***	.07
Mothers								
Play	2.03	1.06	355	1.87	1.07	393	4.46*	.01
Caretaking	2.08	.88	355	2.15	.83	393	0.87	
Affection	3.08	.59	355	2.94	.70	393	9.06**	. 01
4 Month								
Fathers								
Play	2.72	.63	348	2.52	.70	375	14.77***	.02
Caretaking	2.39	.68	348	2.28	.72	375	3.98*	.01
Affection	3.13	.46	348	3.05	.56	375	3.45	
Attachment	4.47	.31	348	4.29	.37	374	87.75***	.11
Mothers								
Play	2.65	.68	351	2.55	.87	388	2.76	
Caretaking	2.26	.73	351	2.28	.81	388	0.01	
Affection	3.12	.52	351	3.04	.74	388	2.45	
9 Month								
Fathers								
Play	2.85	.56	346	2.80	.56	375	2.33	
Caretaking	2.47	.67	346	2.48	.62	375	0.08	
Affection	3.07	.49	346	3.08	.53	375	0.02	
Attachment	4.52	.35	346	4.22	.32	375	144.30***	.17
Mothers								
Play	2.92	.66	355	2.89	.75	393	0.27	
Caretaking	2.48	.70	355	2.51	.81	393	0.10	
Affection	3.13	.62	355	3.10	.76	393	0.63	

Note. ANOVA controlling for HES, father's education, mother's education, number of children, birth weight, sex of child.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Univariate ANOVA for DMC II subscales at 9 months by district

	District							
	Intervention			Control				
	Raw Score M(SD)	*z-score M(SD)*	n	*Raw Score M(SD)*	*z-score M(SD)*	n	*F*	Partial η^2
Motor	30.33 (4.38)	0.25 (0.95)	350	28.20 (4.60)	-0.21 (0.99)	383	38.66	.05
Language	13.41 (2.48)	0.44 (0.77)	350	10.69 (3.32)	-0.40 (1.03)	383	146.85	.17
Personal-Social	31.67 (3.30)	0.20 (0.88)	350	30.26 (3.98)	-0.17 (1.06)	383	23.80	.03

Note. Analysis controlled for age of the child at the time the test was administered, HES, mother's and father's education level, number of siblings, birth weight, sex of the child.

Table 4

Results of individual mediation analyses of fathers' and mothers' father-infant interaction subscales predicting infant development at 9-months postpartum

Predictor	B	SE	*t*	95% CI	
				Lower	Upper
			Motor		
Fathers					
Affection	.478	.418	1.14	-.34	1.30
Play	.006	.304	.02	-.59	.60
Caretaking	.041	.299	.14	-.55	.63
Attachment	.508	.666	.76	-.80	1.82
Mothers					
Affection	.763	.317	2.40*	.14	1.39
Play	.656	.255	2.57*	.16	.16
Caretaking	.650	.265	2.46*	.13	1.17
			Language		
Fathers					
Affection	.776	.272	2.85**	.24	1.31
Play	.231	.199	1.17	-.16	.10
Caretaking	.339	.195	1.74	-.04	.72
Attachment	1.194	.434	2.75**	.34	2.05
Mothers					
Affection	.839	.207	4.05***	.43	1.25
Play	.430	.168	2.56*	.10	.76
Caretaking	.616	.173	3.55***	.28	.96
			Personal/Social		
Fathers					
Affection	.154	.341	.45	-.52	.82
Play	-.198	.285	-.80	-.68	.29
Caretaking	-.274	.243	-1.12	-.75	.20
Attachment	.361	.543	.67	-.70	1.43
Mothers					
Affection	.593	.260	2.28*	.08	1.10
Play	.486	.209	2.33*	.76	.90
Caretaking	.238	.217	1.10	-.19	.66

Note. Analyses controlled for age of the child at the time the test was administered, SES, mother's and father's education level, number of siblings, birth weight, sex of the child. *p<.05. ** p<.01. *** p<.001

Table 5

Descriptive statistics and ANOVA comparing use of intervention components by Father-Infant Interaction, Paternal-Infant Attachment, and infant development

Intervention Component	Users			Non-users				
	M	*SD*	n	*M*	*SD*	n	*F*	Partial η^2
Relationship Calendar								
Play	2.60	.52	296	2.54	.60	51	0.48	
Caretaking	2.39	.54	296	2.17	.64	51	5.64*	.02
Affection	3.11	.33	296	2.91	.56	51	10.86**	.03
Attachment	4.50	.23	296	4.40	.22	51	8.08**	.02
Motor	30.33	4.32	292	30.58	5.01	50	0.88	
Language	13.35	2.48	292	13.60	2.55	50	0.05	
Personal Social	31.77	3.28	292	30.98	3.37	50	2.81	.01
Fathers Club								
Play	2.61	.53	243	2.54	.52	104	0.70	
Caretaking	2.41	.54	243	2.23	.57	104	5.46*	.02
Affection	3.13	.33	243	2.95	.45	104	15.09***	.04
Attachment	4.50	.24	243	4.44	.21	104	4.43*	.01
Motor	30.53	4.39	240	30.00	4.51	102	1.29	
Language	13.30	2.51	240	13.61	2.43	102	0.60	
Personal Social	31.93	3.23	240	31.03	3.39	102	4.90*	.02
Fathers Contest								
Play	2.70	.55	94	2.55	.52	253	4.13*	.01
Caretaking	2.54	.55	94	2.29	.55	253	9.68**	.03
Affection	3.18	.36	94	3.04	.38	253	7.12**	.02
Attachment	4.50	.25	94	4.48	.23	253	0.77	
Motor	30.30	4.65	93	30.39	4.35	249	0.01	
Language	13.33	2.33	93	13.41	2.55	249	0.00	
Personal Social	31.70	3.49	93	31.64	3.23	249	0.01	

Note. ANOVA controlling for HES, father's education, mother's education, number of children, birth weight, sex of child.

* $p < .05$. ** $p < .01$. *** $p < .001$.