1-1-2013

Promoting Early Childhood Development Through Community Health Worker Interventions: Implementation and Measurement Issues In Rural Pakistan

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PROMOTING EARLY CHILDHOOD DEVELOPMENT THROUGH COMMUNITY HEALTH WORKER INTERVENTIONS: IMPLEMENTATION AND MEASUREMENT ISSUES IN RURAL PAKISTAN

by

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Submitted in Partial Fulfillment of the Requirements

For the Degree of Doctor of Philosophy in

Health Promotion, Education, and Behavior

The Norman J. Arnold School of Public Health

University of South Carolina

2013

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DEDICATION

This work is dedicated to all the mothers and their mentor health workers who are working for a brighter tomorrow by caring for the children today.

ACKNOWLEDGEMENTS

I would like to thank my mentor, adviser and dissertation chair, Dr. James Thrasher for his unabated support, guidance and commitment to me and my education. I sincerely feel that without his mentorship and handholding, this achievement would not have been possible. I am also indebted to the other members of my dissertation committee. Many thanks to Dr. Edward Frongillo, Dr. Ruth Saunders, Dr. Deborah Billings and Dr. Atif Rahman for their continued availability, expertise, feedback and guidance during this entire process.

I also want to appreciate my friends and colleagues working at the Human Development Research Foundation Pakistan. Special thanks to Drs. Assad Hafeez, Siham Sikander, Shamsa Rizwan, Mansoor Ahmed, Mr. Ikhlaq Ahmed and Ms. Ayesha Naeem for their cooperation, timely advice on intricacies of community-based research and valuable insights on the family environment and child development in the rural context.

I am truly grateful to my family for their love, understanding, cooperation and support. There is no way I could have completed this milestone had I not have a wife like Nadia, daughter like Durayya and sons like Talha and Daraab. Thank you very much all of you for being there in my life and giving everything that a husband and father would want. I am proud of you and hopefully my work will make you proud too.

Lastly, thanks to Almighty Allah who gave me strength and courage, organized a wonderful support around me, and helped me in successfully completing this research.

ABSTRACT

Appropriate nutrition and psychosocial stimulation during the first three years of life can have long-lasting effects on a child's health and development. Not all children in the world, however, receive adequate nutrition and psychosocial stimulation during this period. There has been enormous interest in developing the evidence on the most effective ways of implementing and assessing early childhood development (ECD) promotion interventions in resource-poor settings. Despite the interest, the integration of ECD interventions into pre-existing public health programs, and assessment of these interventions in extended-family, rural-household environments have not been addressed.

The dissertation research presented here was carried out in rural Pakistan, where child malnutrition and mortality are high, and where a primary-care outreach program comprising more than 100,000 community health workers (called Lady Health Workers or LHWs) is in place. This research involved two studies: 1. a qualitative study that explored the factors that contribute to the successful integration of a comprehensive ECD intervention into a large-scale community health worker program; 2. a quantitative community survey that aimed to adapt and validate the Infant and Toddler version of the Home Observation for Measurement of the Environment (IT-HOME) inventory, which was expanded to address childcare that extended family members provide (HOME+).

Findings from qualitative interviews with LHWs (n=12) and mothers (n=18) suggest that the commitment of LHWs to work, their willingness to learn and take on additional roles, and acknowledgement of LHW work by the mothers are all favorable for implementation. Contextual factors that impede implementation included changes in LHW job responsibilities without her knowledge and involvement, and the lack of support from staff of the healthcare facilities. For mothers, the support provided by the family and the LHW facilitates the integration of new activities into their daily lives while lack of involvement by the family hampers this integration. These results indicate that the professional and domestic environments of LHWs and mothers are dynamic and, as such, should be addressed on an ongoing basis, as a new program moves through various phases of implementation and integration. This attention to the details of implementation is important for effective program delivery to achieve the overall goals of CHW programs, including child health and development.

Findings from community survey (n=153) revealed that a large proportion (70%) of the study sample lived in households that included extended family members. Subscale and total scores were higher in extended families as compared to nuclear families, and this difference was consistently significant when HOME+ was used. Households whose index child was older (i.e., > 1 year) scored significantly higher than households with younger children on the "responsivity" dimension of HOME+, whereas no difference was found while using HOME. Compared for mother's education, children of highly educated mothers scored significantly higher than children of less educated mothers on "acceptance" dimension when HOME+ was used, while the difference was

not significant while using HOME. Aside from these differences, the correlates of both HOME and HOME+ were mostly similar.

Higher subscale and total scores using HOME+ compared to HOME are suggestive of a richer environment for ECD in extended families than nuclear families. Moreover, additional caregivers may be particularly important as the child grows older. That these caregivers may significantly impact ECD may help explain the inconsistent relationship found between HOME and ECD outcomes in prior research in countries where households are organized around extended families. Future studies should consider the HOME+ instrument to assess the developmental consequences of living in extended family systems.

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List of Abbreviations

BHU ..... Basic Health Unit

CNC ..... Community Nutrition Centre

CHW ..... Community Health Worker

ECD ..... Early Childhood Development

HIC ..... High Income Country

HOME ..... Home Observation for Measurement of Environment

IMCI ..... Integrated management of childhood illnesses

IT-HOME ..... Infant/Toddler version of HOME

IUGR ..... Intra-uterine growth restriction

LHW ..... Lady Health Worker

LHWP ..... Lady Health Worker Program

LMIC ..... Low and middle income country

NP for FP&PHC ..... National Program for Family Planning & Primary Health Care

ORS ..... Oral Rehydration Solution

PAIMAN ..... Pakistan Initiative for Mothers and Newborns

PHC ..... Primary Health Care

SES ..... Socio-economic status

SPRING ..... Sustainable Program Incorporating Nutrition and Games

CHAPTER 1

INTRODUCTION

An estimated 6.9 million children die every year, and the majority of these deaths occur in low and middle income countries or LMICs (Black et al., 2013). Malnutrition is the single biggest risk factor and is estimated to account for 45% of these deaths. Moreover, among children who survive, 165 million are stunted (Black et al., 2013) and over 200 million are at risk of impaired cognitive, emotional, and social development (Grantham-McGregor et al., 2007). Children with impaired ability upon school entry have poorer scores on achievement tests, are more likely to repeat grades and drop out of school, and leave school early i.e. at a lower grade level. Lower educational attainment is associated with lower productivity and earning as an adult. Early childhood interventions to promote nutrition and cognitive and social-emotional development can facilitate later gains from educational and societal opportunities, and are a critical strategy to ensure responsible citizens and productive adults (Engle et al., 2007).

Integration of effective interventions into primary healthcare programs and adequate assessment of effects of these interventions on a child's home environment in LMICs has been a challenge. ECD interventions that focus on both nutrition and child stimulation during the first three years of life can have a synergistic effect; however, the implementation details of these interventions have not been well-described (Engle et al., 2011) . For example, involving community health workers (CHWs) to deliver parenting

programs through household visits for ECD promotion is a promising strategy. Despite the interest in CHW delivered programs, however, the implementation details of such studies are not available. A better, more detailed understanding of how effective complex interventions can be integrated into pre-existing primary care programs is needed to develop even more powerful interventions (Engle et al., 2011). Likewise, these interventions focus on bringing a change in the social and physical environment of the child which may be contributed by many family members in LMICs. The assessment of their effectiveness, however, is made while only the mother and infant are in focus. Research is required to improve implementation and evaluation of these ECD interventions aiming to improve the overall environment of a family (Frongillo, Tofail, Hamadani, Warren, & Mehrin, 2013).

The present study comprised a qualitative, phenomenological study (Aim1) and a quantitative community survey (Aim 2) carried out during the early phase of a randomized controlled trial in rural Pakistan. The qualitative study aimed to explore the factors that contribute to the successful integration of a comprehensive ECD intervention into a large-scale community health workers program. The community survey aimed at adaptation and validation of infant and toddler version of Home Observation for Measurement of the Environment (IT-HOME) to the rural context in Pakistan. The study was carried out in rural Pakistan where child malnutrition and mortality are high, and where a primary care outreach program comprising more than 100,000 CHWs (called Lady Health Workers or LHWs) is in place.

Aim 1or the qualitative study draws upon the learning from CHW interventions in various settings. CHWs are one of the principal components of social networks who

provide informational and emotional support to individuals (mostly mothers in LMICs) to help them in carrying out certain desired behaviors. In this study being carried out in a country where extended family system is common and child rearing a shared responsibility, these CHWs visit households in their area and provide counseling to mother and her family to improve the social and physical environment for the child. The CHWs act as a bridge as they learn new knowledge and skills from study team as well as from their colleagues, and deliver it to the mother and family, with the expectation that behaviors and environment of the mother and family will improve child development. Characteristics and contexts of these CHWs and audience mothers may have an influence on implementation of these visits.

The qualitative phenomenological study explored the views of LHWs and the mothers with whom they work, about the implementation, integration and sustainability of an innovative ECD intervention, including the delivery and applicability of this intervention to their daily lives. Semi-structured interviews with LHWs (n=12) before and after intervention implementation and with mothers (n=18) after LHWs implemented the intervention with them, were carried out to explore: A) the context of the program (i.e., LHW system, family context and broader social influences) and the process of integration of new interventions within this context; B) the perspective of LHWs about the intervention curriculum, and issues related to its *Reach*, *Dose*, *Fidelity*, *Adaptation* and *Integration*; and C) the perspective of participant mothers about the visits they received from LHWs and usefulness of these visits in their day-to-day child care activities.

This part of the study will inform the development and refinement of strategies to integrate new innovations by understanding the perspectives of CHWs and mothers about the implementation of an ECD intervention within a CHW program in rural Pakistan. Not all the CHW-delivered, efficacious interventions have been scaled up in the past (Engle et al., 2011), and research on approaches to the delivery of feasible and effective ECD programs at scale has been recommended in order to enhance program effectiveness (Engle et al., 2011; Baker, Kupersmidt, Voegler-Lee, Arnold, & Willoughby, 2010; Griffin, 2010). Specifically, the need to determine the characteristics or the context of CHWs that could influence the success of such programs has been highlighted (Walker, 2011). Meeting this aim will provide critical information regarding practical issues to consider when interpreting primary intervention outcomes, including issues to address when adjusting the intervention to enhance and sustain its impact and when disseminating and scaling up the intervention.

Research has also established that a child's physical and social environment is critical for the child's growth and development. Measuring the developmental opportunities available in a child's environment is crucial to screen children in need as well as to assess the effectiveness of ECD interventions that aim at improving a child's environment. Home Observation for Measurement of Environment of infants and toddlers (IT-HOME) is a valuable tool used for children aged from zero to 3 years. This tool, however, comprises observation and interview of only the primary caregiver, which may leave out important information for children who live in extended families or have multiple caregivers. The developmental opportunities for a child living in extended family may be different from a child living in a nuclear family. Measuring the

environment of children living in families where more than one caregiver is available is therefore crucial, for screening of developmental opportunities as well as assessment of the effectiveness of ECD interventions.

For Aim 2, the quantitative community survey comprised 153 families that were selected through a multi-stage, random sampling technique. An Urdu adaptation of IT-HOME was administered in these families to primary caregiver, and, where possible, an additional caregiver was also included in the observation (HOME+). This inclusion would address the weakness of the original instrument that assessed only the mother (or primary caregiver) while missing on the care provided by additional caregivers in cultures where extended families are the norm. HOME and HOME+ scores were compared for nuclear and extended families to determine which approach appears to provide a more sensitive assessment of differences in the home environment. For families where the additional caregiver was observed, we also assessed hypothesized differences in total and socio-emotional subscale scores for the HOME and HOME+ , comparing families that differed in terms of the child age (<1year vs >1 year), higher parental education, family income, and presence of older siblings.

The development of a culturally adapted and valid home environment assessment tool should be particularly useful for future studies on early childhood development in countries where extended families share early child care responsibilities, where child developmental deficits are huge, and where recognition of the importance of intervening to promote early childhood development is on the rise (Grantham-McGregor, 2007; Aboud, 2007).

Following this introductory chapter, a detailed background and significance of the issue of early childhood development will be presented in chapter 2. Chapter 3 provides the methodological details for the qualitative and quantitative part of this study. Chapter 4 contains two manuscripts. The first manuscript entitled "Think inside: perspectives of community health workers and mothers about an early childhood promotion program in rural Pakistan" provides detailed findings and discussion towards Aim1 of this study. The second manuscript entitled "Shared homes, shared responsibilities: Home Observation for Measurement of the Environment (HOME) in rural Pakistan" captures the findings and provides a detailed discussion as part of Aim 2 of this study. Chapter 5 provides a summary discussion of findings along with conclusions and implications of this research. Finally chapter 6 comprises a list of references while Chapter 7 contains appendix items including study tools and other documentation and analyses carried out during this study.

CHAPTER 2

BACKGROUND AND SIGNIFICANCE

2.1 Early childhood Development

Global child health promotion strategies have evolved over time. These strategies date as far back as 1940s when vaccines were developed and millions of childhood deaths due to communicable diseases like diphtheria, tetanus, tuberculosis and measles were prevented during the decades that followed (The College of Physicians of Philadelphia, 2013). The 1970s saw the invention of oral rehydration solution (ORS) that helped save millions of deaths occurring due to dehydration resulting from diarrheal disease (Ruxin, 1994). The development of a diagnostic and treatment protocol for acute respiratory infections in children (ARI protocol) during the 1980s helped treat these diseases, which were the second biggest cause of morbidity and mortality among children (World Health Organization, 1984).

Following the Convention on the Rights of the Child in 1989 which specifically recognized the right to good nutrition, prevention and treatment of malnutrition started receiving emphasis as a public health intervention. Realizing the combined usefulness of immunization, ORS, and management of acute respiratory infections and malnutrition, they were packaged as "integrated management of childhood illnesses" (IMCI) during the decade of 1990 (Lambrechts, Bryce, & Orinda, 1999). With growing realization that these treatment interventions dealt only superficially with the so-called "tip of the

iceberg" (Grantham-McGregor et al., 2007) and not the underlying factors that caused these diseases, the community of child health experts began to focus more on the idea of early childhood development.

Early Childhood Development (ECD) interventions aim to promote child health at the family, household and community levels, so that chances of becoming weak, stunted, and ill are minimized and chances of becoming healthy, intelligent and, ultimately, growing into a productive individual are maximized. This is done by promoting health, nutrition, growth and development as integrated set of goals. High income countries (HICs) like the United States (US) have been implementing such programs for over four decades, as with Head Start program to ensure a child's health, nutrition, growth and development (Love et al., 2005) . Low income countries (LMICs), however, have lagged behind the HICs in terms of these child health indicators. The international organizations working for child health and child rights like WHO and UNICEF have developed an integrated intervention strategy called "care for development package" to facilitate adequate care of children living in resource poor countries (UNICEF, 2013) . Taking a step ahead of the IMCI that mainly dealt with sickness through facility-based care, the care for development package incites all the players of health system to reach out to children so that chances of their health and development are maximized, while also minimizing the chances of becoming sick.

2.2 The critical period of early childhood

A child's body and mind undergo formative developmental changes during early childhood, of which the first 2-3 years are extremely important (Irwin LG, 2007). Siddiqi

and colleagues (2007) proposed a model for assessment of the developmental environment of a child (Siddiqi A., 2007) by drawing upon literature from various disciplines, including Bronfenbrenner's bio-ecological model (1986), Brooks-Gunn and Duncan & Maritato's (1997) development psychology during early years, Dahlgreen's (1991) and Emmons's (2003) framework of understanding the social determinants of health and the WHO's framework of social determinants of health (2005). According to this model (Figure 2.1), a child's growth and development are shaped by multiple influences that range across the individual, family, extended family and residential community, regional, national, and global levels. The individual, family and community-level influences are relevant to this study and will be discussed here in detail.

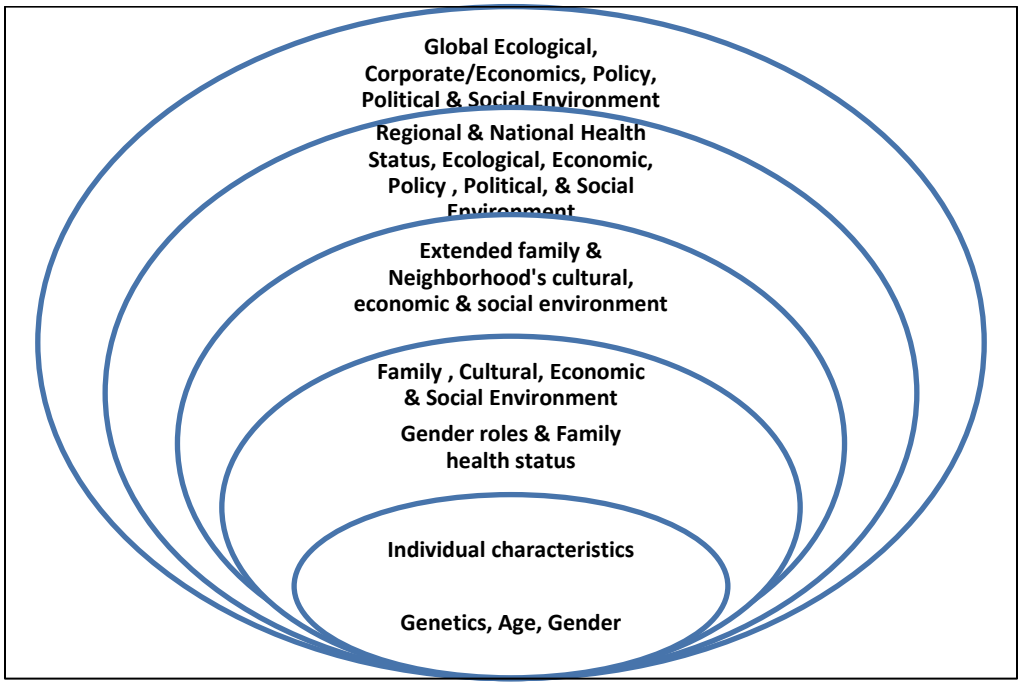

Figure 2.1: Spheres of influence on a child's development (adapted from Siddiqi et al 2007)

Among the individual characteristics, the genetics, age and gender of a child interact with the environment. For example, the health, nutrition, and well-being of

mothers are significant for the child's development (Rahman, Iqbal, Bunn, Lovel, & Harrington, 2004). A growing or grown-up child has various capabilities and can reach out and interact with the environment, whereas a newborn has the minimum of such capabilities. Male children interact with the environment differently than girls, based on gender roles they learn, and can consequently reach different levels of growth and development. In sum, children shape their environments as well as being shaped by them.

The familial environment, including the broader cultural, economic and social environment that shapes the family level is the next sphere of influence of child's development. Family is a fundamental source of nurturing for a child and its socioeconomic status has a crucial role. Families with few resources face difficulties in providing nurturing environments, and this can negatively influence the developmental outcomes of their children (Bradley & Caldwell, 1984; Bradley & Corwyn, 2002). On the other hand, resource-constrained families may be living together in an extended family environment sharing resources and responsibilities with each other (Lingam et al., 2013; PAIMAN, 2006) .

The cultural, economic and social environment of the relational and residential community also influences child development. Relational communities are a primary source through which families derive values, norms, and social support. Gender norms and roles are often rooted in the social beliefs of relational communities making it essential to address gender equity at this level (Mumtaz & Salway, 2007). The integrity and accessibility of physical space in which children can explore and play are also critical factors. In addition, the physical, socioeconomic, and service aspects of residential communities also influence the child development.

2.3 Role of nutrition and stimulation in ECD

Under-nutrition is the single strongest risk factor for child mortality, accounting for 45% of child deaths. Rates of under-nutrition continue to be high, with stunting affecting 165 million of the estimated 556 million children under five who live in developing countries (Black et al., 2013) . Furthermore, stunting in early life leads to irreversible damage later in life, including lower educational attainment, lower income, and lower birth weight for stunted adults' babies. Systematic reviews of the risk factors for poor child growth and development include: stunting, iron deficiency, iodine deficiency, suboptimal stimulation, intra-uterine growth restriction (IUGR), exposure to infections like malaria and HIV, exposure to lead, maternal depression, and societal violence (Walker et al., 2007; Walker et al., 2011).

Nutrition starts within the womb and continues after birth in the form of breastfeeding followed by appropriate complementary feeding to provide macro and micro nutrients that are essential to build organs and structures of the body. Physical growth is accompanied by mental and psychological development which is influenced by genetics, and particular physical and environmental stimuli to which an individual is exposed. When a child is optimally stimulated, the amount of gray matter in the child's brain nearly doubles at 1 year of age and keeps growing. Even faster is the development of brain function. At 3 years, the brain of a child is 2.5 times more active than the brain of an adult and remains so throughout the first decade of life (Shore, 1997).

Neurobiologists have discovered that the brain rapidly develops during the first few years (Figure 2.2) through processes like sprouting of neurons (neurogenesis), growth of different parts (axons and dendrites) of these neurons, development of inter-

connections between neurons (synaptogenesis), removal of dead synapses and development of new ones, maturation of the neurons (myelination), and expansion of supportive tissue (gliogenesis) between neurons. Given that these processes build on each other, small disturbances during early childhood development can have long-term consequences on the structure and function of the brain (Thompson & Nelson, 2001). Animal research has shown that under-nutrition, iron deficiency, environmental toxins, stress, and inadequate stimulation and interaction during this early period can have negative effects on later cognitive and emotional capabilities (Black, 1998; Rodier, 2004).

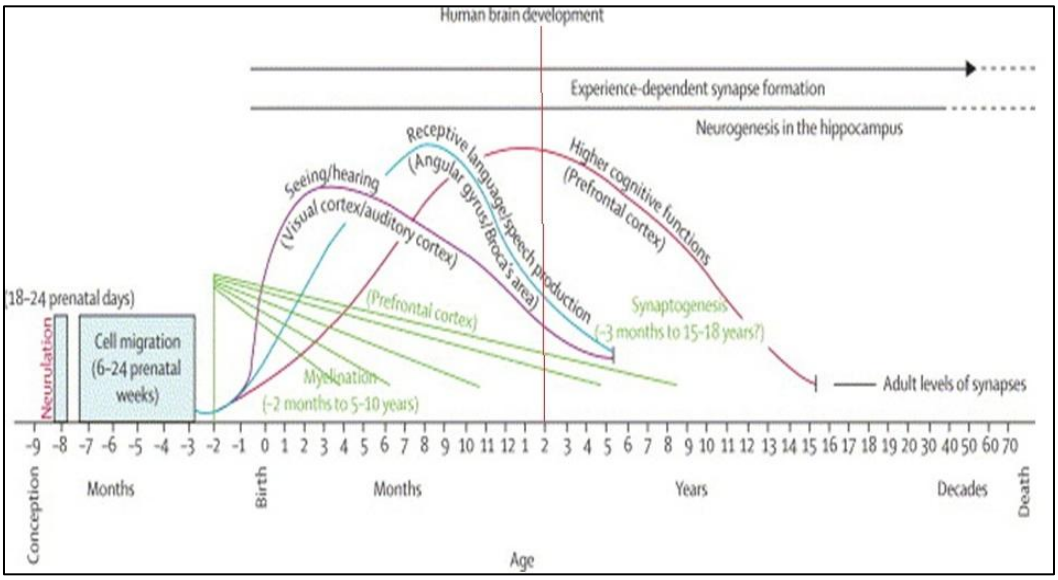

Figure 2.2: Development of structure and functions of human brain over time (Source: McGregor et al, 2007)

Environmental stimuli not only immediately affect the brain structure and function; they also have long-term consequences (Webb, Monk, & Nelson, 2001). Inadequate or inappropriate social and emotional experiences in early age can

compromise the development of higher-level neural systems resulting in difficulty with bonding, imitating and responding in socially appropriate ways (Cynader MS, 1999). Psychological factors like stress can have their own role in the early brain development. Adults who were exposed to stress during childhood tend to have retained higher than normal levels of stress hormones. This allostatic load defined as the "physiological consequences of chronic exposure to fluctuating or heightened neural or neuro-endocrine response that results from repeated or chronic stress" (McEwen & Stellar, 1993) can result in various long standing morbidities including cardiovascular disease, diabetes mellitus and mental disorders. Walker and colleagues in the ECD series of 2007 and 2011 published in *The Lancet* elaborated these risk and protective factors that are being summarized here (Table 2.1).

Patterns of behavior, competency and learning are also initiated and established during childhood. Early cognitive and social-emotional development has been found to be strongly correlated with school performance in developed countries (Currie, 2009). The few studies that have examined this aspect in developing countries have found similar associations (Myers, 1992). In addition, longitudinal studies have clearly shown that most of the seriously antisocial adolescents and adults exhibit behavioral problems during childhood and in fact the origins of these problems can be traced back to fetal development and infancy (Karr-Morse & Wiley, 1997). Early years also have an effect on learning. The infant and toddler years are critical for literacy (Willms 1999) and

Table 2.1: Risk and protective factors for ECD

Factor	Evidence	Implications
Risk factors		
Inadequate stimulation	ES[a] medium to large of beneficial effects of interventions on social-emotional and cognitive outcomes	Enhance the scale of ECD programs
Stunting	ES small to medium for long-term outcomes e.g. educational attainment and formal employment, medium to large for psychological functions for every 1 SD[b] change in height for age at age 2 years	Nutritional care during first 2 years combined with stimulation should be ensured.
Iodine deficiency	ES large showing lower development among iodine deficient children	Universal iodization with special focus on diet of pregnant and lactating mother
Iron deficiency anemia	ES medium to large for long-term cognitive and behavioral effects of early iron deficiency anemia	Iron deficiency anemia should be prevented early in life
IUGR[c]	ES small to medium for lower developmental levels in early childhood	Improve maternal nutrition, special care for IUGR infants
Maternal depression	ES small to medium of treating depressed women through paraprofessionals leading to improved child nutrition and health outcomes	Enhanced identification and treatment of maternal depression through community based strategies
Exposure to violence	ES medium to large about violence exposure negatively affecting socio-emotional development of young children	Specific focus on families exposed to violence and increased child caring capacity of such families
HIV infection	ES medium to large on developmental delays among infected children	Early initiation of treatment with ARV
Institutionalization	ES small of inadequate neural, cognitive and behavioral development of institutionalized compared to family reared children	Focus on family rearing as well as on improving institutional care
Protective factors		
Breastfeeding	ES small to medium for IQ[d] and medium for grade attained among exclusively breastfed for long duration	Breastfeeding should be communicated essential for growth/ development
Maternal education	ES medium to large about beneficial effects on child development	

[a] Effect size [b] Standard deviation [c] Intrauterine growth restriction [d] Intelligence quotient

mathematical skills which have been found to be considerably differentiated by social class during early years (Case, Griffin, & Kelly, 1999).

To summarize, the quality of nutritional, social and psychological factors during childhood has a direct and significant effect on health and academic performance of a child and influences health and economic outcomes during the adult life (Fogel, 1993). The early childhood period is considered to be the most important developmental phase throughout the life span (Irwin LG, 2007). Healthy early child development, which includes physical, social-emotional, and linguistic/cognitive development, is fundamental to success and happiness, not only during childhood, but throughout the life course. The first 2 years within the period of early childhood provide a specific window of opportunity to intervene because the rapid growth during this period does not have nutrition-related adverse consequences like obesity which is seen in rapid growth during later childhood or adolescence (Victora et al., 2008).

2.4 Significance of ECD for LMICs

Interventions for early childhood development (ECD) are crucial for every country but more so for the LMICs. According to estimates, over 6 million children die because of preventable causes before age 5 each year (Jones, Steketee, Black, Bhutta, & Morris, 2003) in these countries, and 4 out of every 10 continue living in extreme poverty. In their systematic review published in the Early Child Development series in *The Lancet*, McGregor and colleagues estimated that there were 217 million disadvantaged children less than 5 years of age in developing countries, including 155 million who were stunted and 62 million who were not stunted but living in poverty. Most of these children lived in 10 countries accounting for 145 million (67%) of the 217

million disadvantaged children in the developing world (Grantham-McGregor et al., 2007) . Such children are likely to suffer from poor nutrition and poor health. They are also at high risk of never attending school (Iltus, 2007).

It is important to note that the number of infant and child deaths in resource poor countries has been estimated to be a mammoth 6 million every year (Jones 2003); however, these deaths may be just the tip of the iceberg. The number of children living in poverty, malnutrition and deficient care is about 30-40 times higher than the number of mortalities (McGregor 2007). If unaddressed, many of these disadvantaged children will contribute to the already high rates of child mortality. Many more will be likely to live a disadvantaged and less productive time for the rest of their lives.

Describing the role of the continued disadvantage, Irvin and colleagues (2007) in their report for the WHO "early child development: a powerful equalizer" conclude that the effect of socio-economic status of the family on child's nutritional health and developmental outcomes is strong and consistent, and has been termed the *gradient effect* (Irwin LG, 2007) . In their systematic review McGregor et al (2007) found that every standard deviation increase in early intelligence or development quotient was associated in substantially improved school outcomes. They describe this relationship with the help of studies from Jamaica, Philippines and Brazil which is summarized (Table 2.2) below.

In addition to the individual studies, McGregor et al also looked at the country data from LMICs (Grantham-McGregor et al., 2007). In 79 countries with a 26% or higher prevalence of child stunting, for every 10% increase in stunting, the proportion of children achieving the final grade of primary school dropped by 7.9%. In 64 countries with an absolute poverty level of 20%, for every 10% increase in absolute poverty the

number of children entering the final grade of primary school decreased by 6.4%. The prevalence of stunting among people living in poverty has been estimated at 50%, which translates to 156 million stunted children. When combined with an additional 63 million children living in poverty, about 66% of these children live in 10 countries, including Pakistan.

Table 2.2: Relationship of early intelligence with school outcomes in 3 countries

Country	N	Independent variable	Outcome variable	Measure of effect	Estimate	95% CI
Jamaica	165	IQ[a] on the Stanford Binet test at 7 years	Drop out before grade 11 Reading and Arithmatic score at age 17 years	Odds ratio Mean difference in SD	0.53 0.65	0.32-0.87 0.53-0.78
Philippines	1134	Cognitive score at 8 years	Ever repeat a grade by age 14 years	Odds ratio	0.60	0.49-0.75
Brazil	152	DQ[b] on Griffith's test at 4.5 years	Grades attained by age 18 years	Mean difference in grades achieved	0.71	0.34-1.07

[a] Intelligence quotient [b] Development quotient

While the status quo relationship of poverty, stunting and poor education paints a dismal picture, reversing this status through promotion of ECD can bring significant positive effects. Development economists have estimated that every year of schooling raises the adult yearly income by 9% (Duflo, 2000; Psacharopoulos & Harry, 2004). According to Irwin, the gradient effect of poverty that occurs on "almost all child outcomes at almost all places" can be helped by providing access to families for a range of supports and programs for their children and for themselves (Irwin LG, 2007). Studies

have also established that in order to improve children's education through ECD promotion, the most disadvantaged children gain the maximum benefit from these interventions (Engle & Pelto, 2011). Evidently, the current substantial impact of poor ECD on national economies, including maintenance of societal inequalities with associated problems can be reversed through appropriate ECD programs (Grantham-McGregor et al., 2007; Engle et al., 2007).

2.5 Addressing the challenge: ECD promotion programs

High income countries were amongst the first to mobilize resources to address the issue of ECD. The U.S. government started its Head Start program in 1965 to address preexisting ECD disadvantages of children from poor families upon entering school. Focusing on the first two levels of a child's environment, i.e., the child and his family, the program strived to strengthen families who are the primary nurturers of their children, to provide children with health, nutritional and educational services, and to enhance children's growth and development. According to the Department of Health and Human Services (DHHS), the Head Start program served more than 20 million children in first 35 years, and by 1997 13 million children of working mothers attended early child care and education programs under this initiative (Love et al., 2005) .

In their systematic review, Anderson and colleagues (2003) summarize the lessons learned from Head Start and other programs delivered to the child and family. They describe these programs as "center based" (i.e., located in a public school or child development center) providing the child with a physical and social environment alternative to home (Anderson et al., 2003). A few programs also had home visitations as part of their program. The reviewers divided the ECD outcomes into 4 categories namely:

cognitive (reductions in retention in school and placement in special education); social (child's social competence and avoidance of risk behaviors); child health screening (screening tests and dental examination); and family outcomes (both parents achieving high school graduation, family income above poverty level, parents employed and not receiving public assistance). The programs have been effective in preventing delayed cognitive development as indicated by significant reductions in grade retention and placement in special education. The evidence was less conclusive for addressing the remaining three outcomes (Anderson et al., 2003).

ECD has been the focus of research and practice outside of the U.S. as well. Boocock (1995) in her review of international initiatives describes how participation in early childhood programs influenced children's later development and success in school (Boocock, 1995). Reviewing studies from 13 nations (Australia, Canada, Colombia, France, Germany, India, Ireland, Japan, Singapore, South Korea, Sweden, Turkey, and the United Kingdom) she describes varying prevalence of preschool enrolment across countries (100% in Belgium and France, 28% in Spain and Portugal and less than 6% in Switzerland), and that preschool enrollment is positively associated with cognitive development and school performance in these countries.

Scholars have also looked at the effect of individual ECD promotion strategies, e.g., center-based and family-based, and drawn comparisons between these two strategies. Drawing lessons for policy, Love in their evaluation of early Head Start for 3-year-old children and their parents and Sweet in their meta-analysis of home visiting programs found that the combination of family and center-based approaches are more effective than either approach alone (Sweet & Appelbaum, 2004; Love et al., 2005).

Programs other than preschool and center-based interventions have also been tested. For example, Ficano examined the role of policy reforms and implementation. She found that subsidy spending and tax policy significantly affects county-level child-care expansion, with poor and rural areas responding most to policy intervention in the U.S (Ficano, 2006). In another study, the reviewers examined the impact of mother's book reading as an ECD intervention to their child 0-3 years. They found that Caucasian mothers read books more than Hispanic or African Americans and that children having increased exposure to book reading have higher vocabulary (Raikes et al., 2006).

2.6 ECD interventions: lessons from low and middle income countries

Low and middle income countries are increasingly focusing their attention on ECD. In 2005, 13 developing countries had started compulsory preschool or pre-primary programs, and at least 30 countries had formulated child development policies (Engle et al., 2007) -a number that rose to 40 in 2011 (Engle et al., 2011). During this period, ECD gained greater attention from donor agencies and research institutions. As a result, several ECD intervention strategies and programs have been evaluated with the objective of creating an environment that fosters child health, growth and development (Engle et al., 2007; Engle et al., 2011; Evans JL, 1998). These include providing services directly to children (e.g. preschool centers, growth monitoring, healthcare, education services and mass media interventions) and intervening directly with parents and caregivers (e.g., parenting education, distribution of food supplements, and conditional cash transfers). Various categories of these interventions for children up to 3 years, along with the level of scale at which implemented, are summarized in Table 2.3 on the next page.

Preschool centers and parenting education programs are the two interventions that have been most commonly adopted or tested in developing countries (Engle et al., 2007) and will be discussed in detail in the subsequent sections. In addition to these, the

Table 2.3: Categories of ECD interventions for children <5 years and their outcomes

Country	Intervention	Outcome measure	Scale [a]
Centre based			
Guinea	Community based early learning centers	Cognitive development at 5 years	2
Vietnam	Centre and home (education, parenting, nutrition)	Raven's colored progressive matrices	1
Parent/child			
Jamaica	Home visits by roving caregivers (health, nutrition, parenting, income generation)	Griffith's scale, parent knowledge & practice	1
Jamaica	Home visits by health aides (parenting)	Griffith's scale, mothers knowledge & practice	1
Colombia	Nutritional supplement, stimulation, or both	Griffith's scale, motor, social, speech and language	1
Bolivia	Home visits (parenting, health, nutrition) with adult literacy	Psychosocial development	2
Bangladesh	Parent group meetings	Maternal knowledge HOME Language, picture talk	2
Bangladesh	Parent group sessions	HOME, Responsive talk, Bayley's III scale	Not available
South Africa	Parenting education at home	Mother/infant interaction at 6 & 12 months	Not available
China	Care for development visits	Gesell development schedules	Not available
St Lucia	Roving care giver home visits	Mullen scale of early development	Not available
Parent/family			
India	Home visits to improve complementary feeing, responsive feeding and play	Bayley's (mental & motor) HOME	3

Israel	Parenting intervention through primary health care	Development quotient	Not available
Kyrgyzstan	Care for development visits	Early learning & development standards Ages & stages questionnaire	3
Comprehensive			
Bolivia	Childcare centers for feeding, stimulation, health & nutrition monitoring with maternal education	Gross & fine motor, language and auditory, psychosocial skills	2
Uganda	Childcare centers with communication on stimulation, health & nutrition monitoring coupled with child health days	Ugandan version of ability scale Parenting practices, nutritional status	2
Philippines	Childcare centers with home visits on parenting and nutrition with improved services	Motor, language, cognitive and social-emotional assessments	2
[a] Scale: 1=coverage <10 villages, 2=coverage >10 villages or a district, 3=national-level government program			

conditional cash transfer where the intervention comprises transfer of money to women plus direct nutritional supplements and nutrition education, is another methodology used to deliver parenting education and improve child rearing behaviors in Mexico and Brazil. Consistent improvement in child growth and development has been observed in Mexico while more mixed results have been found for this intervention approach in Brazil (Fernald, Gertler, & Neufeld, 2008; Morris, Olinto, Flores, Nilson, & Figueiro, 2004)

2.6.1 Preschool interventions

Preschool interventions are among the most widely used strategies for promoting ECD. Several combinations have produced positive results, including stimulation and play in Guinea, Cape Verde and Bangladesh (Jaramillo A, 2002; Aboud, 2006); stimulation and nutrition education for children in Nepal and Vietnam (Unicef 2006; (Watanabe, Flores, Fujiwara, & Tran, 2005); stimulation and nutrition

supplementation in Bolivia (Behrman, Cheng, & Todd, 2004); and stimulation along with nutrition education and distribution of food supplements in Burma, India, Peru and Philippines (Armecin G, 2006; Rao, 2005; Ghuman, Behrman, Borja, Gultiano, & King, 2005)

In their systematic review of studies published till 2006, followed by another review of studies published after 2006 up until 2011, Engle and colleagues found that the short term studies that only assessed immediate outcomes resulted in improved non-cognitive skills like sociability, self-confidence, willingness to talk to elders, and motivation (Engle et al., 2007; Engle et al., 2011). Studies looking at long-term ECD outcomes recorded positive effects on the number of students entering schools, age of entry, retention in schools and academic performance. In the second review, the authors described findings from two types of preschools, including formal (generally linked to schools or offered by private providers, with curricula, learning materials, paid and trained teaching staff, and a fixed classroom site) and non-formal (community-based schools which did not have professionally trained teachers and had locally adapted sites) schools (Engle et al., 2011). The review concluded that compared to non-attendees, children who attended a preschool were more likely to score higher on developmental measures such as literacy, vocabulary, numeracy, quantitative reasoning and teacher assessment of performance at the end of year. The review also concluded that in order for them to be effective, the preschool programs needed to be of fairly long duration. In both reviews, the authors concluded that despite convincing evidence about effectiveness, the coverage of children by ECD programs was low. In the second review, they added that

not all the efficacious interventions retained their effectiveness when implemented at large scale (Engle et al., 2007; Engle et al., 2011) .

2.6.2 Parenting interventions

Parenting education programs is the second most common strategy used to promote ECD in developing countries. Three common methodologies have been reported, including home visitations, group discussions and hospital visits to educate parents about ECD and/or nutrition. Home visitations generally involve a trained educator coming to the household to educate the primary caregiver about ECD issues (Table 2.4). For example, health-aids in Jamaica have tutored parents on optimal parenting practices and have improved maternal knowledge, care-giving practices and child development. The trial also focused on knowledge sharing about nutrition and ECD, maternal knowledge improved but had no impact on their child rearing practices or child outcomes (Powell, Baker-Henningham, Walker, Gernay, & Grantham-McGregor, 2004) . In Colombia (Super, Herrera, & Mora, 1990; Waber et al., 1981), infants belonging to different age groups were randomly assigned to various home-delivered interventions that included providing parents with education about child stimulation and with food supplements. Supplementation of diet was positively associated with motor development, and stimulation with cognitive development among the children. Stimulation combined with supplementation had larger effect on growth than supplementation alone at 3 and 6 years. To summarize, home visitations are a useful strategy to tutor parents at home, and has maximum effects when the tutoring involves educating about nutrition and psychological stimulation.

Group discussion is a strategy where facilitator-led focus groups of primary caregivers (usually mothers) are organized to promote ECD in a community. In Turkey, Kagitcibasi and colleagues compared the effectiveness of facilitator-led focus groups of mothers at homes with a centre-based, child-focused intervention (Kagitcibasi, Sunar, & Bekman, 2007). More sustained cognitive outcomes were observed four years after the intervention among the children of the home-based group as compared to center-based children. In a similar study in Bangladesh (Aboud, 2007), mothers who participated in facilitator-led discussions were compared to mothers who received no such intervention.

Table 2.4: ECD interventions delivered through home visitations

Country /study	Sample size/design	Intervention details	Intensity/ quality	Outcome measure	Effect size (group mean difference)
Jamaica /Powell et al 2004	9-30 mo old 129 undernourished children attending 18 clinics (clusters) randomly assigned to interv/control	30 min weekly visit by CHW to educate & demonstrate play	32/50 (planned visits) averaging 2.7/month	DQ* Mother's knowledge Practices	0.91 1.25 0.65
Jamaica /Powell et al 2004	12-30 mo old 160 children randomly assigned to interv/control	Weekly visits of "Roving Caregivers" for knowledge /discussion	NA	DQ	0.70
Bangladesh/Hamadani et al 2006	6-24 mo old 206 undernourished children attending nutrition centers (20) randomized to interv/control	Local literate women trained to deliver twice weekly visits for 8, then wkly for 4 months for discussion/demonstration.	Average contact/month =7.6	Bayley** Motor dev Responsive Cooperative	0.32 0.17 0.17 0.45

Bangladesh/Nahar et al 2009	6-24 mo old 133 undernourished children randomized to interv/control	Local women having 8 years schooling trained and sent for 11 home visits over 6 months, they also gave daily ½ hr visit for 2 wks in ospital	Average contact/month =3	Bayley Motor dev Test session for behavior	0.85 0.50 None
Jamaica/McGregor et al 1987	6-24 mo old 34 hospitalized children randomized to interv/control and followed up at home	CHW gave daily play session in hospital Wkly visits for 2 years, fortnightly in 3rd year after discharge	4 visits/month planned, actual info NA	DQ PPVT*** (after 3 years)	0.94 0.96
Jamaica/Powell et al 1989	6-30 mo old children randomized to control, monthly and fortnightly visits Children 16-30 mo randomized to control or wkly visits	CHW gave visits to educate, demonstrate and play		DQ Monthly Fortnightly Weekly Fortnightly	 No 0.43 1.11 0.36
Jamaica/Walker et al 2004	140 term LBW infants randomized	CHW after 2 wks training gave weekly i-hr visits for 2 mo, wkly ½ hr visits from age 7-24 mo	3 visits/mo	Problem solving Performance Griffith's Hand-eye DQ	 0.30 0.42 0.36 0.27
Brazil/Eickmann et al 2003	156 infants tested at 12 and 133 at 18 mo in a quasi-exp design	ECD specialists gave 3 workshops to 8 mothers/wks hp Followed by 10 home visits for play sessions	~2 contacts/ month	Bayley's MDI PDI	 0.82 0.66

The intervention improved mothers' knowledge about ECD and resulted in higher scores on a child stimulation scale. Care-giving practices did not improve, however, nor was any difference observed in the cognitive capacity of the children. Another study in Bangladesh assessed the addition of an ECD intervention to a preexisting nutrition supplement intervention among undernourished children who attended community nutrition centers (CNCs). The intervention group received facilitator-led support groups at CNCs, followed by individual home visits. There was an improvement in maternal knowledge and cognitive/social development of children; however, no effect was observed on growth outcomes (Hamadani, Huda, Khatun, & Grantham-McGregor, 2006). It appears that group discussions may be more effective than center-based approach; however, no study could be found that compared effects of group discussions with home visitations on ECD outcomes.

Hospitals can be another useful setting where ECD interventions could be delivered, as they take advantage of sick child visits, rather than sending auxiliary staff or peer-facilitators for home visitations. In a randomized controlled trial in Turkey (Ertem et al., 2006), the intervention consisted of pediatricians explaining play and communication activities to parents. The intervention had significant positive effects on parent-child communication and home environment.

2.6.3 Conclusions about ECD interventions

From these studies it can be concluded that interventions bring maximum benefits when nutrition and early stimulation are combined and delivered in a packaged fashion through home visitations or child center-based interventions (Engle 2007). Moreover, it has been emphasized that women's rights be protected and promoted as part of a holistic approach

to ECD (UNICEF 2006). It is also recommended that ECD programs should address maternal nutrition and health as poor maternal nutrition and infections lead to intra-uterine growth restriction (IUGR) (Walker et al., 2007). Effects of this IUGR persist up to adolescence both in the developed and developing countries.

Our review of these studies also suggests that although efficacious interventions to promote ECD are available, very few have been implemented at large scale and half of those implemented at large scale lost their effect compared to when they were implemented at the smaller scale. Engle and colleagues documented the low coverage of ECD programs recommending more research on approaches to deliver feasible effective child health and development programs at scale. In their second review, they reiterated these findings and added that although all parenting education effectiveness trials affected parenting behaviors, only half of the scaled-up programs showed similar effects. They concluded that knowing the program quality to improve effectiveness was important (Engle et al., 2007; Engle et al., 2011).

One important feature of effective ECD interventions through home visitations is the involvement of lay health advisers. In her review of of home visitation programs, Walker has listed 8 out of 9 studies that engaged some form of lay health advisers (Walker, 2011). Among these, community health workers (CHWs) were engaged for studies in Jamaica (Grantham-McGregor, Schofield, & Powell, 1987; Powell & Grantham-McGregor, 1989; Powell et al., 2004; Walker, Chang, Powell, & Grantham-McGregor, 2005), and local literate women were engaged as lay health advisers in Bangladesh (Hamadani et al., 2006; Nahar et al., 2008) and Jamaica (Powell et al., 2004).

Only one study (Eickmann et al., 2003) from Brazil employed occupational therapists who had specialized training on child development for home visits.

In the Jamaican studies (McGregor 1987; Powell 1989; Powell 2004; Walker 2004), the CHWs generally had between primary and incomplete secondary-level education and had received 8 weeks of training from their parent program at the time of recruitment. They were given between 2-8 weeks of additional training by the research team on child development, teaching techniques, conduct of the visits, and toy making. They were provided with a curriculum manual for reference and were facilitated by a supervisor during their field activities. These workers carried out weekly, fortnightly, and monthly visits during various studies. Duration of their visit ranged from ½ hour to one hour. The two Bangladesh studies adopted the Jamaican model except that they engaged literate women from the local community and also added center-based play sessions or group sessions on child development and the importance of play (Hamadani et al., 2006; Nahar et al., 2008).

Synthesizing information from these home visitation studies, Walker concludes that interventions produce better results if they involve CHWs as opposed to volunteers, have a frequency of fortnightly visits compared to monthly visits, and a visit duration of more than half hour than a less than half hour duration of the visit. Little information is available about the characteristics of CHWs or lay health advisers that could play in success or failure of such programs (Walker, 2011).

CHWs have special significance in countries with low income and high population density. Institutional health care in these countries usually struggles to cope with increased demands for services. CHWs in this situation are seen as a bridge between

communities and health systems, and they are expected to share work burden with the institution-based part of the health system. Studying CHW programs and improving services provided by them is therefore crucial to promote health and to improve health systems in these countries.

2.7 Overview of CHW interventions

There is growing interest in engaging CHWs in parenting education programs in resource poor settings. In a review of characteristics of successful programs, Engle and colleagues conclude that most of the effective ECD programs have a systematic training component for health workers including a structured and evidence-based curriculum, opportunities for parental practice with children, and an adequate feedback from the workers to the program (Engle et al., 2011). Owing to the lack of human resources in the health sector (Chen et al., 2004) and low and inequitable use of health services (Schellenberg et al., 2003) in resource poor settings, CHWs are considered to be an effective mechanism for delivery of interventions at scale, with the potential for reaching equitable coverage, including of the most disadvantaged populations (World Health Organziation, 2007). CHWs can be engaged in addressing the challenges of newborn mortality and community health development (Bang, Bang, Baitule, Reddy, & Deshmukh, 1999; Baqui et al., 2007; Kumar et al., 2008) in resource poor settings.

The interest in CHWs to address public health problems gained momentum in 1978, when the World Health Organization through Alma-Ata declaration (WHO, 1978), advocated "health for all" and recommended primary health care (PHC) as the core strategy to achieve this goal. Countries across the globe responded to this call by designing, adapting, and implementing primary care strategies to improve population

health. CHWs act as a bridge between consumers in need and health services in hard-to-reach areas, and they are considered the backbone of PHC (World Health Organziation, 2007). CHWs can be part of the formal or informal health care system. Eng & Parker used the term "natural helpers/lay health advisers" for such health workers in order to emphasize their location within community social networks (Eng & Parker, 2002). Natural helpers have knowledge and expertise that promote health and development of their community through information sharing, assistance and community organization activities that capitalizes on their existing social networks. Lay health advisers (they have different names in different contexts) can be volunteers or paid outreach workers who seek to provide social support, including health information and assistance, to individuals who do not necessarily belong to their social network. Through peer-to-peer social support, these helpers improve knowledge; access to options to be healthy; and use of appropriate services of their communities which can ultimately help improve health practices. In the long run, efficient networks may also impact organization policies and practices, community attachment and political dynamics leading to improved community competence and coordination of agency services.

Other research has further elaborated the conceptualization of how helpers engage social networks and provide social support (Heaney C & Israel B, 2008). Types of support include emotional (empathy, trust, care), instrumental (tangible help), informational (advice, information), and appraisal (feedback, helping self-evaluation). Both Eng & Parker and Heaney & Israel propose that the ultimate outputs (improved practices, community competence) depend upon the individual characteristics, training

and work environment of the agents responsible for creating social networks and social support (Figure 2.3).

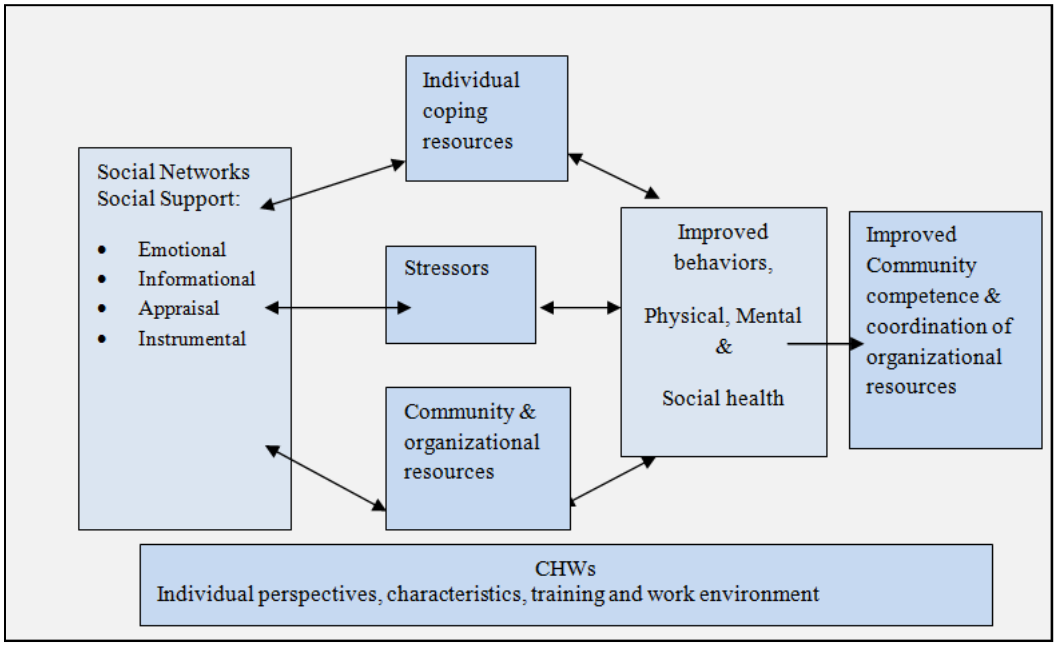

Figure 2.3: A simple outline of social networks and social support relationships

Countries from north to south, have been implementing primary care initiatives through lay health advisers, also called community health workers (CHW), to address their local context. In the U.S., CHWs have been engaged to provide services predominantly to under-served populations including women, children, aging populations, ethnic minorities, and people suffering from stigmatized conditions like HIV/AIDS. A national study (HRSA, 2007) informs that these CHWs play one or combinations of 5 roles including; member of care delivery team (i.e., subordinate to a care provider); navigator (i.e., helping people negotiate healthcare within complex system); educator (i.e., teaching self care, screening, and other healthy behaviors); outreach enrolling-informing agent (i.e., reaching out and getting specific cases enlisted); and organizer (i.e., engaged in community development). Most of CHWs were engaged

in donor-funded service delivery programs being implemented by social sector and non-profit organizations (Rosenthal et al., 2010).

Synthesizing lessons learned from around the world, the WHO published a brief on lay health advisers/CHWs to present a summary of different CHW programs, and to suggest the way forward to improve their public health impact, particularly by addressing child health. It emphasizes careful planning, secure funding, regular training and supervision, and reliable logistical support, but does not discuss incorporating CHW's perspectives in the development, integration and scaling up of innovations interventions and practices (World Health Organziation, 2007).

Exploring the characteristics which make a CHW perform better than the other and factors that increase or decrease the motivational level of these workers are important. In their study, Bhattacharya and colleagues examined the incentives and disincentives for CHWs and how they affect motivation, retention and sustainability of the CHW programs (Bhattacharyya, 2001). Based on literature review and guided interviews of CHW programs working on child health (mainly integrated management of childhood illnesses or IMCI), the authors concluded that there could be no single set of incentives to ensure performance and sustainability across CHW programs. Rather there had to be context specific and locally adaptive incentives. For example, CHWs are usually poor and need to earn for their family. Monetary incentives are therefore relevant in most of the cases. On the other hand, non-monetary incentives like identification badge, job-aids (e.g., counseling cards), and peer support may also enhance motivation.

Providing medicines also may be an important incentive where communities expect CHW to not only provide preventive and health promotion services, but also to

provide curative services. The paper reported that the inherent characteristics of CHWs like their age, gender, education, economical status would affect their role and relationship in the community. At the micro level, the specific daily tasks to be performed by the CHW if too many, may overwhelm the CHW and affect motivation and performance. The review recommends that CHW programs help CHWs enhance relationship with their community, use variety of incentives to enhance motivation and performance, be introspective about their program and carry out research on continued basis in this regard (Bhattacharyya, 2001). What it does not explicitly recommend is a system to incorporate the CHW perspectives into their program on a continued basis.

A recent review about CHW effectiveness, however, gave significant importance to involvement of CHW into program decision making and including their perspectives while making additions to the services provided by them (Jaskiewicz & Tulenko, 2012). This review of CHW programs in developing countries highlights four areas that need focus to improve effectiveness of CHW programs. The areas include a rationalized workload (define), supportive supervision, adequate supplies and equipment, and respect both from health system and community. In addition to increasing CHW involvement in decision making, the authors also recommend further research on the health system factors like improved supply system (e.g. regular provision of medicines, job-aids and training), training of supervisors to provide supportive supervision, use of information technology to improve connectedness of CHWs with various players of health system, and optimum workload and factors that enhance job satisfaction of CHWs. Table 2.5 provides a summary of the findings as well as recommendations from this review.

Table 2.5: Lessons learned from CHW programs

Facilitating or inhibiting factors for CHW performance	Consequences	Recommendations
Workload • Number of tasks No fixed number recommended. • Organization of tasks The way a system allocates responsibilities and expects performance • Catchment area No fixed formula. The households covered vary from as few as 10 in Sri Lanka, to a moderate 250 in Pakistan to a mammoth 1000 in India. Catchment area also depends on the geographical area in which CHW population resides and the terrain and transport facilities in that area.	Higher number of tasks leads to lowered performance Unsystematic allocations decrease efficiency while integration of activities improves it e.g. time spent with clients gets increased Bigger the area and population to cover, less efficient will be the CHW system	Involve CHWs in the decision about whether to add new services and if so, which tasks are most needed in their community. Conduct research to answer the questions about the optimum level of workload a CHW can undertake before productivity suffers. Determine the ideal number or highest limit of tasks as well as target geographical and household coverage.
Supportive supervision CHWs require a reliable and regular support and supervision system for optimal performance	This important aspect is often ignored. Supervisors are often healthcare staff who may lack the background to provide supportive supervision.	Improve the supervisory system to enhance CHW productivity, provide recognition and feedback, assist in problem-solving, and link CHWs to the formal health sector.
Supplies and equipment Regular supplies and working state of equipment is necessary.	Short supplies lead to lack of respect from community and dampened level of CHW motivation	Provide supplies, equipment, and basic transport to CHW on consistent basis
Respect A level of respect which operates cyclically between community and health system	CHWs do enjoy a level of respect from their community as they belong to the same community. However, when referrals by CHW are not attended by the hospital staff, community members start doubting the role of CHW and the respect decreases.	Improve the CHW connectedness to health facilities. Use mobile technology to improve connectedness between the two. Provide training to facility staff on supportive supervision.

2.8 CHW program implementation in Pakistan

The CHW program in Pakistan (officially National Program for Family Planning and Primary Health Care or NP for FP & PHC, popularly known as Lady Health Worker Program or LHWP) has been functional since 1994 (Hafeez, Mohamud, Shiekh, Shah, & Jooma, 2011). With over 100,000 lady health workers (LHWs) working in rural areas, the program is critical for disseminating a variety of health messages and prevention behaviors and practices among rural populations in the country. Various health promotion programs have engaged LHW to deliver health education through various strategies: one-on-one peer support, group support, and health committees being a few examples of these strategies.

Hafeez et al. (2011) provide a comprehensive summary of achievements and challenges faced during 15 years of implementing this country-wide program. They report that the indicators on contraceptive prevalence, child immunization, skilled birth attendance, infant mortality and maternal mortality are better in LHW covered areas as compared to the national-level indicators. Poor support from the sub-optimally functional health facilities, financial constraints and political interference are the challenges faced by the program. The authors, however, present a global picture of the program and do not dwell on characteristics or factors that can make some LHWs more effective than the others (Hafeez et al., 2011).

Ariff and colleagues in a cross sectional study, carried out a training needs assessment of 3 cadre of health providers including physicians, lady health visitors (or nurse, midwife) and LHWs working at the primary care level (Ariff et al., 2010). They assessed the training needs on areas like knowledge, counseling and clinical skills (e.g.

newborn resuscitation) in maternal and newborn health. The LHWs performed better than physicians on knowledge, physicians did better than LHWs on counseling, while all 3 cadres performed poorly in newborn resuscitation. This paper suggests that LHWs with knowledge scores higher than even the physicians have the potential of making significant contribution to the health system if their counseling capacities are enhanced.

Few studies from Pakistan have explored the perspectives of LHWs about their job and job-related issues. In a multi method study, the authors surveyed 150 LHWs from an entire sub-district and held qualitative focus groups with a subsample (48/150). About 1/4th of respondents were found to have significant occupational stress. Having low socio-economic status and having to travel long distances for work were likely to be associated with this stress. Inconsistent medical supplies, inadequate stipends, lack of career structure and not being equipped to communicate effectively with families were found to be the main factors for job dissatisfaction among these workers (Zaeem, Zafar, & Atif, 2008) .

In a qualitative study (Haq & Hafeez, 2009) with LHWs and their supervisors from all the four provinces of the country, the authors reported that about four fifths of the respondents feel that they have moderately sufficient communication skills and want improvement. Knowledge on emerging health issues is perceived as insufficient by the respondents and there is willingness among them to participate in continued education activities. It was also found that media campaigns are helpful in building the image of health workers as a credible source of health information.

Important changes have occurred recently on the LHW landscape in Pakistan. Under the 18th constitutional amendment, the federal Ministry of Health was abolished

and “health” as a function of government was transferred to provinces (Nishtar & Mehboob, 2011) This involved devolution of all the national health promotion programs including the Lady Health Workers Program to the provinces. Moreover, the health workers’ semi-governmental, semi-volunteer status was changed into the status of a permanent government employee. Lastly some of the LHWs were targeted and killed during late 2012 and early 2013 while carrying out their duty during the national immunization days for polio (Riaz & Rehman, 2013). All these factors can have implication on the LHW performance and the new and old community-based interventions being delivered by them.

2.9 Examining the implementation of ECD programs

Implementation monitoring of health programs has been emphasized by various studies (Durlak & DuPre, 2008a; Engle et al., 2011; Irwin LG, 2007) to improve program effectiveness. According to Durlak (2008), monitoring the process is positively correlated with program outcomes. Irwin (2007) has described “process” as one of the three elements that contribute to the quality of an ECD program. He includes staff stability and continuity and positive relationships between service providers, caregivers and children as essential process elements. The conceptualization of process monitoring highlights characteristics of the community, healthcare providers, innovation, program delivery and program support. These factors can influence the success of program implementation.

There is a consensus that sustaining successful public health interventions requires the ability to identify key components, to identify for whom the intervention is effective, and to identify under what conditions the intervention is effective (Linnan L & Steckler A, 2002). This important objective can be achieved through process evaluation

for which a few frameworks are available (Linnan L & Steckler A, 2002; Saunders, Evans, & Joshi, 2005a). Saunders and colleagues (2005) suggest that a "complete and acceptable delivery of the program" should be outlined first. This should be based on details of the program (e.g. program components, theory, and elements in logic model) that will be monitored through recommended elements of a process evaluation plan. These elements include fidelity (quality of implementation), dose (dose delivered-amount of intervention delivered by program implementers and dose received- extent to which participants absorb the intervention and use materials or other resources), and reach (degree to which intended audience participate in the program). Others like the RE-AIM framework suggested by Glasgow or the basic elements of process evaluation recommended by Linan & Steckler also comprise similar elements of process evaluation (Glasgow RE, Vogt TM, & Boles, 1999; Glasgow, Klesges, Dzewaltowski, Estabrooks, & Vogt, 2006; Linnan L & Steckler A, 2002).

None of the reviewed studies on ECD describe its complete and acceptable delivery, however, nor have any elucidated the process elements. All these studies were multi-level interventions in which research teams trained CHWs or volunteers who in turn visited households to tutor parents, and parents in turn modified their child rearing behaviors. Knowing how much of the dose was delivered and received across these levels, and with what fidelity could have helped in better understanding the relationship between "real" intervention and its effects during these studies. Similarly these studies were multi-modal i.e. they adopted more than one mode to deliver the intervention. These modes included talking; using pictures, toys or other educational materials; talking in one-on-one as well as in group settings; and delivering the sessions at home as well as in

a child center. Which of these modes were used more and which were used less, or were they used with equal frequency is important to understand the actual components that were delivered as "intervention", and produced results.

Review of process evaluation studies from other disciplines suggests that the intervention process is usually viewed from the program's perspective, where evaluation aims to determine the level of quality (fidelity) or of completeness and acceptable delivery (Reach, Effectiveness, Adoption, Implementation, Maintenance etc) of its own program. None of the reviewed studies documented the implementation process from the implementer's perspective. This lack of "insider's perspective" leaves a void in true understanding of the processes as they occurred in real world, and has implications for scale-up. For multi-level, multi-modal, complex intervention studies on ECD, it is essential to study how CHWs view their current effectiveness in promoting child health and how, from their perspective, this effectiveness can be enhanced? Moreover it is also important to explore how they view the development and implementation of "innovations" to be delivered by them, and how their perspective can be incorporated into these interventions. Along the same lines, it is also important to examine how a package of health education messages and their delivery is perceived by a caregiver (e.g. mother), how much of this package is relevant to her universe from her perspective, and how much she can really incorporate in her day-to-day child rearing activities.

2.10 Measuring the outcomes of ECD programs: child's environment

As described in the earlier sections, the physical and social environments of home are major influences on the overall development of children (Iltus, 2006). Home environments may be even more critical to child development in resource-poor countries

where preschool institutions are few in number or lack quality and resources. In those countries, the home environment and child care often includes extended family members. Interventions that aim to change the home environment to promote early child development (ECD) would benefit from valid and reliable measurement of this key domain.

Home Observation for Measurement of the Environment (HOME) inventory is an observation and interview tool to assess the physical and social environment in the home, including the quality and quantity of stimulation and support available to a child. There are four different versions of HOME for various age groups. The infant/toddler version of HOME (IT-HOME referred to as HOME in the subsequent text) is a 45-item instrument that is used to assess the physical and social environment available to infants and children up to 3 years of age (Bradley, 1994).

HOME is administered when the primary care giver and the index child both are available and its administration takes about 45 minutes. Various items on HOME are scored through interview, observation or either of the two methods (denoted by I, O, and E, respectively, in the instrument). There are six subscales of the inventory (Table 2.6) which tap into six different environmental domains (Caldwell, 2003). Developers of this tool have proposed two versions. For the unstructured version, the interview items are not phrased as questions and the method of asking is left to the skill and preference of the interviewer. The structured version on the other hand, has pre-phrased questions and the interviewer is expected to ask question as stated. Settings where well-trained observers are available and assessments are carried out on a single site (e.g., one geographical area), the unstructured version is preferred. On the other hand, when well-trained observers are

not available, and the study involves multiple sites (e.g. multiple geographical areas that are far part), the structured version is preferred.

Table 2.6: I/T-HOME subscales and their definitions

Number	Subscale	Definition	Items
1.	Responsivity	The extent to which the mother responds to child behavior offering tactile, verbal and emotional support for their behavior and communicating freely with the child through words and actions	1-11
2.	Acceptance	Parental acceptance of less than optimal behavior from the child and the avoidance of undue restriction and punishment.	12-19
3.	Organization	The extent to which there is regularity and predictability (without monotony) in the family's schedule, to the safety of the physical environment, and to the utilization of community services as part of the family support system.	20-25
4.	Learning materials	Provision of appropriate play and learning materials capable of stimulating development.	26-34
5.	Involvement	The extent to which the parent is actively involved in the child's learning and provides stimulation for increasingly mature behavior.	35-40
6.	Variety	The inclusion in daily life of people and events that bring some variety (without disorganization) into the child's life.	41-45

2.11 Correlates of HOME

The original validation studies of HOME revealed that HOME scores were correlated with family context (parental education, economic status) variables (Bradley & Caldwell, 1984). The validation of HOME included showing that higher HOME scores were correlated with better child outcomes (physical, social and intellectual development) (Bradley & Caldwell, 1984). Later on, using the process model of parenting, the authors also argued that HOME reflects parental personality (Bradley 1994). Many studies that focused on measurement properties of HOME across different cultures and continents

have shown a consistent correlation between HOME and the family context (Bradley & Caldwell, 1979; Bradley, 1993) and child's development (Bradley, Corwyn, & Whiteside-Mansell, 1996; Elardo, Bradley, & Caldwell, 1975).

Among the correlates of HOME, child's cognitive and socio-emotional outcomes are difficult to measure as they require variety of assessment materials and trained human resource. The socio-economic status (SES) on the other hand, is relatively easy to measure. SES variables therefore are usually documented and analyzed for their correlation with HOME in most of the studies on early childhood development.

2.12 Socio-economic status (SES) and development

Several ways of measuring SES have been proposed in the context of child development, with most of them recommending quantification of income, parental education and occupation. It has been suggested that income, education, and occupation together represent SES better than any of these alone (White, 1982), however, using individual SES dimensions that are more relevant to cultural context have also been recommended (Bradley, 1994).

Research shows that SES, however measured, is associated with a wide range of health, cognitive, and socio-emotional outcomes in children, with effects beginning prior to birth and continuing through childhood into adulthood (Bradley & Corwyn, 2002). In terms of ECD outcomes, a number of studies have documented that poverty and lower parental education are associated with lower levels of school achievement and IQ later in childhood (Alexander, Entwisle, & Dauber, 1993; Duncan, Brooks Gunn, & Klebanov, 1994; Pianta, Egeland, & Sroufe, 1993; Zill, Moore, Smith, Stief, & Coiro, 1995).

Regarding which dimension of SES relates most strongly with child development, Mercy & Steelman (Mercy & Steelman, 1982), found that family income, maternal education, and paternal education all predicted intellectual development, but education was the strongest predictor, with maternal education being stronger than paternal education.

2.13 HOME in a collectivist context

Originally developed in the U.S., HOME has been shown to be a valid and reliable instrument in European (e.g., U.K) and other developed countries (Bradley et al., 1996); however, less is known about its utility in resource-poor countries or marginalized populations within developed countries. Since HOME captures the physical and social environment of a family, its application should be examined within cultural context. Special importance may need to be given to whether the child's environment is characterized by individualism or collectivism.

When describing the importance of context in child development, Kim and Choi (1994) have explained individualistic versus the collectivistic societies. Tracing the development of *individualist* characteristics from the era of industrialization, they explain how western societies gradually valued technological intelligence more than before, because of which personal development and excellence became important (Kim & Choi, 1994) . The goal of socialization in such societies was to build the cognitive and linguistic skills necessary for success in a competitive environment. The spirit that emerged in this context was outside of the relationships, family, or clan, and more because of common interest, experiences, and goals. *Collectivist* societies on the other hand, nurtured trust, cooperation, and conservatism. Subsistence was important, and the goal of socialization therefore was survival. Social intelligence was valued more in such

societies and cultures maintained communal and familial characteristics (Kim & Choi, 1994). Using the same typology, Hofstede in a survey of 50 countries, categorized U.S., Australia, U.K., Canada, Netherlands as individualist and Venezuela, Colombia, Pakistan, Peru, Thailand, as collectivist societies (Hofstede, 1983) .

In European and North American countries, where individualism is predominant, HOME has been used without adaptation and has produced consistent patterns of results (Bradley et al., 1996). In middle income countries of the Caribbean (Jamaica) and Latin America (Costa Rica), where societies place a higher value on collectivist orientations, the content of HOME has been modified at some places. In Jamaica, Grantham-McGregor et al produced a modified version with 22 items clustered into six subscales and also rescaled the instrument to obtain increased variability among the Jamaican population (Bradley et al., 1996). In Latin America, Lozoff and colleagues thought that standard IT-HOME would not capture the entire stimulation environment prevalent in Costa Rica. For example, children were routinely vaccinated, but having regular medical check-ups was not a practice of Costa Rican families. Researchers therefore instructed the observers to note the environmental features that were in spirit of the HOME but did not strictly fall into criteria of its items (Lozoff, Park, Radan, & Wolf, 1995).

In low-middle income countries (e.g., Pakistan) where society, particularly rural society, is collectivist and the home environment mostly includes parents, grandparents, other close relatives like aunts and uncles, and siblings, instruments like IT-HOME may need to consider the role of the extended family within the home environment and

childcare. Little modification to the content or cultural adaptation, however, has been done (Bradley et al., 1996).

A close examination of IT-HOME reveals that its 3 socio-emotional domains (i.e., responsivity, acceptance and involvement) are focused only on the mother (or primary caregiver).In the Pakistani context where extended family system is normative, other household members may interact with the child on a consistent basis (Table 2.7). For an objective assessment of the Pakistani home environment and that of other South East Asian countries, the HOME subscales to measure responsivity, acceptance, and involvement of these other consistent caregivers may need to be included in order to ensure the validity of the HOME instrument. No published studies of which we are aware take this family structure into account while assessing home environment. A plausible reason of this paucity is that in countries like Pakistan, ECD projects used IT-HOME to assess the impact of interventions whose primary focus was mother, hence they did not consider other family members as part of the home environment (PEDS trial, personal communication).Interventions increasingly target additional caregivers in the home environment (London School of Hygiene and Tropical Medicine, 2013)

Table 2.7: I/T-HOME dimensions and questions arising in the collectivist context

Subscale	Items/relatedness	Questions/Comments
Responsivity	1-11 All items belong to mother/primary caregiver	What about other family members who may be doing similar things to/for child during the observation, or earlier, as a routine?
Acceptance	12-19 All items belong to mother/primary caregiver except two (13&19) which respectively ask about presence of a pet or books.	What about other family members who may be spanking or shouting etc at the child?
Organization	20-25 Items presumably pertain to behaviours of any family member	This dimension may be the same across western and Pakistani cultures.
Learning materials	26-34 All about observing for the presence of materials	This dimension may be the same across cultures. The only difference will be some families using items of daily use or home-made things as toys in the Pakistani context.
Involvement	35-40 All items belong to mother/primary caregiver	What about other family members who may be doing similar things to/for child during the observation or earlier (as a routine)?
Variety	41-45 Items pertain to father or other family members.	This dimension may be the same across western and Pakistani cultures. Pakistani children may be experiencing a "richer" variety.

Moreover, as children age, the features of the social and physical environment that promote ECD change. According to Bronfenbrenner's ecological systems theory, an individual is placed in a context of interdependent environment (Bronfenbrenner, 1986). A growing child through his gestures, vocalizations, and demands stimulates others who in turn, stimulate him with variety of actions and materials. Several studies from developed countries have documented that association between environmental measures and measures of cognitive development get stronger as children grow and approach 2 years (Bradley, 1994; Wachs, 1992). HOME scores obtained after 2 years of age in these

countries have better correlations with cognitive test scores than the correlations at younger ages (Totsika & Sylva, 2004). Studies from Europe and North America point out that these correlations between HOME and cognitive development are strongest with Caucasian, moderate in African-American, and almost non-existent in Mexican-American children (Totsika & Sylva, 2004). Moreover, studies from collectivist communities have shown more mixed results, with some reporting no association between HOME scores and age-related development outcomes (Aboud, 2006; Lozoff et al., 1995). One reason for this may be HOME's omission of the extended family's contribution to the care of growing children. Local adaptation of socio-emotional constructs used in HOME can help in examining the association of age of the child with HOME scores.

For households where multiple household members may engage in regular child care activities, the mother may perceive it as a useful social support. At the same time, some mothers may experience interpersonal problems with family members, and may not view their immediate home environment as supportive, despite the presence of childcare assistance in the family. Hence, social support may be independent of childcare assistance that should be considered when assessing the social environment of the household. How does this affect the home environment of the child? Does social support improve home environment and lack of it negatively impact the same environment? These questions which are important in the context of collectivist societies are yet to be answered.

A number of researchers have highlighted the need to adapt the HOME inventory for application in non-Western societies, because HOME was designed with

the Western concept of the mother-child dyad as the basic unit and does not necessarily account for the influence of the continued presence of alternate caregivers (Bradley & Corwyn, 2005; Bradley et al., 1996; Frongillo et al., 2013; Totsika & Sylva, 2004). The present study addresses this important gap in the ECD research. In Pakistan, particularly in rural areas, the home environment mostly includes parents, grandparents, and other close relatives like aunts, uncles, and siblings, who may interact with the child on a consistent basis (Rahman, Iqbal, Roberts, & Husain, 2009; Lingam et al., 2013). The assessment of Pakistani home environments, as well as those in other societies organized around extended families, the socio-emotional support of these other caregivers may need to be included in order to ensure the content validity of the HOME instrument.

The proposed study is expected to fill these knowledge gaps from Pakistan and neighboring countries where family environments are different from Europe or North America, child developmental deficits are huge, and interest in early child development is on the rise (Grantham-McGregor, 2007; Aboud, 2007).

CHAPTER 3

RESEARCH DESIGN AND METHODS

This research was carried out during the early phase of a large-scale randomized controlled trial called Sustainable Program Incorporating Nutrition and Games (i.e., SPRING) in the rural areas of Pakistan. SPRING is being implemented in India and Pakistan; however, the present study focused only Pakistan, where lady health workers or LHWs (the official title of CHWs in Pakistan) have conducted the community outreach program within primary healthcare since 1994. There were two components of this research. First was a qualitative component which involved exploring the perspectives of LHWs and mothers about the integration and implementation of a new ECD curriculum into their preexisting work. This curriculum was developed by SPRING program and added to the preexisting monthly household visits of these LHWs. The integration of this new ECD component into the LHW and mother's daily childcare routines was explored. The second was a quantitative study involving the adaptation and validation of the infant toddler version of the Home Observation for Measurement of the Environment (i.e., IT-HOME) inventory. A household survey was carried out to assess the difference of child's physical and social environment in nuclear and extended family households using the classical HOME and its adapted version, HOME+.

Study 1: Think inside: perspectives of community health workers and mothers about the implementation of an early childhood development program in rural Pakistan

Qualitative approach adopted

Various scholars have outlined research situations where qualitative approach is considered to be the most appropriate to examine an issue. Creswell, for example, provides a list of criteria which include: when a problem or an issue needs to be *explored;* when the aim is to hear *silenced voices;* when a detailed understanding of a *complex* issue is required; when the aim is to *empower individuals* to share their stories, when the emphasis is on understanding the *context* in which the participants are addressing a problem or an issue; and when the aim is to generate a new *theory* on a phenomenon of interest (Cesswell, 2013). Fitting most of these criteria, this study aimed to explore the incorporation of a new and complex early childhood development (ECD) promotion intervention into LHW curriculum, into the LHW's practices during monthly visits to the household, and into the daily childcare activities of mothers. This study also aimed to understand the broader social context in which LHWs and mothers adopt and put into practice a new set of activities. Finally through this study, the voices of the two most important stakeholders of the implementation of ECD promotion in rural Pakistan i.e. LHWs and mothers, would be documented for the first time, adding their voices to those of the others who develop and evaluate interventions that target their lives.

Keeping in view the study objectives, a phenomenological approach with individual, semi-structured interviews was adopted for this qualitative inquiry. Miles and Huberman discuss that research designs or approaches are important for qualitative

research and that these designs have implications for the data analysis and merit of the study outcomes (Miles & Huberman, 1994). They also emphasize that design elements can dictate study sample, participant selection and the storage, management and processing of data. Various typologies of qualitative research designs have been suggested. Out of them, Creswell's classification is practical and easy to understand (Cesswell, 2013).

Creswell has described five approaches to qualitative research including narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research. Phenomenological research explores the meaning that several individuals place on a phenomenon of interest and focuses on the lived experiences related to this specific concept. Adopting this approach enables the researcher to focus on exploring what all research participants have in common as it relates to a specific phenomenon. Drawing from the participant discourse the researcher moves towards the universal essence caused by various phenomenon of interest (Cesswell, 2013).

Using the phenomenological approach for this study, the perspectives of LHWs and mothers were explored during the individual interviews. Individual interviews were conducted to allow for independent context and perceptions to arise, as group settings may have inhibited expression of these perspectives (Miles & Huberman, 1994). All the participant LHWs and mothers were engaged in SPRING; a parenting education program that combined education about nutrition and ECD which was delivered through LHW visits to primary caregivers. Adopting a holistic approach, the SPRING program emphasized maternal psychosocial health, maternal knowledge and skills about child

care, and improved social support available to the mother-infant dyad to improve ECD outcomes in rural areas of Pakistan (London School of Hygiene and Tropical Medicine, 2013).

Two basic questions were asked during the interviews. One, what were the experiences of LHWs and mothers about the integration of the newly learned ECD curriculum into their daily lives and work routines. Two, what were the contextual details in which they learned and implemented this new curriculum. The discussions were facilitated with the help of probes where required.

Background and conceptual framework

The role of the primary caregiver (usually mother) and the structure of the family are key family characteristics that should be considered when developing effective interventions in rural Pakistan. A mother is usually the caregiver who has the primary responsibility for raising a child, including feeding and care (Lingam et al., 2013; Zafar et al., 2013). She fulfils this role while taking care of other responsibilities like domestic work or other obligations, such as fieldwork during harvest season. Building her knowledge and skills as a primary caregiver for the child is therefore fundamental for an ECD intervention. Moreover families in rural Pakistan usually live with their extended families. Sometimes, many nuclear families that share kin ties live in the same house, resulting in a rich social network to support children, including grandparents, uncles, aunts and cousins, in addition to a child's parents (PAIMAN, 2006). Recognition of these social resources and converting them into strong social support for the mother and infant shows great promise as another pillar of such interventions.

Lady Health Workers (LHWs) in Pakistan are a critical conduit for health education to promote maternal and child health in rural areas. There are about 100,000 LHWs working across Pakistan under a program called National Program for Family Planning and Primary Health Care (NP for FP & PHC), popularly known as Lady Health Worker Program (LHWP). LHWs are recruited from the same community in which they will work, have at least 8-10 years of schooling, and are provided 15 months of training before assuming their official LHW role. One LHW is responsible for providing primary and preventive care to a population of 1000 in her area. The LHW visits every household in her area once a month to deliver health education messages and important health products like Iron tablets for pregnant and lactating women, contraceptives for couples practicing modern methods of birth spacing, and oral rehydration salt (ORS) for cases of diarrhea (NP for FP & PHC, 2011). Building upon the work of LHWs, the SPRING intervention tried to improve their capacity to effectively communicate with primary caregivers (mothers) and other members of their household about ways to enrich the home environment in order to improve young children's health and development.

SPRING developed a new ECD curriculum for LHWs. Based on lessons learned from other studies and the findings from qualitative formative research, this curriculum was developed by making some modifications to the existing curriculum of the LHW program (Lingm, 2013). The LHWs received six-day training on intervention implementation, including five principles for intervention delivery: 1. Empathic listening (i.e., putting herself into mother's shoes while trying to understand her problems); 2. Family involvement; 3. Dialogue though pictures; 4. Behavioral activation (i.e., suggesting actions to mother and the family that would help initiate the desired behavior);

and 5. Problem solving (Zafar et al., 2013). The LHWs received picture cards for use as communication tools during their household visits. Such picture cards have been shown to reinforce messages with low literacy audiences (Rahman, Malik, Sikander, Roberts, & Creed, 2008; Rahman et al., 2012). Monthly meetings with supervisors allowed them to seek advice on any problems faced (Table 3.1).

SPRING expected that LHW visits would enhance the childrearing practices of mothers and their family, which would ultimately improve physical growth and mental development of their children (London School of Hygiene and Tropical Medicine, 2013). We proposed that a number of characteristics related to LHWs (e.g., workload and job satisfaction) (Jaskiewicz & Tulenko, 2012; Haq, Iqbal, & Rahman, 2008), mothers and their families (e.g., family support), and other forms of social support (Heaney C & Israel B, 2008) could influence the integration and, ultimately, delivery of the intervention within the home environment (see Figure 3.1). Our study focused on exploring the views of LHWs and mothers about the context (e.g., their professional environments, daily routines), as well as the specifics of intervention implementation and its relationship to this context. These specifics include reach (i.e. program coverage), dose and fidelity (i.e. how much and with what quality is the intervention implemented and received), adaptation (i.e. why and which part of content was modified), and integration (i.e. fit of the new practices into the pre-existing routines). Studying these characteristics in relation to implementation will help in drawing lessons for large-scale delivery of programs that rely on LHWs and, more generally, CHWs.

The present study focused on the perceptions of LWHs and mothers about their own work and integration of SPRING into this work. Semi-structured, in-depth

Table 3.1: ECD intervention components, practices, and materials

Program area	**Brief description**
Intervention components	1. Maternal wellbeing: Achieving a wellness status of mother; both physically and psychologically 2. Nutrition: Providing adequate nutrition to the mother and the child 3. Responsiveness: Providing a stimulating and learning environment to the child through love, affection and play
Intervention delivery approach	1. Family involvement: Using the shared agenda of the child's optimal development, the LHW engages with husbands and mothers-in-law. 2. Empathic listening: The LHW actively listens (conveying interest and empathy, giving feedback) the mother as well as family members. 3. Guided discovery: Using characters of mothers, infants and family members shown in the pictures, the LHW helps mothers and families discuss deeply held beliefs and undesired behaviors without alienating them. 4. Behavioral activation: A structured approach of breaking tasks into small manageable activities, and then working with the mother and other family members to develop a schedule in which these activities can be conducted. 5. Problem solving: Taking the time to listen to problems, and then working with the clients and their families to generate solutions.
Materials	1. LHW manual: A training manual for health workers with step-wise instructions for every visit pictorial counseling cards to use during home visits; a 'health calendar' for families. 2. Counseling cards: Pictorial cards to use during home visits 3. Health calendar: An illustrated diary for mothers that acts as a reminder as well as a record keeper of the activities
6-day Training	1. Class-room training (5 day): Trainers from study team provide this training in a workshop setting while all LHWs attend all sessions of this workshop. Following training methods are used: a. Lectures b. Discussion c. Videos d. Role-play 2. Field training (1 day): The LHW and her trainer visit a household where the LHW gives a practical demonstration of a field visit and the trainer provides feedback.
Monthly visits	Lady health workers continue their routine visits to all households. They also deliver additional ECD content to pregnant mothers or mother-infant pairs, recruited into the pilot study
Monthly supervision	Monthly supervision sessions for the new ECD component are integrated into the routine monthly supervision meetings of LHWs at their health centre

interviews with LHWs before and after SPRING implementation explored how this innovative intervention fit into their daily work routines, their level of comfort with its development and implementation, and their perspectives about issues related to intervention reach, dose, fidelity and adoption, all of which influence the complete and acceptable delivery of the intervention. Similarly, we explored the views mothers had about childcare practices after the LHW visit when the SPRING intervention was delivered.

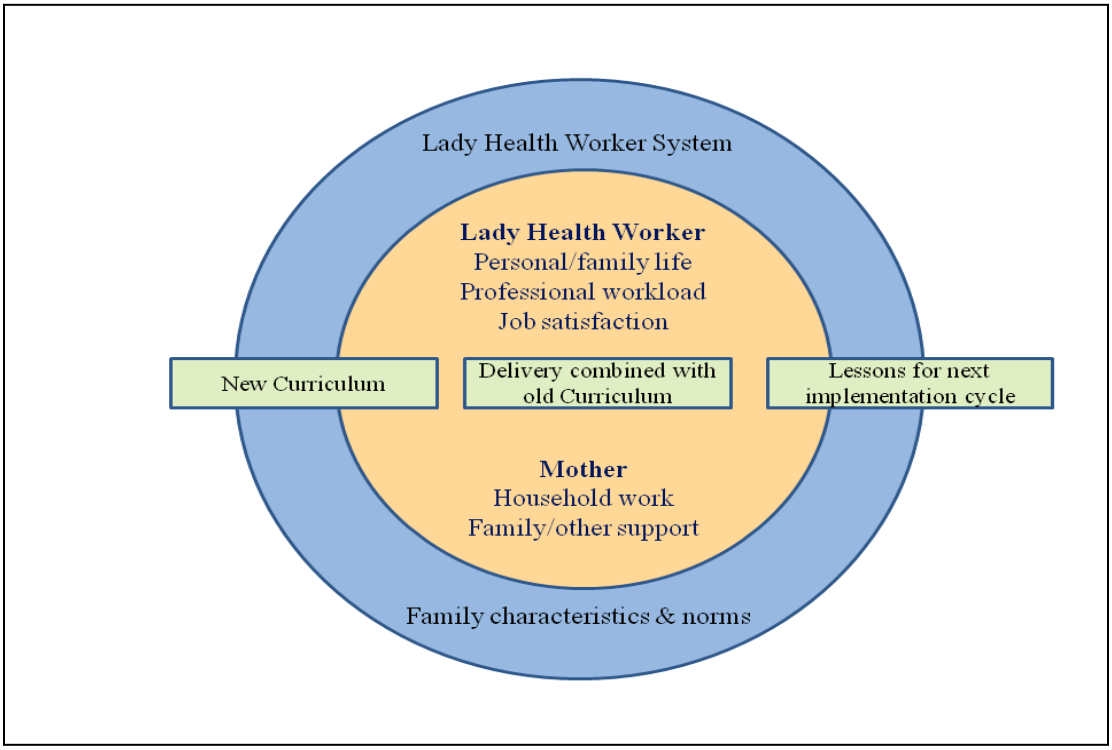

Figure 3.1: Conceptual framework for integration of an ECD intervention into Lady Health Worker's program in rural Pakistan.

Setting

The study was conducted in union council Bhelpur (name anonymized), sub-district Gujar Khan of the district Rawalpindi. This rural sub-district with a geographical

area of 1,466 km^2 (566 sq mi) and a population of approximately 750,000 (Government of Punjab, 2009), has a population density of about 49.7/km^2 (129/sq mi). The population speaks Punjabi with Potohari and Hindko being the predominant dialects. The majority of the population is dependent on subsistence farming, supported by earnings of one or more of the adult male members employed in the public or private sector service in nearby Rawalpindi city (43 Km or 27 miles) or serving in the armed forces. The socioeconomic status of these families generally depends on their landholdings, the number of adult males in the household, and the nature of their jobs.

Participant selection

All participants to a phenomenology study should have experienced the phenomenon of interest, which was the case in this study (Cresswell, 2013). All LHWs (n=13) belonging to the union council Bhelpur were trained in the SPRING protocol and invited to participate in the study, which involved two interviews: one immediately after the training, but before program implementation; and a second interview three months later, after they had completed at least three monthly visits to target families.

Of the total 13 LHWs, eleven participated in these interviews before SPRING implementation while 12 participated after initial implementation. The participants were from 23 to 50 years' old, had from 8 to 12 years of schooling and from 3 to 18 years of work experience, and most of them were married and had children. Each LHW was responsible for 130 to 198 families, carried out 6 to 7 household visits every day, spending 15-20 minutes with each family prior to SPRING. The demographic characteristics of these LHWs are provided in Table 3.2 below. The LHWs (two in 1st

and one in 2nd round) that could not participate had similar socio-demographic characteristics. The reasons for their inability to participate were traveling out of town or personal/family commitments during the interview days.

Table 3.2: Demographic characteristics of LHWs that were interviewed (n=12)

Experience	**Number of LHWs**	**Age in years Mean (range)**	**Education in years Mean (range)**	**Marital Status**
<10 years	5	23.5 (23-27)	10 (10)	3M*, 2 UM**
>10 Years	7	45.5 (30-50)	9 (8-12)	6 M, 1 UM

*M=married **UM=unmarried

To examine LHW work context in the interviews conducted immediately after training, LHWs were asked about how they viewed their professional lives and work, especially around the area of child health and development; their perceptions about integrating new work activities, in general; and their feedback about the newly-learned ECD curriculum. The second round of interviews, carried out after LHWs had done their visits with the new curriculum for three months, focused on the constructs of reach, dose, fidelity, adaptation, and integration (without using this jargon, but expressed in terms that were most relevant to the implementation context and components of SPRING).

Using the new curriculum, LHW workers visited 150 women who were either pregnant (5 months or more) or mothers of infants (0-6 months), participating in the early phase of the trial. To recruit mothers, four LHWs were purposefully selected based on their performance, accessibility and work in four different villages. These LHWs were asked to identify women who were pregnant and who were mothers of newborn to six-month-old infants. Within each of these categories, there was a quota of five participants who LHWs saw as "performing well" and five who were "not performing well". As it

happened, the LHWs could not identify enough mothers who were not performing well, and the study ended up interviewing 12 well performing and 6 not well performing (total=18) mothers. Eighteen mothers were interviewed who were 23 to 32 years of age, nine of whom were pregnant and nine had a child aged 0-6 months. The average schooling of these mothers was 9 years (range 0-16 years), and in terms of implementation of the new intervention, 12 of these mothers were described by the LHW as "performing well" and six as "not performing well." The demographic characteristics of these LHWs are provided in Table 3.3 below.

Table 3.3: Demographic characteristics of mothers interviewed (n=18)

Performance level	Number	Age Mean (range)	Edu/years Mean (range)	Husb/edu Mean (range)	# children Mean (range)	Motherhood status	
						Pregnant	Mother
Performing well	12	29.5 (20-32)	13 (5-16)	12 (5-16)	1.5 (0-2)	6	6
Not performing well	6	25.5 (23-30)	8.5 (0-12)	9 (8-10)	2.5 (2-4)	3	3

Interview protocol

Starting from the day after LHWs completed intervention training, they were interviewed. These interviews were conducted at LHW's houses and included the interviewer and a note-taker, neither of whom had taken part in the six-day training of these LHWs. Interviews were conducted with LHWs using a semi-structured interview guide that explored various domains that could influence integration and implementation of the new ECD intervention (See Appendix A-1). For example, each LHW was asked about how she viewed her professional life and work, especially around the area of child health and development; her perceptions about new interventions, in general, as LHW's

responsibilities often shift in response to public health priorities; and specifically the possible integration of the newly-learned ECD component into her routine visits.

After three months of implementing the SPRING program, LHWs were re-interviewed, with a focus on exploring their experiences while carrying out visits according to the ECD component and its behavior change counseling approach, and possible issues and challenges. The interview guide (Appendix A-2) shows the question wording, while also informing about the general conceptual domain that the question addresses. Exploration at this time focused on key implementation areas like reach, dose, fidelity, and adaptation of the intervention without using the research jargon while asking questions from these LHWs.

Interviews with mothers were conducted after they had been visited at least twice during the implementation period. The interview guide (see Appendix A-3) focused on any new child health information they received during past couple of months, how the mother was taking care of the nutrition and play activities of her child or older children before the intervention (if applicable), and her feedback about the recent visits in which the LHW was expected to improve mother's knowledge and perceived social support using the new behavior change approach.

Role of study team

The importance of the researcher's distancing from the experiences of the participants is considered an essential component of qualitative research. Called "bracketing out" (Cesswell, 2013) of the researcher from the participant experiences, or being reflexive about his/her identity and role (Maxwell, 2005), the emphasis of this approach is on identifying from the outset the researcher's personal experiences with the

phenomenon of interest and aiming to set these experiences aside so that participant perspectives can be clearly understood. This does not take the researchers out of the study; however, it allows for reflexive understanding about their role with respect to the participants and informs their interpretation of the information in a given study (Creswell, 2013).

As part of the intervention development team, the principal investigator (PI) shared the research team's perspective.He did not have any role during the class-room or field training sessions of LHWs in order to enhance his ability to be an independent interviewer who could more readily explore the LHWs' and mothers' perspectives. He was accompanied by a female note-taker during the interviews. A female team member helped in addressing the cultural sensitivities that might impede rapport with female respondents. For example, even knocking at the door of a LHW house and entering in is easier when a female accompanies a male, compared to male researcher visiting alone who will have to stand outside and wait till a male member of the family is available and opens the door for a male guest. Interviewing mothers by a male during a household visit was culturally inappropriate; hence two female researchers with significant experience with anthropological studies conducted the interviews. The research team was not influenced by SPRING or officials from the LHW program at any stage.

Data collection

A team of two participated in each interview, one as the interviewer and the other as the note taker. For LHW interviews, the interviewer (male) and the note-taker (female) visited the LHWs at their homes, as preferred by them. Two female researchers

with significant experience with anthropological studies conducted the interviews of mothers. The interviewer obtained written consent, conducted the interview, and digitally recorded it, while the note-taker took detailed verbatim notes of the discussions. A small monetary amount (300 Rupees ~= $3 USD) was paid to all participants as a compensation for their time.

The data collection was carried out from September 4, 2012 to December 22, 2012. The study was supported through funds provided to the PI from the Office of the Provost, University of South Carolina (USC). Ethical clearance was obtained from the Institutional Review Board (IRB) of the USC as well as from Human Development Research Foundation; the local organization in Pakistan.

Data management

During interviews with LHWs and mothers, the PI carefully documented every development (e.g., changes in phrasing of questions, order of interviews), keeping all the data secure and in order. After every interview he labeled the demographic sheet, consent form, interview notes, and the digital audio file according to a labeling system. For example, an interviewwith pregnant mother # 1 conducted on 9th October 2012 was labeled as Int-PM1-091012. Similarly an Interview with mother #1 of infant 0-6 months carried out on 15th October 2012 was labeled as Int-06M1-151012, and so on. The PI kept the labeled demographic sheets and consent forms in a folder under lock and key, and labeled interview notes in a separate folder under lock and key. A photocopy of the interview notes (back up) was labeled and stored under lock and key, under the supervision of SPRING data manager. The digital files after labeling were saved on to a password protected computer system being used by PI, with copies for back up saved in a

compact disc (CD), labeled, and stored under lock and key with the SPRING data manager.

Analysis

Analysis of qualitative interviews started on the same day of the interview, or at most the following day, when the PI and note taker met to discuss their activity and general findings. The PI entered all important points into a memo. In addition, he wrote down his own observations after the interview in the form of field notes. These notes and memos were used in making appropriate modifications to the interview guides or to the method of their administration. These field notes and memos were also used for the final analysis of the qualitative data.

All interviews were transcribed from the audio file using InPage; the computer software for Urdu language. The PI or the note-taker listened to audio files and transcribed them using in-page. Thematic content analysis was done on the final data as soon as the transcripts were available, by reading and re-reading the transcripts, field notes and clarifying information (where required) with the help of audio recording. The PI and another member of the research team carried out the analysis at this stage. They agreed on an initial uniform method of coding guided by the conceptual framework of the study, following which they independently analyzed the data, and then met again to discuss additional emergent codes.

Manual coding was done on the transcripts to identify the significant statements across individual interviews. Subsequent readings of the significant statements helped in identifying meaning units or sub-themes emerging within these patterns.

"Horizontalization" (Moustakas, 1994) of data was achieved by displaying the sub-themes in the form of a matrix in which left hand column represented each type of respondent, while right hand columns represented subthemes under each broad pattern, emerging from discussions with each respondent. Employing constant comparison (Patton M Q, 2002), the convergent subthemes were then grouped as themes emerging from discussions with a specific type of respondent. Equal attention was given to the divergent themes; points that were not shared by majority of respondents but were significant (Patton M Q, 2002; Miles & Huberman, 1994).

A lot has been published on validity, which is also called credibility or trustworthiness of the qualitative research studies. Drawing upon various authors, Creswell has provided a useful list of strategies that can be used to improve trustworthiness (Creswell, 2013). Among them are prolonged observation, and triangulation including member checking (researcher solicits participants' views about credibility of findings and interpretations), rich, thick description (details that allow the reader to visualize what is happening versus what is being interpreted), clarifying researcher's bias (reader knows researcher's position from the outset), peer review or debriefing (external check of the research process) and negative case analysis (giving attention to views that diverge from the views of majority).

In this study, prolonged observation was ensured by carrying out interviews during the entire phase of learning new intervention and its embedding into the LHW's preexisting visits. Data were triangulated by comparing themes emerging from discussions with LHWs and mothers as well as from different data sources (e.g., interviews and intervention curriculum) to analyze the intervention intended versus

delivered (Maxwell, 2005). Equal attention was given to convergent as well as divergent themes. The findings were shared with members of SPRING team and with LHWs in the subsequent meetings to ensure respondent validation (Maxwell, 2005). Lastly the PI received a continuous feedback from faculty, from conceptualization of the research project up through final analysis and writing study results.

For presentation of thematic findings, both *textural* and *structural* descriptions (Moustakas, 1994) are used in the results section. Textural descriptions are significant statements used to write what the participants experienced. Structural descriptions are the interpretation of the context or setting that influenced participants' experiences. For textural descriptions, the quotes of participants are given in italics with the respondent to whom that quote belongs marked with type (i.e., LHW or mother), age, and work experience as required. The structural descriptions as interpreted by the researcher are provided in plain text. All of these are being presented under the four thematic headings including the "broader context", "learning the new innovation", "implementation", and "integration." The essence of these findings is presented in the discussion section.

Study 2: Shared homes, shared responsibilities: home observation for measurement of a child's environment in rural Pakistan

The physical and social environments of home are major influences on the overall development of children (Iltus, 2006). In ECD intervention research, a common approach for assessing the home environment involves the Home Observation for Measurement of the Environment (HOME) inventory. The HOME inventory is an observation and interview tool and its focus is on the child within the household's

physical and social environment. Originally developed and validated in the U.S., HOME has been shown to be a valid and reliable instrument in European (e.g., U.K) and other developed countries where nuclear families are common. Evidence, however, has been less compelling about the cultural equivalence and validity of HOME in societies like Pakistan where households mostly include extended families. One reason can be that in addition to the primary caregiver (usually mother), a child is also cared for by other family members and siblings. This study proposed that for the assessment of Pakistani home environments, as well as those in other societies where households include extended families, the socio-emotional support of the other caregivers should be considered (called HOME+) in order to ensure the content validity of the HOME instrument.

The objective of this study was to adapt IT-HOME so that it adequately considered how additional caregivers contribute to children's physical and social environment in rural Pakistan. To help determine the construct validity of this adapted instrument, which we call "HOME+", we tested a series of hypotheses about expected correlations between the physical and social environment domains and familial characteristics (see Table 3.4). This testing of hypotheses was done using both HOME and HOME+ scores. In rural Pakistan the home environment mostly includes parents, grandparents, and other close relatives like aunts, uncles, and siblings, who may interact with the child on a consistent basis (Rahman et al., 2009; Lingam et al., 2013); because of this, we hypothesized that the socio-emotional subscales as well as total scores of children living in extended family households would be higher than in nuclear families (hypothesis 1). The importance of the social and physical environment for cognitive

development increases as children grow, particularly as they approach the second year of life (Bradley, 1994; Wachs, 1992). Based on this, we hypothesized that socio-emotional support of children who are older than one year will be higher than that for younger children (hypothesis 2). Past studies also suggest that, maternal education, paternal education, and family income, all have positive correlations with child's home environment (Bradely, 1996; Bradley, 2005; Mercy & Steelman, 1982). We hypothesized that children with high parental education will have higher scores than children with low parental education (hypothesis 3). Similarly, we hypothesized that children from families with relatively higher household income will have higher scores than children from less wealthy family households (hypothesis 4). Lastly, studies have indicated a negative correlation between HOME scores and crowding (Bradley, 1996), so we hypothesized that children with no older siblings will have higher scores than children who have siblings (hypothesis 5).

Table 3.4: Study hypotheses

Number	Hypothesis
1.	Socio-emotional subscale and total scores of extended families will be higher than nuclear families.
2.	Socio-emotional subscale and total scores of children >1 year will be higher than children <1 year.
3.	Socio-emotional subscale and total scores of children with parents having ≥ 10 years of schooling will be higher than children with parents <10 year of schooling.
4.	Socio-emotional subscale and total scores of children from middle-class families will be higher than children from poor families.
5.	Socio-emotional subscale and total scores of children having no older siblings will be higher than children having older siblings.

Setting

The study was conducted in four different villages located within union council Sagri, sub-district Kallar Syedan of the district Rawalpindi. This rural sub-district has a geographical area of 420 km^2 (162 sq mi) and a population of approximately 197,000 (Government of Punjab, 2009). Union Council Sagri has a total population size of 22,098, the majority of which is poor or lower-middle class, dependent on subsistence farming, and supported by the earnings of one or more of the adult male members. The socioeconomic status of these families generally depends on their landholdings, the number of adult males in the household, and the nature of their jobs. Union Council Sagri has a basic health unit (BHU) to cater to the health needs of its inhabitants. Along with curative health care, the BHU also has a community outreach program being serviced by 17 lady health workers (LHWs) who, according to records from 2012 (District health data) provide outreach to 20,039 inhabitants (i.e. 91% of its population).

Population and participant selection

While proposing some guidelines for scale development, DeVellis (2003) has discussed the sample size issues that should be considered for testing items during scale development (DeVellis, 2003). He mentions Nunnally's recommendation of 300 respondents being a fairly good number; however, he also thinks that the number of items and number of scales to be extracted also has a bearing on the sample size. According to him, a single scale comprising fewer than 20 items may need a sample size much lower than 300 respondents (DeVellis, 2003). Keeping in view the number of items (i.e., 25) we were testing and the exploratory nature of the study with no baseline available to estimate

effect sizes and power, we aimed to recruit a convenience sample of 150 families having a newborn to 3 years old child.

These families were selected through a multi-stage, random sampling technique. For this, four LHWs out of the 17 from Sagri were randomly selected and asked to share the list of families to whom they provided health education. From the pool of about 700 families thus obtained, we randomly selected 85 families with a child aged 1 to 3 years and 85 families with a child aged <1 year, all of whom were invited to participate in the study. In families that had more than one child aged 0-3 years, the youngest child was selected as the index child. A letter of invitation was sent to 170 families and those agreeing to participate (162) were visited for HOME observation. Out of the 162, we visited 153 families. The reasons for why a planned visit could not be conducted included unwilling grandmother (2), sleeping child (2), guests in the house (3), or mother and child gone for some urgent work (2).

Data collection

A trained researcher visited the household at the agreed-upon time and date arranged by the LHW. After obtaining written consent, the researcher administered the family demographic part of the questionnaire. If the respondent mentioned an additional caregiver or sibling contributing to the child's care, the person who most commonly provided childcare was also invited for observation. Depending upon their availability and convenience, the mother (HOME) and additional caregiver (HOME+) were observed jointly or separately. The perceived social support scale was administered to the mother after completing HOME. A gift containing household items worth PKR 300.00 (=~USD 3.00) was given to the family for their participation. Data collection was completed from

25th November 2012 to 12th January 2013. The study was partially funded through Provost Funds from the University of South Carolina (USC) and the ethical clearance was obtained from IRB of USC as well as Human Development Research Foundation Pakistan.

Measures

IT-HOME: The instrument was translated in Urdu and shared with six ECD experts engaged in community-based research in Pakistan for their perspectives regarding the adequacy of the translation and the cultural appropriateness of its various items. The protocol involved inclusion of the additional caregiver for 3 socio-emotional subscales (i.e., responsivity, acceptance, involvement). The additional caregiver where available and agreeable, was interviewed or observed for the same items as those for the mother. Items were scored with a value of 1 if present and a 0 if not present. For additional caregiver, a column was added on the response sheet next to that of mother, and a value of 1 or 0 was given in the same way it was done for mother.

A team of two field researchers who were already familiar with ECD concepts and had experience with field observations were trained to administer HOME. For inter-observer reliability, HOME was assessed in a sub-sample of 20 households, nine of which were extended family households. Two field researchers trained on administering Urdu-HOME performed a home visit together and independently observed the same home environment. After completing the visit, they had a meeting with the PI to discuss and compare their codes and build a consensus on codes that did not match. The process was repeated on three consecutive days during the early phase of data collection, wherein

6 or 7 families were visited each day, and a satisfactory level of inter-observer agreement was reached. As the items had dichotomous response options of 'yes' or 'no', inter-item correlations were calculated using the Kuder Richardson (KR-20) formula. The mean value of the inter-item correlation (alpha) was 0.84 for primary caregiver and 0.80 for additional caregiver while minimum and maximum value of this correlation for both was 0.60 and 1 respectively. In general, the items pertaining to observation of the physical environment (e.g., family has a pet) had 100% agreement while items about caregiver's speech or expression (e.g., parent voice conveys positive feelings towards child or parent converses freely and easily) received low agreement. The inter-observer agreement calculated by averaging the total of constituent items for each subscale ranged from 0.75 (involvement) to 0.91 (organization) for mother and 0.72 (involvement) to 0.86 (acceptance) for additional care. Please see appendix B-1 for details.

Data were converted both for HOME and HOME+ subscale and total scores. For every item scored as positive towards ECD development, a value of 1 was given while 0 was given if not present. These were added together to form the six subscales and the total scores. For the socio-emotional dimensions, three types of scores were created: mother only (traditional HOME), additional caregiver only (HOME+ supplementary questions), mother AND additional caregiver (HOME and HOME+ combined).

Family demographics: A brief questionnaire for administration to the mother or primary caregiver before the HOME observation included questions on the child's age (in months), parental education (schooling years completed), occupation, family type (nuclear or extended), and family size. For financial status, the LHW of the area was asked to categorize the families as rich, middle class, and poor, while the families were

asked about their monthly income in rupees. The data from two sources were triangulated to create 3 groups including very poor, poor, and middle class with respective income of ≤10000, 10000-20000, and >20000 PKR per month.

Additional care: A brief questionnaire was administered to the mother or primary caregiver before doing the HOME observation. Questions included the number of additional caregivers, their relationship with the child, the various tasks they performed for the child, and the amount of time they spent on these responsibilities. Similar questions were included about the siblings of the index child. These questions were asked independent of the perceived social support scale (see below).

Perceived Social Support: The Perceived Social Support (PSS) scale was adapted from the Multidimensional Scale for Perceived Social Support (Zimet, Dahlem, Zimet, & Farley, 1988) which assesses three key social categories: 1) Family including the extended family 2) Friends, and 3) Non-familial, significant person. The MSPSS has been adapted and validated in the context of an intervention study to enhance social support in order to treat peri-natal depression among Pakistani mothers (Sikander, 2009). The MSPSS scores had an inverse correlation with depression scores, suggesting its construct validity. We modified the MSPSS by asking the level of agreement (5-point Likert scale) from respondents regarding the availability (i.e., *There is [a family member/a friend/someone else] who can help me in childcare*), accessibility (i.e., *I can readily seek help from [a family member/a friend/someone else] with childcare*), and practical actions (i.e., [*A family member/A friend/Someone else] helps me with childcare issues*) from each of three social categories of potential support. The respondent mother rated each support category indicating the extent of agreement with 1 equal to high

disagreement and 5 equal to high agreement. Initial interviews revealed that the availability and accessibility items about 'friend' were causing confusion for the respondents; hence availability item for friend was dropped. The final score for each item ranged from a minimum 1 to a maximum of 5. Scores for each potential support category were calculated by averaging the total of constituent items for that category. Cronbach's alpha value was 0.83 (Non-familial significant person), 0.85 (family), and 0.98 (friend).

Quantitative Data Management

Data were managed and analyzed using SPSS, version 16.0 for windows (SPSS Inc. 2008). The codebook was prepared using the survey items. In SPSS, columns represented variables and rows represented observations. Data were entered into SPSS and examined for missing cases. After entering the data, the dataset was cleaned which involved the detecting, diagnosing, and editing of incorrect entries. After cleaning the data, the data were inspected using frequency distributions and graphical representations of distributions.

Cross tabulations and correlations (Spearman, Pearson, depending on variable types) were examined among key study variables. Significance was set at the alpha level of 0.05. The descriptive statistics and cross-tabulation results are summarized in-text and/or in tabular form in Chapter 4.

Specific analyses

Hypothesis 1: For hypothesis 1, i.e., the socio-emotional subscale (responsivity, acceptance, involvement) scores as well as the total scores of extended family households will be higher than nuclear among the entire sample (n=153), mean scores were compared using independent sample t-test. The type of family was treated as

independent, and subscales as well as the total scores were treated as dependent variables. Scores both from HOME and HOME+ approach were used for this analysis.

Hypothesis 2-5: These hypotheses were tested on the analytical subsample (n=94) of households where both mother and additional caregiver were observed. Mean scores were used to carry out with independent sample t-tests for all these hypotheses. For hypothesis 2, mean scores of children <1 year were compared with children >1 year. For hypothesis 3, mother's and father's educational level were categorized into low (≤ 9 years schooling) and high (≥10 years schooling) to compare the difference in child's environment because of difference in parental education levels. For hypothesis 4, family income was categorized into low (≤ 19,000 PKR) and high (>20,000 PKR) while hypothesis 5 was tested between households having no older sibling and with older siblings. All these comparisons were conducted three separate times: 1. using mother's scores (HOME); 2. Using only the data from additional caregivers (i.e., the supplemental questions developed for this study); and 3. Combined scores of mother plus additional caregiver (HOME+).

To further assess hypotheses 2-5, we examined bivariate associations of family characteristics, i.e., child's age, gender, parental education, family income and perceived social support with HOME and HOME^{+} by computing Pearson correlation coefficients. Finally, to examine the combined effect of variables on HOME and HOME+, adjusted linear regression models were used. The fully adjusted models included child's age, gender, mother's education, father's education, family income, presence of older siblings and perceived social support. For the fully adjusted models, R^2 values were estimated to evaluate the explanatory power of selected predictors.

Sensitivity analysis: Past studies have treated HOME scores both as categorical ("high" and "low") and continuous variables in their analyses (Rijlaarsdam, 2012; Aboud, 2007). A sensitivity analysis was carried out to decide which method (i.e., categorical or continuous) will be used for this study. For this, the dependent variable, i.e., subscale and HOME as well as HOME^{+} scores were dichotomized into "high" and "low" categories. As suggested by past review (Totsika & Sylva, 2004), below the 25th percentile score was considered as "low" and above 75th percentile as "high" scores for this categorization. As shown in sensitivity analysis tables (appendix B-2& B-3), comparison while using dichotomous variables produced same results as when continuous variables were used.

A similar sensitivity analysis was carried out for HOME^{+} scores by giving half weight to the scores given for the 3 subscales on which additional caregiver was observed. These half weighted scores of 3 socio-emotional subscales were added to the remaining 3 cognitive environment subscale scores to compute half weighted HOME^{+} scores. These half weighted scores were compared with full HOME^{+} scores as well as with HOME scores. Consistent pattern of results was seen with half weighted HOME^{+} scores as with full HOME^{+} scores (appendix B-4).

CHAPTER 4

THINK INSIDE: PERSPECTIVES OF COMMUNITY HEALTH WORKERS AND MOTHERS ABOUT THE IMPLEMENTATION OF AN EARLY CHILDHOOD DEVELOPMENT PROGRAM IN RURAL PAKISTAN[1]

[1] Haq, Z., Thrasher, J.F., Saunders, R.P., Billings, D.L., Rahman, A.S., and Frongillo, E.A. To be submitted to *Social Science and Medicine.*

Abstract

Parenting programs can promote early childhood development (ECD), and program delivery through community health workers (CHWs) is a promising strategy in resource-poor countries. Calls have been made to integrate ECD into existing CHW programs for implementation at scale. Through a qualitative phenomenological study, we aimed to inform this integration by understanding the perspectives of CHWs and mothers about the implementation of an ECD intervention within a CHW program in rural Pakistan.

Twelve Lady Health Workers (called LHWs instead of CHWs in Pakistan) and 18 mothers who participated in the early phase of a randomized trial were interviewed. Semi-structured interviews addressed their daily environment and routines; understandings of ECD curriculum content and recommended counseling practices; and the integration of the intervention into their daily routines. The commitment of LHWs to work, their willingness to learn and take on additional roles, and acknowledgement of their work by the mothers was favorable for implementation. Factors that impeded implementation included changes in LHW job responsibilities without her knowledge and involvement, and the lack of support from staff of the healthcare facilities. For mothers, the support provided by the family and the LHW facilitated while lack of involvement by the family hampered this integration of new activities into their daily lives. The professional and domestic environments of LHWs and mothers are dynamic and, as such, should be addressed on an ongoing basis, as a new program moves through various phases. This attention to the details of implementation is important for effective program delivery to achieve the overall goals of CHW programs including child health and development.

Introduction

There has been enormous interest in developing the evidence on the most effective ways to promote early childhood development (ECD). It is well known that appropriate nutrition and psychosocial stimulation during the first three years of life can have long-lasting effects on brain structure and function (Thompson & Nelson, 2001). Not all children in the world, however, receive adequate nutrition and psychosocial stimulation during this period. McGregor and colleagues' systematic review about the potential of ECD highlighted the particular salience of this issue for the 217 million disadvantaged children in low and middle income countries (LMICs), including 155 million who are stunted and 62 million who are not stunted but living in poverty (Grantham-McGregor, Cheung, Cueto, Glewwe, Richter & Strupp, 2007).

Several intervention strategies have been tested in LMICs to foster child health and development (Engle, Black, Behrman, Cabral de Mello, Gertler, Kapiriri et al. 2007; Engle, Fernald, Alderman, Behrman, O'Gara, Yousafzai et al. 2011). Among them, home visitations for parental education have consistently been effective in various countries, including Jamaica (Grantham-McGregor, Walker, Chang & Powell, 1997), Bangladesh (Nahar, Hamadani, Ahmed, Tofail, Rahman, Huda et al. 2008) and Brasil (Eickmann, Ana, Guerra, Lima, Pedro, Huttly et al. 2003), where interventions achieved medium to large effect sizes. Engaging lay health advisers for home visitations has been a predominant feature of effective interventions. According to one systematic review, eight out of nine studies engaged lay health advisers, mostly community health workers (CHWs) belonging to the community outreach programs of the health delivery system (Walker, 2011).

Owing to the lack of human resources in the health sector, as well as the low and disparate use of health services in LMICs (Schellenberg, Victora, Mushi, de Savigny, Schellenberg, Mshinda et al. 2003), CHWs are an effective mechanism for the delivery of primary-care interventions (Singh & Sachs, 2013). Large-scale CHW programs are being implemented or considered in various LMICs (Haines, Sanders, Lehmann, Rowe, Lawn, Jan et al. 2007; Lewin, Babigumira, Bosch-Capblanch, Aja, Van Wyk, Glenton et al. 2006). In some of these, CHWs involvement has successfully addressed challenges like newborn mortality and peri-natal depression (Baqui, El-Arifeen, Darmstadt, Ahmed, Williams, Seraji et al. 2007; Rahman, Malik, Sikander, Roberts & Creed, 2008), and their use in ECD interventions is a logical extension of these successes.

The growing interest in engaging CHWs is consistent with reviews of characteristics of the most effective ECD programs (Engle et al., 2011). ECD interventions appear to produce better results if they involve CHWs instead of volunteers, have a frequency of fortnightly visits compared to monthly visits, and a visit duration of at least half an hour (Walker, Wachs, Grantham-McGregor, Black, Nelson, Huffman et al. 2011). Among the efficacious interventions, however, very few have been scaled up and half of these have resulted in lower effectiveness than when implemented at smaller scales (Engle et al., 2011). Research on approaches to the delivery of feasible and effective ECD programs at scale has been recommended in order to enhance program effectiveness (Baker, Kupersmidt, Voegler-Lee, Arnold & Willoughby, 2010; Engle et al., 2011; Griffin, 2010). Specifically, there is a great need to determine the characteristics or the context of CHWs that could influence the success of such programs

in order to address these characteristics as part of intervention development and implementation (Walker, 2011).

Study context

To fill the aforementioned gaps, we examined the initial phase of a CHW-delivered ECD effectiveness trial called the Sustainable Program Incorporating Nutrition and Games (i.e., SPRING). SPRING is being implemented in India and Pakistan; however, the present study focused only Pakistan, where lady health workers or LHWs (the official title of CHWs in Pakistan) have conducted the community outreach program within primary healthcare since 1994. Based on extensive formative research, SPRING engaged LHWs to test the inclusion of a new ECD component that focuses on maternal well-being, nutrition for mothers and young children, and child stimulation through interaction and play (Lingam, Gupta, Zafar, Hill, Yousafzai, Iyengar et al. 2013).

The LHWs received six-day training on intervention implementation, including five principles for intervention delivery: 1. Empathic listening (i.e., putting herself into mother's shoes while trying to understand her problems); 2. Family involvement; 3. Dialogue through pictures; 4. Behavioral activation (i.e., suggesting actions to mother and the family that would help initiate the desired behavior); and 5. Problem solving (Zafar, Sikander, Haq, Hill, Lingam, Skordis-Worall et al. 2013). The LHWs received picture cards for use as communication tools during their household visits, and a monthly supervision session was included to allow them to seek advice on any problems faced (Table 4.1). SPRING expected that LHW visits would enhance the childrearing practices of mothers and their family, which would ultimately improve physical growth

and mental development of their children (London School of Hygiene and Tropical Medicine, 2013).

The study was conducted in union council Bhelpur (name anonymized), sub-district Gujar Khan of the district Rawalpindi. This rural sub-district with a geographical area of 1,466 km^2 (566 sq mi) and a population of approximately 750,000 (Government of Punjab, 2009), has a population density of about 49.7/km^2 (129/sq mi). The population speaks Punjabi with Potohari and Hindko being the predominant dialects. The majority of the population is dependent on subsistence farming, supported by earnings of one or more of the adult male members employed in the public or private sector service in nearby Rawalpindi city (43 Km or 27 miles) or serving in the armed forces. The socioeconomic status of these families generally depends on their landholdings, the number of adult males in the household, and the nature of their jobs.

We proposed that a number of characteristics related to LHWs (e.g., workload and job satisfaction) (Haq, Iqbal & Rahman, 2008; Jaskiewicz & Tulenko, 2012), mothers and their families (e.g., family support), and other forms of social support (Heaney C & Israel B, 2008) could influence the integration and, ultimately, delivery of the intervention within the home environment (see Figure 4.1). Our study focused on exploring the views of LHWs and mothers about the context (e.g., their professional environments, daily routines), as well as the specifics of intervention implementation and its relationship to this context. These specifics include reach (i.e. program coverage), dose and fidelity (i.e. how much and with what quality is the intervention implemented and received), adaptation (i.e. why and which part of content was modified), and integration (i.e. fit of the new practices into the pre-existing routines). Studying these

characteristics in relation to implementation will help in drawing lessons for large-scale delivery of programs that rely on LHWs and, more generally, CHWs.

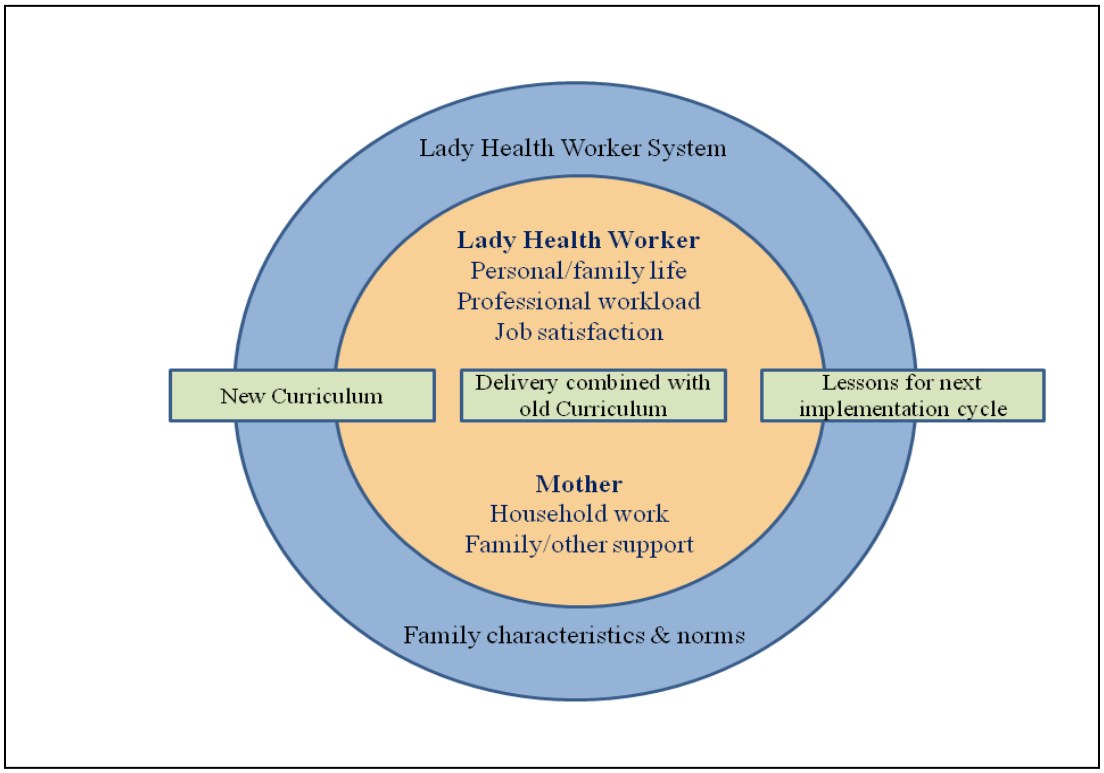

Figure 4.1: Conceptual framework for integration of an ECD intervention into lady health workers program in rural Pakistan.

Methods

Keeping in view the study objectives, a phenomenological approach with individual, semi-structured interviews was adopted for this qualitative inquiry. Phenomenological research explores the meaning that several individuals place on a phenomenon of interest and focuses on the lived experiences related to this specific concept (Cesswell, 2013). As part of the intervention development team, the principal investigator (PI) shared the research team's perspective. However, he did not have any

role during the training sessions of LHWs so that the study participants could view him as a neutral observer and social desirability in their responses could be minimized. Individual interviews were conducted to allow for individual context and perceptions to arise, as group settings may have inhibited expression of these perspectives. A team of two participated in each interview, one as the interviewer and the other as the note taker. For LHW interviews the interviewer (male) and the note-taker (female) visited the LHWs at their homes, as preferred by them. A female team member was necessary to address the cultural sensitivities that might impede rapport with respondents. Interviewing mothers by a male was culturally inappropriate; hence two female researchers with significant experience with anthropological studies conducted the interviews. The interviewer obtained written consent, conducted the interview, and digitally recorded the interview, while the note-taker took detailed verbatim notes of the discussions. A small monetary amount (300 Rupees 300 ~= $3 USD) was paid to all participants as a compensation for their time.

The data collection was carried out from September 4, 2012 to December 22, 2012. Ethical clearance was obtained from the Institutional Review Board (IRB) of the USC as well as from Human Development Research Foundation; the local organization in Pakistan.

Study sample

All participants to a phenomenology study should have experienced the phenomenon of interest, which was the case in this study (Cesswell, 2013) . All LHWs (n=13) belonging to the union council Bhelpur were trained in the SPRING protocol and invited to participate in our study, which involved two interviews: one immediately after

the training, but before program implementation; and a second interview three months later, after they had completed at least three monthly visits to target families. Using the new curriculum, these workers delivered visits to women who were either pregnant (5 months or more) or mothers of infants (0-6 months), participating in the early phase of the trial. Interview guides addressed implementation context based on the conceptual model of the study (Figure 1). To examine LHW work context in the interviews conducted immediately after training, LHWs were asked about how they viewed their professional lives and work, especially around the area of child health and development; their perceptions about integrating new work activities, in general; and their feedback about the newly-learned ECD curriculum. The second round of interviews, carried out after LHWs had done their visits with the new curriculum for three months, focused on the constructs of reach, dose, fidelity, adaptation and integration (without using this jargon, but expressed in terms that were most relevant to the implementation context and components of SPRING).

To recruit mothers, four LHWs were purposefully selected based on their performance, accessibility and work in four different villages. These LHWs were asked to identify women who were pregnant and who were mothers of newborn to six-month-old infants. Within each of these categories, we aimed to include five participants who LHWs saw as "performing well" and five who were "not performing well". As it happened, the LHWs could not identify enough mothers who were not performing well, so we ended up interviewing 12 well performing and 6 not well performing (total=18) mothers. The interview guide for mothers focused on any changes she had made to her own or her child's routine during the prior months and the context in which this change

was made especially focusing on the recent LHW visits. Mothers were interviewed once they had received 2-3 visits that should have included delivery of the new curriculum.

Analysis

All interviews were transcribed from the audio file using in-page computer software for the Urdu language. Data compilation was done by reading the transcripts and field notes, and clarifying information where required, with the help of audio recording. Compiled transcripts were data which the PI and another member of the research team analyzed and manually coded. They agreed on an initial uniform method of coding, which was informed by key concepts that the interview guide aimed to explore, following which they independently analyzed the data, and then met again to discuss additional emergent codes. The agreed coding scheme was applied to all transcripts including further identification of emergent subthemes. Manual coding was done on the transcripts to identify the significant statements across individual interviews. Subsequent readings of the significant statements helped in identifying meaning units or sub-themes emerging within these patterns. "Horizontalization" (Moustakas, 1994) of data was achieved by displaying the sub-themes in the form of a matrix in which left hand column represented each type of respondent, while right hand columns represented subthemes under each broad pattern, emerging from discussions with each respondent. Employing constant comparison (Patton M Q, 2002), the convergent subthemes were then grouped as themes emerging from discussions with a specific type of respondent. Equal attention was given to the divergent themes; points that were not shared by majority of respondents but were significant (Miles & Huberman, 1994).

Data were triangulated by comparing themes emerging from discussions with LHWs and mothers as well as from different data sources (e.g. interviews and intervention curriculum) to analyze the intervention intended versus delivered (Maxwell, 2005). The findings were shared with members of SPRING team and with LHWs in the subsequent meetings to ensure respondent validation (Maxwell, 2005).

For presentation of thematic findings, both *textural* and *structural* descriptions (Moustakas, 1994) are used in the results section. Textural descriptions are significant statements used to write what the participants experienced. Structural descriptions are the interpretation of the context or setting that influenced participants' experiences. All of these are being presented under the four thematic headings. The essence of these findings is presented in the discussion section.

Results

Eleven of the 13 LHWs participated in the first while 12 in the second round of interviews. The participants were from 23 to 50 years' old, had from 8 to 12 years of schooling and from 3 to 18 years of work experience, and most of them were married and had children. Each LHW was responsible for 130 to 198 families, carried out 6 to 7 household visits every day, spending 15-20 minutes with each family prior to SPRING. The LHWs (two in 1st and one in 2nd round) that could not participate had similar socio-demographic characteristics. The reasons for their inability to participate were traveling out of town or personal/family commitments during the interview days. Eighteen mothers were interviewed who were 23 to 32 years of age, nine of whom were pregnant and nine had a child aged 0-6 months. The average schooling of these mothers was 9 years (range 0-16 years), and in terms of implementation of the new intervention, 12 of

these mothers were described by the LHW as "performing well" and six as "not performing well."

The following four themes emerged from the qualitative data analysis: the broader context, learning the new innovation, implementation, and integration, which are presented below along with related subthemes.

Broader context

LHW and her community

Having grown up in the same communities in which they worked, the majority of LHWs joined the program because of their interest in helping their communities, especially mothers. These LHWs viewed their primary responsibility as providing health education to mothers and their families. They felt respected by their communities and saw their work as having helped their communities change for the better. Improved rates of breastfeeding and child spacing were specific achievements that some mentioned as worthy of celebration:

> *"I joined the program 17 years ago. I can tell you that people's lives have gradually improved and so has our respect. For example, kahndani mansooba bandi (birth spacing) used to be a taboo subject. Not anymore! Many families do practice it now and talk to us about whatever concerns they have."* (LHW, aged 40 years)

The respondent mothers generally echoed the high esteem in which LHWs are held, considering that LHWs have made important contributions to their own and their childrens' lives and health:

> *"More than half of what I do as a mother comes from the Baji (LHW). Even though I am educated, read newspaper and watch TV; Baji is the main source of health information for me."* (Pregnant woman, aged 27 years)

Mothers also reported that the usual focus of the LHW visit was their own and their child's health, although other household members were also attended by the LHW for minor health problems.

Control over work and level of motivation

The primary function of a LHW is to educate about optimal health behaviors during household visits. They visit five to seven households a day but the frequency and quality of these visits get undermined when their parent program requires additional tasks, like mass vaccination for polio. For example, talking about the past three months, the LHWs shared that a significant amount of time was spent on activities that were required by their parent program, above and beyond their routine schedule. Nevertheless, they carried out visits incorporating the SPRING curriculum when a pregnant woman or mother of an infant was available. One LWH described competing demands of new responsibilities:

> *"We had polio day activities throughout the past three months except November; the month when we had the MCH week. So, about a month and a half was taken*

by other activities and little time was left for our scheduled visits to the household." (LHW, aged 23 years)

Some LHWs believed that consultation with them about new responsibilities could be helpful to their communities, as problems that might accompany carrying out these responsibilities could be highlighted and, ideally, addressed. Almost all of the LHWs shared that their parent program increased their work responsibilities and protocols without consulting with them:

"Since the time I joined, many things have been added. For example, new family planning methods, dengue fever and eye problems; all of which bring new work. I have never been consulted about new things. I come to know about these when we get new trainings." (LHW, aged 23 years, work experience: 3 ½ years)

Most LHWs had the support of their own families, but they did not usually feel equally respected and supported by the health facility staff and parent department. A worker shared:

"How can we perform if our work is seen [by supervisors] suspiciously without a reason, if the salaries are going to be cut or delayed, or if the doctors won't pay attention to a patient brought by us? Where will the trust come from? Why would our community listen to us?" (LHW, aged 40 years)

Hence, inadequate support from the health department can negatively influence community member perceptions of LHWs and their work. When discussing other issues that dampen their work motivation, the LHWs shared that some mothers did not follow their recommendations because of the domestic workload, poverty or cultural beliefs and

taboos. Consistent with LHW's concerns, about half of the respondent mothers reported that their domestic workload did not allow them to take care of their own health. Most of these mothers belonged to the "not performing well" category. Taking care of children was a mother's main responsibility but domestic chores like cooking and washing often took precedence over childcare, as well. For the other half of respondent mothers, their domestic workload was alleviated by their family members or a house maid.

Learning the new curriculum

When discussing the new ECD component, the LHWs voiced appreciation for the curriculum, its counseling methods, and the respectful attitude of the SPRING team towards them. They frequently recalled two of the three components of the intervention and four of the five principles of the new counseling approach. Among the intervention components, LHWs did not mention nutrition, and neither did they mention behavioral activation, one of the principles of counseling. The LHWs liked the instructional materials including the counseling cards (i.e., picture cards to facilitate discussion with mother) and health calendar (i.e., pictorial messages in the form of a booklet for mother), and they anticipated these materials would facilitate their discussions with mothers:

> *"Tasweeri kitabcha (counseling cards) seems to be the best. Simple talking to mothers takes longer but pictures will facilitate talking as well as understanding. People are receptive and get impressed when they listen about new things from us."* (LHW, aged 50 years)

Before the intervention, LHWs anticipated that some intervention elements would be challenging to implement. For example, the SPRING approach relies on

bringing all family members to the table and ensuring their support for the mother and the child. Based on their past experience, the LHWs mentioned that most husbands in their communities were not available at home during the day time:

> *"Husbands are usually away for work. If we try our visit in the evening when they are back; it is difficult saying to a tired man to do something for the wife or to play with a child. On weekend, they have other tasks waiting and besides that, going to meet especially with males is not seen as an appropriate thing here."* (LHW aged 40 years, work experience 18 years)

Overall, however, the LHWs seemed to have learned the primary components of the innovative intervention and were well-prepared to move to its implementation phase.

Implementation

Reaching out the mothers and families

For ECD sessions, the LHW visited 10-15 families each month. A family of focus was one with either a pregnant woman, or a mother of infant aged 0-6 months. Of all the families for which LHWs were responsible, the number of families belonging to these two categories differed across LHWs, ranging from 3-10 (pregnant) and 2-11 (mothers of infants). Household visits to deliver the ECD intervention lasted an average of 30 minutes, ranging from 15 minutes to one hour. These visits and their duration were corroborated by the mothers in their interviews.

The LHWs shared that they were able to visit all mothers that they planned during the study period. No families refused the visit; however, they did have to adjust

timing of the visit for some families, which is customary. The LHWs reported variable experiences with families. While the majority of families were receptive to the new information and practices from the intervention, some of them were not. As anticipated, husbands were not usually available and other family members who were at home chose sometime not to participate:

> *"Some of the families do not understand the need for mother's health or wellbeing. It does not occur to them that a mother's physical and mental health is important, and her tensions can get transferred to the baby."* (LHW aged 40 years, work experience 12 years)

These were the families reported by the LHWs as "not performing well", which they often explained by pointing to the sensitive domestic relationships or a stereotypical bias towards the daughter-in-law by other family members.

Amount of the new content delivered

When asked about the amount of new curriculum that LHWs were able to integrate into their visits, they spoke about maternal wellbeing followed by infant's nutrition during their visits. They also talked about the importance of stimulation provided to the baby through various play activities:

> *"I have been talking about khushhaal maan (maternal wellbeing), then about the nutrition of both mother and the child and about understanding and carrying out some of the play activities."* (LHW, aged 50 years)

Some visits were not ideal for full delivery of intervention content. This happened where family members did not take interest or where some other activity was going on because of which the LHW had to curtail the content of that specific visit. For complete delivery of intervention components, it was necessary that both mother and child and some family members were available, and that the child was not sleeping. In reality, this proved difficult for some LHWs to have all three awake and available at the same time, which occasionally led to dropping some intervention content (e.g. play activity where a child was sleeping). A LHW shared:

> *"Play activities especially with newborns were difficult for us as well as for mothers. Many a times babies were asleep and waking them up was not appropriate. We had to go again for this part of the visit but this was not always possible."* (LHW, aged 39 years)

All mothers reported that their LHW regularly visited them during the past 3 months. Most of them received some book or picture cards from the LHW. Only a couple of mothers reported that they did not receive any book from their LHW nor was the LHW using any pictures while talking to them during a visit.

Quality of delivery

The LHWs reported using the picture cards for various steps during a visit. They recalled talking about different components of the intervention (i.e. maternal wellbeing, nutrition and responsiveness to child) while using the picture cards during their visits. A LHW shared the usual flow of her visits:

"I begin the visit by listening to the mother.... I use tasweeri kitabcha (picture cards) for this discussion. When I show them pictures, it becomes easy for them to understand and talk. Having family members while we discuss mother and child is beneficial as it helps build trust in our visit and in overall work that we are doing for mother and child." (LHW aged 40 years)

The LHWs mentioned the steps they learned for a complete visit including family involvement, listening from the mother, talking to her through pictures and problem solving. The step of "behavioral activation," in which nutrition and play tasks are broken down to smaller steps and carried out during the setting of a visit, was not mentioned.

Majority of the mothers reported that LHW used picture book while talking to them. These mothers reported that LHWs involved other family members during the visit and that her interaction was usually very useful:

"I like talking to her....just like you talk to a friend. She (LHW) shows me the pictures and asks questions about them. We discuss till I understand. With pictures, I understand much better." (Mother, aged 30 years)

The involvement of all family members also appeared to be a time consuming activity, however, and was not possible at certain times. *"Getting family members together, listening, showing pictures and finally giving out messages do take time. Sometimes I just leave the messages for family members when time is short"*, reported a LHW with 16 years of experience who tried to address this issue.

Changes made to the visit protocol by LHW

The LHWs had to make some changes to the sequence or content of visits in accordance with the family situation. Factors that led to this modification included domestic sensitivities (e.g. a dominant mother-in-law taking precedence for the initial part of the visit), poverty (low-cost alternatives like lentils and home-made toys in place of costly foods or shop-bought toys), unavailable husbands (leaving the message for husbands with wife), and child's routine (not doing a mother-child play activity if the child was sleeping). For example, one LHW shared:

> *"We cannot start our visit if the family is into a discussion or an argument. Sometimes the visit has to be postponed. We were taught to begin the visit from the focus mother but in a household, if the mother in law is dominant; we start from her and make her comfortable with the process."* (LHW aged 50 years, experience 16 years)

At times, the change meant not doing the suggested action at all. For example, in case of nuclear families, the husband was away working most of the time, and no other family member was available for talking about family support.

Integration

Combining new knowledge with old visits

The LHWs integrated the new intervention content into their preexisting routines for household visits and reported giving about two thirds of a visit's time to the new and one third to the old content. They saw the new intervention as consistent with

what they had been doing already. They felt that talking about the new thing (i.e. "development") in addition to the old topic (i.e. "health" of the child) contributed an additional layer of meaningfulness to their communication:

> *"I have been doing these visits during past months and am fully confident that I can do this in future. The only requirement is some extra time and being able to respond to questions that families have."* (LHW, aged 24 years)

Some LHWs also shared their concerns about the amount of time that an integrated visit took. With additional things (e.g. pneumonia and other respiratory infections during the interview days) to talk about, little time was left for adequate content delivery about ECD. Similar views were expressed about supervision meetings, which some workers thought were taking too much time and should be done separate from the routine supervision meetings:

> *"Even the initial part of the ECD visit, if conducted properly, takes at least 15 minutes because I have to get mother, baby and family members together, show pictures, listen to their views about the picture, and then move on."* (LHW, aged 23 years)

Changes observed

The LHWs reported that mothers and families appeared to understand and adopt the recommended behaviors of taking care of the mothers' nutrition, her wellbeing, and being responsive to the child. Although a few LHWs also shared that some families did not seriously consider maternal wellbeing; most families seemed to understand and adopt this change:

"Mother in law and other family members have become supportive to mother and child. They spend time and engage in talking and playing with the child." (LHW, aged 24 years)

Some mothers reported that after having participated in these visits, their family members tended to fulfill the roles discussed during an LHW visit. For example, family members could remind the mother about consuming fruit or milk, or accompanied her for antenatal checkups, as reported by this mother:

"Yes my family agrees to what LHW says and things become much easier when everyone in the family is in agreement. With my family's support, I get enough food and rest, a helper that will accompany me during delivery, and peace of mind." (Pregnant woman, aged 25 years)

Pregnant women in their interviews reported that they had recently made changes to their diet and rest schedule, started using the iron/folate tablets that SPRING recommends, and were going for antenatal checkups. Half of the lactating mothers stated they were exclusively breastfeeding their child and intended to do so till the child reached 6 months of age. "*I have been going to doctor for check-up and eating more as advised*," said one pregnant mother. A few mothers, however, also said they did not make any changes nor did the LHW say anything about the need to do so. From those who did make a change, we also asked reasons for making changes to their or their child's routine. All the mothers mentioned the role of their LHW in facilitating this change.

Discussion

Our study highlights a number of contextual factors that may influence the integration of a new ECD innovation into the LHW program in Pakistan. Key enhancing factors included community acceptance of LHWs, the commitment of LHWs to their work, especially to maternal and child health, their willingness to learn and take on additional roles, and their positive attitudes towards incorporation of new communication materials and activities into their preexisting work. Challenges included increasing LWH job responsibilities without their knowledge or involvement leading to reduced time for effective delivery of visit, occasional behaviors of health facility staff and LHW superiors that decrease their motivation level, and non-availability of husbands for participation during LHW visits to the household.

These results are consistent with a recent study that identified characteristics of effective CHW programs, including manageable workload, supportive supervision, supplies and equipment, and respect from health system and the community (Jaskiewicz & Tulenko, 2012). Our results are also consistent with suggestions that CHWs can work optimally if they are included in decision-making, development of training module, and intervention adaptation to ensure its cultural appropriateness (Dower, 2006), while also improving their communication capacity and ongoing mentoring (Ariff, Soofi, Sadiq, Feroze, Khan, Jafarey et al. 2010; Haq & Hafeez, 2009). Addressing these contextual factors can enhance program delivery and effectiveness (Bhattacharyya, 2001; World Health Organziation, 2007).

Our study also indicates that mothers view the LHW and family support as important for taking adequate nutritional and psychological care of the child. Mothers whose workload was shared with family members appeared to be clearer and more focused on their role as a caregiver, and LHWs reported that their families were performing well compared to families of less supported mothers. LHWs, too, were better able to engage families that already realized the need for sharing the workload of a pregnant or lactating mother, while facing difficulty in families where domestic relations were less favorable. Family environment is crucial for adequate nutrition, optimal health and early neuronal development of the child (Irwin LG, 2007; Shonkoff, 2003), and creating an optimal family environment is key to successful outcomes of programs like SPRING (Walker et al., 2011). Programs like SPRING should monitor that this objective is adequately addressed on a consistent basis.

We also delved into various implementation aspects that are crucial for achieving objectives like involving family members and being responsive to the child over the course of the program. For example, *reach* is the degree to which the intended audiences participate in the program, and is usually measured by attendance records (Linnan & Steckler, 2002). We relied on reports by LHW and mothers that LWHs recommended for interviews, who indicated that LHWs visited households to deliver the new curriculum.They were generally not able to reach husbands because of social reasons (e.g., being away working), however, and some family members did not get involved because of domestic sensitivities (e.g., unpleasant relations with daughter-in-law). LHW trainings should focus on strategies for dealing with such families. For example, LHW can identify a senior female member of the household where husband is not available

during the visit, and leave the "message" for him. A child could be made the focus of a visit instead of mother in families where domestic relationships are turbulent.

Dose is an another important aspect of implementation (Saunders, Evans & Joshi, 2005). Dose delivered is the number or amount of intended units delivered, while dose received is the extent to which the intended audience uses materials or recommended resources (Linnan & Steckler, 2002). The LHWs reported being able to deliver most of the intervention, albeit in a hurried manner. The frequency and duration of visits is important for adequate dose delivery and reviews of ECD interventions recommend fortnightly visits of CHWs with a visit duration of at least half an hour (Walker et al., 2011). The LHWs in Pakistan, as per their job description, carry out monthly visits, and SPRING did not change this visit frequency; a step that ensured integration. Effective delivery of the intervention also required adequate time for SPRING visits. Before SPRING, the LHWs were spending 15-20 minutes with each family, as part of their time was being consumed by other duties. Addition of SPRING activities requiring 30 minutes for effective delivery posed a challenge to these workers and to long-term sustainability of the intervention. Freeing the LHW from responsibilities other than household visits coupled with a training emphasis on key elements of a visit could enhance complete delivery.

We examined *fidelity* by asking whether or not the five steps of intervention delivery were being practiced with the same order and quality as in the LHW curriculum. The LHWs reported implementing all but one step (i.e. behavioral activation), although they had to change the sequence of these steps at times. According to LHWs, maintaining the same sequence was not always possible, as when the concerns of a mother-in-law

about the visit had to be addressed before beginning to talk to the focus mother. More importantly, however, the principle of behavioral activation was missing from the visits. Behavioral activation involved breaking down tasks into smaller activities and having mother and family members practice so that a "behavior" is introduced instead of leaving just a "message." In addition to the short time, a practical difficulty in behavioral activation concerned requirements that the child be awake and accessible. This difficulty could be offset by supplementing the visits with a monthly group meeting of participant mothers and children where new play activities, food recipes, and feeding techniques are shared and practical coaching provided (Aboud, 2007; Aboud, Singla, Nahil & Borisova)

LHWs engaged in intervention *adaptation* when improvising modifications to best fit the context of a visit. Past reviews suggest that interventions change during their course and study designs and reporting (e.g. consort) should include information on this change (Cohen, Crabtree, Etz, Balasubramanian, Donahue, Leviton et al. 2008). They suggest that adaptation and fidelity can co-occur and programs should carefully document the adaptations rather than taking them as a failure (Durlak & DuPre, 2008). The implementation literature of ECD interventions is usually devoid of this vital documentation. Where available, it is incomplete, as details on the different kinds of modification are not provided (Sanford DeRousie & Bierman, 2012). In our study, the LHWs made changes or adapted the visits to address the antecedent factors like domestic sensitivities, socioeconomic condition, and religious rituals. SPRING and other similar studies are likely to benefit from allowing a certain amount of flexibility yet documenting it to ensure that essential elements of their intervention are delivered as intended.

Furthermore, future research should aim to better understand whether encouraging specific adaptive strategies enhances study outcomes.

With a few exceptions, the LHWs were able to *integrate* ECD activities into their preexisting household visits. This happened while some significant changes were taking place to the overall LHW program. The federal ministry of health along with preventive programs including LHW program were decentralized under a constitutional amendment (Nishtar & Mehboob, 2011); the LHW's status was changed from semi-volunteer on a stipend to regular employee without due consideration to the affordability of this change; and the LHWs and other field workers involved in the polio eradication were being targeted by terrorist groups (Riaz & Rehman, 2013). Despite these changes, LHWs were able to integrate a new intervention into their preexisting work, which provides further proof of the resilience of the LHW program and the strength of the new intervention.

A few limitations of this study are worth mentioning. We could not assess implementation of the whole program as we were focusing on a purposively selected subset of the population from the early phase of the program. We explored the views of LHWs and mothers and could not include other perspectives like those of LHW program managers, which could have brought a more comprehensive picture. We tried to explore the "emic" perspectives of LHWs and mothers but given the relationship of study team, the social desirability of their responses cannot be ruled out. Similarly we tried to include mothers with various experiences of implementation, but we interviewed fewer mothers who LHWs reported were not receptive to or influenced by the intervention. This may have resulted in meeting with more mothers who were positively deviated and likely to

change, and our getting an overstated impression of the ability of SPRING to be integrated and implemented. Lastly, the three-month period of implementation we studied was short; similar explorations should be conducted over a longer period and with wider populations, in order to better illuminate the integration of the program into LHW work.

CHWs are a critical resource that can integrate and deliver relatively complex public health interventions, however, their motivation level and system support are essential requirements for effective program delivery, as is the need to attend to and balance changes in their job responsibilities and daily routines. Given the short amount of time which they often face for a visit, their trainings should emphasize on key areas of a visit that must be delivered within a limited time. Moreover, their skills to handle difficult families and situations should be improved. Lastly, a degree of flexibility to enable the CHW to adapt the visit is desired, yet the program should have the first-hand knowledge about the amount and quality of intervention content being delivered during their visits. Addressing the contextual changes that may influence the implementation is important for effective program delivery to achieve the overall goals of CHW programs including child health and development.

Table 4.1: Early childhood development intervention components, practices, and materials

Program area	Brief description
Intervention components	• Maternal wellbeing: Achieving a wellness status of mother; both physically and psychologically • Nutrition: Providing adequate nutrition to the mother and the child • Responsiveness: Providing a stimulating and learning environment to the child through love, affection and play
Intervention delivery approach	• Family involvement: Using the shared agenda of the child's optimal development, the LHW engages with husbands and mothers-in-law • Empathic listening: The LHW actively listens (conveying interest and empathy, giving feedback) the mother as well as family members • Guided discovery: Using characters of mothers, infants and family members shown on the counselling cards, the LHW helps mothers and families discuss deeply held beliefs and undesired behaviours without alienating them • Behavioural activation: A structured approach of breaking tasks into small manageable activities, and then coaching the mother and family members so that they are able to carry out these activities on regular basis • Problem solving: Taking the time to listen to problems, and then working with the clients and their families to generate solutions
Materials	• LHW manual: A training manual for health workers with step-wise instructions for every visit • Counselling cards: Pictorial cards to use during home visits • Health calendar: An illustrated diary for mothers that acts as a reminder as well as a record keeper of the activities

6-day Training	• Class-room training (5 day): Trainers from study team provide this training in a workshop setting while all LHWs attend all sessions of this workshop. Following training methods are used:
	  ○ Lectures
	  ○ Discussion
	  ○ Videos
	  ○ Role-play
	• Field training (1 day): The LHW and her trainer visit a household where the LHW gives a practical demonstration of a field visit and the trainer provides feedback.

Monthly visits	Lady health workers continue their routine visits to all households. They also deliver additional ECD content to pregnant mothers or mother-infant pairs, recruited into the study
Monthly supervision	Monthly supervision sessions for the new ECD component are integrated into the routine monthly supervision meetings of LHWs at their health center

REFERENCES

Aboud,F.E. (2007). Evaluation of an early childhood parenting programme in rural Bangladesh. *Journal of Health Population and Nutrition*(1606-0997 (Print)).

Aboud,F.E., Singla,D.R., Nahil,M.I., & Borisova,I. Effectiveness of a parenting program in Bangladesh to address early childhood health, growth and development. *Social Science & Medicine*(0).

Ariff,S., Soofi,S., Sadiq,K., Feroze,A., Khan,S., Jafarey,S., Ali,N., & Bhutta,Z. (2010). Evaluation of health workforce competence in maternal and neonatal issues in public health sector of Pakistan: an assessment of their training needs. *BMC health services research*, *10*(1), 319.

Baker,C., Kupersmidt,J.B., Voegler-Lee,M.E., Arnold,D.H., & Willoughby,M.T. (2010). Predicting teacher participation in a classroom-based, integrated preventive intervention for preschoolers. *Early Childhood Research Quarterly*, *25*(3), 270-283.

Baqui,A.H., El-Arifeen,S., Darmstadt,G.L., Ahmed,S., Williams,E.K., Seraji,H.R., Mannan,I., Rahman,S.M., Shah,R., Saha,S.K., Syed,U., Winch,P.J., Lefevre,A., Santosham,M., & Black,R.E. (2007). Effect of community-based newborn-care intervention package implemented through two service-delivery strategies in Sylhet district, Bangladesh: a cluster-randomised controlled trial. *The Lancet*, *371*(9628), 1936-1944.

Bhattacharyya,K. (2001). Community Health Worker Incentives andn Disincentives: How They Affect Motivation, Retention and Sustainability.

Cesswell,J.W. (2013). Qualitative Inquiry and Research Design: Choosing Among Five Approaches. Los Angeles: Sage.

Cohen,D.J., Crabtree,B.F., Etz,R.S., Balasubramanian,B.A., Donahue,K.E., Leviton,L.C., Clark,E.C., Isaacson,N.F., Stange,K.C., & Green,L.W. (2008). Fidelity versus flexibility. *American journal of preventive medicine*, *35*(5), S381-S389.

Dower,C. (2006). Advancing community health worker practice and utilization: the focus on financing. National Fund for Medical Education.

Durlak,J.A., & DuPre,E.P. (2008). Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American journal of community psychology*, *41*(3-4), 327-350.

Eickmann,S.H., Ana,C., Guerra,M.Q., Lima,M.C., Pedro,I., Huttly,S.R.A., & Worth,A.A. (2003). Improved cognitive and motor development in a community-based intervention of psychosocial stimulation in northeast Brazil. *Developmental Medicine & Child Neurology*, *45*(8), 536-541.

Engle,P.L., Black,M.M., Behrman,J.R., Cabral de Mello,M., Gertler,P.J., Kapiriri,L., Martorell,R., & Young,M.E. (2007). Strategies to avoid the loss of developmental potential in more than 200 million children in the developing world. *The Lancet*, *369*(9557), 229-242.

Engle,P.L., Fernald,L.C., Alderman,H., Behrman,J., O'Gara,C., Yousafzai,A., de Mello,M.C., Hidrobo,M., Ulkuer,N., Ertem,I., & Iltus,S. (2011). Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *The Lancet*(0).

Government of Punjab (2009). Preinvestment Study on Rawalpindi District 2009. Lahore: Directorate of industries, Punjab Poonch House, Multan Road.

Grantham-McGregor,S.M., Walker,S.P., Chang,S.M., & Powell,C.A. (1997). Effects of early childhood supplementation with and without stimulation on later development in stunted Jamaican children. *The American Journal of Clinical Nutrition*, *66*(2), 247-253.

Grantham-McGregor,S., Cheung,Y.B., Cueto,S., Glewwe,P., Richter,L., & Strupp,B. (2007). Developmental potential in the first 5 years for children in developing countries. *The Lancet*, *369*(9555), 60-70.

Griffin,J.A. (2010). Research on the implementation of preschool intervention programs: Learning by doing. *Early Childhood Research Quarterly*, *25*(3), 267-269.

Haines,A., Sanders,D., Lehmann,U., Rowe,A.K., Lawn,J.E., Jan,S., Walker,D.G., & Bhutta,Z. (2007). Achieving child survival goals: potential contribution of community health workers. *The Lancet*, *369*(9579), 2121-2131.

Haq,Z., & Hafeez,A. (2009). Knowledge and communication needs assessment of community health workers in a developing country: a qualitative study. *Human resources for health*, *7*(1), 59.

Haq,Z., Iqbal,Z., & Rahman,A. (2008). International Journal of Mental Health Systems. *International Journal of Mental Health Systems*, *2* 15.

Heaney C, & Israel B (2008). Social Ntworks and Social Support . In R.B.&.V.K. Glanz K (Ed.), *Health Behavior and Health Education: Theory, Research and Practice* (pp.189-207). San Francisco: Jossey-Bass.

Irwin LG,S.A.H.C. (2007). Early Child Development : A *Powerful* Equalizer.: World Health Organization's Commission on the Social Determinants of Health.

Jaskiewicz,W., & Tulenko,K. (2012). Increasing community health worker productivity and effectiveness: a review of the influence of the work environment. *Hum Resour Health*, *10*(1), 38.

Lewin,S.A., Babigumira,S.M., Bosch-Capblanch,X., Aja,G., Van Wyk,B., Glenton,C., Scheel,I., Zwarenstein,M., & Daniels,K. (2006). Lay health workers in primary and community health care: A systematic review of trials.

Lingam,R., Gupta,P., Zafar,S., Hill,Z., Yousafzai,A., Iyengar,S., Sikander,S., Haq,Z., Mehta,S., & Skordis-Worall,J. (2013). Understanding care and feeding practices: building blocks for a sustainable intervention in India and Pakistan.

Linnan,L., & Steckler,A. (2002). Process evaluation for public health interventions and research. Jossey-Bass San Francisco, California.

London School of Hygiene and Tropical Medicine (2013). The Intervention Package: Sustainable Programme Incorporating Nutrition and Games.

Maxwell,J. (2005). Qualitative Research Design: An Interactive Approach. Thousand Oaks: Sage Publications.

Miles,M., & Huberman,M. (1994). Qualitative data analysis: an expanded sourcebook. Thousand Oaks: Sage.

Moustakas,C. (1994). Phenomenological research methods. Sage.

Nahar,B., Hamadani,J.D., Ahmed,T., Tofail,F., Rahman,A., Huda,S.N., & Grantham-McGregor,S.M. (2008). Effects of psychosocial stimulation on growth and development of severely malnourished children in a nutrition unit in Bangladesh. *Eur J Clin Nutr*, *63*(6), 725-731.

Nishtar,S., & Mehboob,A.B. (2011). Pakistan prepares to abolish Ministry of Health. (pp.648-649).

Patton M Q (2002). Qualitative Research & Evaluation Methods. California: Sage Publications.

Rahman,A., Malik,A., Sikander,S., Roberts,C., & Creed,F. (2008). Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: a cluster-randomised controlled trial. *The Lancet*, *372*(9642), 902-909.

Riaz,H., & Rehman,A. (2013). Polio vaccination workers gunned down in Pakistan. *The Lancet Infectious Diseases*, *13*(2), 120.

Sanford DeRousie,R.M., & Bierman,K.L. (2012). Examining the sustainability of an evidence-based preschool curriculum: The REDI program. *Early Childhood Research Quarterly*, *27*(1), 55-65.

Saunders,R.P., Evans,M.H., & Joshi,P. (2005). Developing a process-evaluation plan for assessing health promotion program implementation: a how-to guide. *Health Promotion Practice*, *6*(2), 134-147.

Schellenberg,J.A., Victora,C.G., Mushi,A., de Savigny,D., Schellenberg,D., Mshinda,H., & Bryce,J. (2003). Inequities among the very poor: health care for children in rural southern Tanzania. *The Lancet*, *361*(9357), 561-566.

Shonkoff,J.P. (2003). From Neurons to Neighborhoods: Old and New Challenges for Developmental and Behavioral Pediatrics. *Journal of Developmental & Behavioral Pediatrics*, *24*(1).

Singh,P., & Sachs,J.D. (2013). 1 million community health workers in sub-Saharan Africa by 2015. *diabetes*, *14* 17.

Thompson,R.A., & Nelson,C.A. (2001). Developmental science and the media: Early brain development. *American Psychologist*, *56*(1), 5-15.

Walker,S. (2011). Promoting equity through early child development interventions for children from birth through three years of age. In H. Alderman (Ed.), No Small Matter: The Impact of Poverty, Shocks, and Human Capital Investments in Early Childhood Development Wsahington D.C.: The World Bank.

Walker,S.P., Wachs,T.D., Grantham-McGregor,S., Black,M.M., Nelson,C.A., Huffman,S.L., Baker-Henningham,H., Chang,S.M., Hamadani,J.D., Lozoff,B., Gardner,J.M.M., Powell,C.A., Rahman,A., & Richter,L. (2011). Inequality in early childhood: risk and protective factors for early child development. *The Lancet*(0).

World Health Organziation (2007). Community health workers: What do we know about them? Geneva: World Health Organization.

Zafar,S., Sikander,S., Haq,Z., Hill,Z., Lingam,R., Skordis-Worall,J., Hafeez,A., Kirkwood,B., & Rahman,A. (2013). Integration of a scalable maternal psychosocial well-being (MPW) component into a child-development intervention: challenges and opportunities.

SHARED HOMES, SHARED RESPONSIBILITIES: HOME OBSERVATION FOR MEASUREMENT OF A CHILD'S ENVIRONMENT IN RURAL PAKISTAN[1]

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Abstract

Background: The home environment is a key factor in child health and development. The infant/toddler version of Home Observation for Measurement of the Environment (IT-HOME) inventory is used to assess the development opportunities for children aged from 0-3 years. IT-HOME involves observation of only the primary caregiver; however, the child's home environment in low- and middle-income countries often includes extended family members who provide childcare. This study aimed to include the assessment of additional caregivers to produce a more valid measure of the home environment. **Methods**: Through a multi-stage, random sampling in rural Pakistan, we administered IT-HOME to 153 families. During the interview, we asked questions from the primary caregiver about the number of additional caregivers and their role in childcare. One of these caregivers where available, was included into the observation for the three socio-emotional subscales, and this supplementation was called HOME^{+}. **Results**: A large proportion (70%) of the study sample lived in households that included extended family members. Subscale and total scores were higher in extended families as compared to nuclear families and this difference was adequately captured by HOME^{+}. When compared for child's age, older children scored significantly higher than younger children and this difference was captured better by HOME^{+} than HOME. **Conclusion**: The higher subscale and total scores in extended families suggests the possibility of a richer environment. Additional caregivers may be particularly important as the child grows older, and these caregivers may have a significant impact on ECD outcomes. Future studies should use HOME+ to assess the developmental consequences of living in extended family system.

Introduction

The physical and social environments of home are major influences on the overall development of children (Iltus 2006). The period of early childhood from birth to 3 years is especially critical, as the environment can have profound effects on a child's health and development (Walker et al. 2011). Home environments may be even more critical to child development in resource-poor countries where preschool institutions are few in number or lack quality and resources (Engle et al. 2011). In those countries, the home environment and child care often includes extended family members. Interventions that aim to change the home environment to promote early childhood development (ECD) during this period would benefit from valid and reliable measurement of this key domain, including recognition and assessment of the different ways that families may be organized to care for children.

The HOME Instrument

In ECD intervention research, a common approach for assessing a child's home environment involves the Home Observation for Measurement of the Environment (HOME) inventory. There are four versions of HOME, each tailored for various age groups. The infant/toddler version (IT-HOME, referred to as HOME in the subsequent text) is a 45-item instrument used to assess the features of the physical and social environment that are important for infants and children up to 3 years of age (Bradley 1994). HOME is administered when the primary caregiver and the index child both are available and its administration takes about 45 minutes. Items on HOME are assessed through interview, observation or either of the two methods. There are six subscales,

three of which address "socio-emotional support" (i.e., responsivity, acceptance, organization), while the other three address "cognitively stimulating aspects" of the environment (i.e. organization, learning materials, variety) (Caldwell 2003).

Originally developed and validated in the United States (U.S.), HOME has been shown to be a valid and reliable instrument in high-income western countries where individualism and nuclear families are predominant and no significant modification was required to the instrument (Bradley et al. 1996). In low- and middle-income countries from the Caribbean and Latin America, where families tend to be relatively collectivist, the researchers reported modifications to the scale by adding or deleting items, although the details of these changes have not been reported (Bradley, Corwyn, & Whiteside-Mansell 1996). In Costa Rica, to assess "organization" researchers asked about the completion of vaccination as a positive element of child's environment, rather than counting visits for medical check-ups (Lozoff et al. 1995). In various African and Asian countries, the number of books or toys which assesses the "learning materials" part of a child's environment was reduced to reflect more common material conditions and local culture (Bradley and Corwyn 2005). None of these adaptations, however, addressed the issue of a child's environment in extended families.

HOME and the importance of extended families

In countries where household labor and childcare are organized around the extended family, the HOME instrument may require modifications to adequately capture the socio-emotional environment of the child. The three socio-emotional domains (i.e., responsivity, acceptance and involvement) of HOME only consider the mother or primary caregiver leaving out the other potential caregivers from this assessment.

Moreover, the two items in the subscale "variety" that assess the role of father in child care are asked only from the mother or primary caregiver. As a consequence, while several studies reported theoretically meaningful correlations between total HOME scores and both family socio-economic status and child's development outcomes, the evidence of the cultural equivalence of parenting constructs and validity of subscales, specifically the socio-emotional subscales, has been less compelling (Aboud 2006;Bradley & Corwyn 2005;Bradley, Corwyn, & Whiteside-Mansell 1996).

As children age, the features of the social and physical environment that promote ECD, change. According to Bronfenbrenner's ecological systems theory, an individual is placed in a context of interdependent environment (Bronfenbrenner 1986). A growing child through his gestures, vocalizations, and demands, stimulates others who in turn, stimulate him with variety of actions and materials. Several studies from developed countries have documented that association between environmental measures and measures of cognitive development get stronger as children grow and approach 2 years (Bradley 1994;Wachs 1992) . HOME scores obtained after 2 years of age in these countries have better correlations with cognitive test scores than the correlations at younger ages (Totsika and Sylva 2004). Studies from Europe and North America point out that these correlations between HOME and cognitive development are strongest with Caucasian, moderate in African-American, and almost non-existent in Mexican-American children (Totsika & Sylva, 2004). Moreover, studies from collectivist communities have shown mixed results, with some of them reporting no associations between HOME scores and age-related development outcomes (Aboud 2007;Lozoff, Park, Radan, & Wolf 1995). One reason for these inconsistent results may be that HOME

does not adequately address the context of a growing child in an extended family. Local adaptation of socio-emotional constructs used in HOME can help in examining the association of age of the child with HOME scores.

Associations of family characteristics with HOME may also vary between individualist and more collectivist societies. Consistent positive correlations between family's socio-economic status and HOME scores have been a feature of HOME studies in high-income societies (Bradley & Corwyn 2005;Totsika & Sylva 2004). These associations have also been reported in studies that aimed to promote early child health or development and used HOME as the battery of assessments in developing countries (Aboud 2006;Black et al. 2004). Less is known about how an extended family, however, which may rely more on collective resources than individual income or education, shapes the child's social and physical environment. Similarly the number of siblings and parental education level may function differently within households organized around extended family than around nuclear families, and this needs to be examined.

In families where multiple household members engage in regular child care activities, mothers may perceive greater social support. At the same time, some mothers may experience interpersonal problems with these family members, and deem them less supportive, despite potential childcare assistance in the family (Lewis et al. 2004;Lewis and Rook 1999). Hence, social support for mothers and primary caregivers may be independent of actual childcare assistance within the household.

Other researchers have recognized that the original HOME instrument was based on the mother-child dyad as the basic unit of analysis and does not adequately account for the influence of alternate caregivers (Bradley & Corwyn 2005;Bradley,

Corwyn, & Whiteside-Mansell 1996;Frongillo et al. 2013;Totsika & Sylva 2004). This concern applies to Pakistan, particularly in rural areas, where the home environment mostly includes parents, grandparents, and other close relatives like aunts, uncles, and siblings, who may interact with the child on a consistent basis (Lingam et al. 2013;Zafar et al. 2013). In assessing Pakistani home environments, as well as those in other societies organized around extended families, the socio-emotional support of these other caregivers may need to be included in order to ensure the content validity of the HOME instrument. No published studies of which we are aware take this dimension of family structure into account while assessing the home environment using HOME.

The development of a valid home environment assessment tool should be particularly useful for future studies on early childhood development in countries where extended families share early child care responsibilities, where child developmental deficits are huge, and where recognition of the importance of intervening to promote early childhood development is on the rise (Aboud 2007;Grantham-McGregor 2007).

The objective of this study was to adapt IT-HOME so that it adequately considered how additional caregivers contribute to children's physical and social environment in rural Pakistan. To help determine the construct validity of this adapted instrument, which we call "HOME+", we tested a series of hypotheses about expected correlations between the physical and social environment domains and familial characteristics (see Table 3.4). This testing of hypotheses was done using both HOME and HOME+ scores. In rural Pakistan the home environment mostly includes parents, grandparents, and other close relatives like aunts, uncles, and siblings, who may interact with the child on a consistent basis (Lingam, Gupta, Zafar, Hill, Yousafzai, Iyengar,

Sikander, Haq, Mehta, & Skordis-Worall 2013;Rahman et al. 2009); because of this, we hypothesized that the socio-emotional subscales as well as total scores of children living in extended family households would be higher than in nuclear families (hypothesis 1). The importance of the social and physical environment for cognitive development increases as children grow, particularly as they approach the second year of life (Bradley 1994;Wachs 1992). Based on this, we hypothesized that socio-emotional support of children who are older than one year will be higher than that for younger children (hypothesis 2). Past studies also suggest that, maternal education, paternal education, and family income, all have positive correlations with child's home environment (Bradely, 1996; Bradley, 2005; Mercy & Steelman, 1982). We hypothesized that children with high parental education will have higher scores than children with low parental education (hypothesis 3). Similarly, we hypothesized that children from families with relatively higher household income will have higher scores than children from less wealthy family households (hypothesis 4). Lastly, studies have indicated a negative correlation between HOME scores and crowding (Bradley, 1996), so we hypothesized that children with no older siblings will have higher scores than children who have siblings (hypothesis 5).

Methods

Setting

The study was conducted in four different villages located within union council Sagri, sub-district Kallar Syedan of the district Rawalpindi. This rural sub-district has a geographical area of 420 km^2 (162 sq mi) and a population of approximately 197,000

(Government of Punjab 2009). Union Council Sagri has a total population size of 22098, the majority of which is poor or lower-middle class, dependent on subsistence farming, and supported by the earnings of one or more of the adult male household members. Household socioeconomic status generally depends on landholdings, the number of adult males in the household, and the nature of their jobs. Union Council Sagri has a basic health unit (BHU) to cater to the health needs of its inhabitants. Along with curative health care, the BHU also has a community outreach program involving 17 lady health workers (LHWs) who provide coverage to 20,039 inhabitants (i.e. 91% of its population).

Population and participant selection

DeVellis (2003) has discussed the sample size issues that should be considered for testing items during scale development (DeVellis 2003). Although a sample over 300 is considered to be adequate, a single scale comprising fewer than 20 items may need a sample size much lower than 300 respondents (DeVellis, 2003). Keeping in view the exploratory nature of this study, we aimed to recruit a sample of 150 families with a newborn to 3-year-old child. Families were selected through a multi-stage, random sampling technique. For this, four LHWs out of the 17 from Sagri were randomly selected and asked to share the list of families to whom they provided health education. From the pool of about 700 families thus obtained, we randomly selected 85 families with a child aged 1 to 3 years and 85 families with a child aged <1 year. In families that had more than one child aged 0-3 years, the youngest child was selected as the index child. A letter of invitation was sent to all 170 selected families.

Data collection

A trained field data collector visited the household at a time and date that the LHW had arranged with the family. After obtaining written consent to participate, the field worker administered the family demographic part of the questionnaire. If the respondent reported an additional caregiver in the household, including a sibling to the index child, the person who most commonly provided care was also invited for study participation and observation. Depending upon their availability and convenience, the mother and additional caregiver were observed jointly or separately. The perceived social support scale was administered to the mother after completing HOME or HOME+ depending upon the household type. A gift containing household items worth PKR 300.00 (=~USD 3.00) was given to the family for their participation. Data collection was completed from 25th November 2012 to 12th January 2013. The study was partially funded through Provost Funds from the University of South Carolina (USC) and ethical clearance was obtained from IRB of USC as well as the Human Development Research Foundation Pakistan.

Measures

The standard infant and toddler version of HOME instrument (Caldwell 2003) was translated into Urdu and shared with six ECD experts engaged in community-based research in Pakistan. Their perspectives regarding the adequacy of the translation, the cultural appropriateness of its various items, and the addition of new items on additional caregivers were queried through individual interviews. The experts indicated some items from HOME might be socially and culturally inappropriate for newborns and infants up to 2 months of age in Pakistan: parent permits messy play (responsivity), parent tells

child name of object or person (responsivity); at least 10 books are present and visible (acceptance), child is taken to market at least once a week (organization); child gets out of the house at least 4 times a week (organization); parent invests maturing toys with value via personal attention (involvement); parent provides toys that challenge child to develop new skills (Involvement); and child has 3 or more books of his/her own (variety). The experts, however, advised retaining these items for the present study as its focus was on the additional caregiver. They agreed that the protocol should repeat for the additional caregiver each of the items from the 3 socio-emotional subscales (i.e. responsivity, acceptance, involvement).

A team of two field researchers who were already familiar with ECD concepts and had experience with field observations were trained to administer the tool. HOME is administered by observing or interviewing for a particular item and entering a 1 or zero in the column against that item on the HOME scoring sheet. For additional caregiver, an additional column was inserted on the same sheet and scores were marked as those for the primary caregiver. To assess inter-observer reliability, the instrument was administered simultaneously by the two field researchers in a convenience sub-sample of 20 families 9 of which also received HOME+ during the beginning of the study. After completing each visit, they met with the first author to discuss and compare their codes and reach consensus on codes that did not match. The process was repeated on three consecutive days during the early phase of data collection, wherein 6 or 7 families were visited each day, and a satisfactory level of inter-observer agreement was reached. The mean value of alpha calculated with Kuder Richardson formula was 0.84 for primary caregiver and 0.80 for additional caregiver while minimum and maximum value for both

was 0.60 and 1 respectively. In general, the items pertaining to observation of the physical environment (e.g. family has a pet) had 100% agreement while items about caregiver's speech or expression (e.g. parent voice conveys positive feelings towards child or parent converses freely and easily) received low agreement. The inter-observer agreement calculated by averaging the total of constituent items for each subscale ranged from 0.75 (involvement) to 0.91 (organization) for mother and 0.72 (involvement) to 0.86 (acceptance) for additional care.

Data were converted both for HOME and HOME+ subscale and total scores. For every item scored as positive towards ECD development, a value of 1 was given while 0 was given if not present. These were added together to form the six subscales and the total scores. For the socio-emotional dimensions, three types of scores were created: mother only (traditional HOME), additional caregiver only (HOME+ supplementary questions), mother AND additional caregiver (HOME and HOME+ combined).

Family demographics: Questions included child's age in months, parental educational attainment (schooling years completed), occupation of father and mother, household type i.e. nuclear (only parents and siblings living together) and extended households (family members like grandfather, grandmother, uncle, aunt etc. living with family of the index child), and family size. For financial status, the LHW of the area was asked to categorize participant families as rich, middle class and poor, while the families were asked about their total monthly income in rupees. The data from two sources were triangulated to create 3 groups including very poor, poor and middle class with respective income of ≤10000, 10000-20000 and >20000 PKR per month.

Additional care: A brief questionnaire was administered to the mother or primary caregiver before doing the HOME observation. Questions included the number of additional caregivers who live in the household, their relationship with the child, the various tasks they performed for the child, and the average amount of time in hours that they spent each day on these responsibilities. Similar questions were included about the older siblings of the index child.

Perceived Social Support: Measures to assess mothers' perceptions about available social support was adapted from the Multidimensional Scale for Perceived Social Support (MSPSS), which assesses three key social network categories: 1) Family including the extended family 2) Friends and 3) Significant other i.e. someone (e.g. LHW) not belonging to the earlier two categories (Zimet et al. 1988). The MSPSS has been adapted and validated in the context of an intervention study to enhance social support in order to treat peri-natal depression among Pakistani mothers (Sikander 2009). The MSPSS scores had an inverse correlation with depression scores, suggesting its construct validity. We modified the MSPSS by asking the level of agreement (5-point Likert scale) from respondents regarding the availability (i.e., *There is [a family member/a friend/someone else] who can help me in childcare*), accessibility (i.e., *I can readily seek help from [a family member/a friend/someone else] with childcare*), and practical actions (i.e., [*A family member/A friend/Someone else] helps me with childcare issues*) from each of three social categories of potential support. The respondent mother rated each person indicating the extent of agreement with 1 equal to high disagreement and 5 equal to high agreement. The final score for each item ranged from a minimum 1 to

a maximum of 5. Scores for each potential support category were calculated by averaging the total of constituent items for that category.

Analysis

We calculated descriptive statistics to characterize the study population. Frequencies and percentages were generated to contrast characteristics of nuclear and extended households, including child's age, child's gender, mother's education, father's education, family income and number of siblings. For each of these characteristics, chi square tests were performed to determine statistically significant differences between these groups. For main hypotheses (Table 4.2), we also carried out a sensitivity analysis by treating HOME scores both as continuous and categorical variables. For categorical variable, 25th and 75th percentile scores were used as the cut-off for low (Totsika & Sylva, 2004) and "high" scores respectively. Comparison of these results with differences in mean scores using t-test produced consistent results when examining both HOME and HOME+. Results using the continuous variable are reported for this paper.

We used t-tests to compare means for the socio-emotional subscales as well as the total scores between the extended and nuclear family household. This comparison was done on the entire sample (n=153) using HOME and HOME+ scores separately. We also carried out a within sample (n=94) comparison where both mother (HOME) and additional caregiver (HOME+) were included to see the mean difference of subscale and total scores between demographic categories including child's age, parental education, family income and presence of older siblings. For this, child's age was categorized as <1 year and > 1 year, mother and father's education was categorized as low (≤ 9 years schooling) and high (≥10 years schooling), family income as low (≤ 19,000 PKR) and

high (>20,000 PKR). This comparison was done using mother's scores (HOME), only additional caregiver's scores, and combined scores of mother plus additional caregiver (HOME+).

For perceived social support (PSS), we computed the mean scores along with standard deviations for total scores as well as for each category i.e. family, friend and non-familial, significant person.

On families where mother and additional caregiver both were observed (n=94), we also examined the bivariate correlations of family characteristics with HOME and HOME+ by computing Pearson and Spearman's correlation coefficients. Finally we also examined the relationship of these characteristics with HOME and HOME+ score through linear regression models, adjusting for other variables. For the fully adjusted models, R^2 values were estimated to evaluate the explanatory power of selected predictors. SPSS version 16.0 for windows was used for these analyses.

Results

A total of 170 households were invited to participate in the study; 162 agreed to participate, and 153 were surveyed. The reasons why visits could not be conducted with families who agreed to participate included unwilling grandmother (n=2), sleeping child (n=2), guests in the house (n=3), or mother and child were not present due to an unforeseen obligation (n=2). About half of children in participant households were <1 year (52%) and half (48%) >1 year of age (see Table 4.3). About half of the children were female and half male. All primary caregivers were mothers, out of which 45% were uneducated or low educated (≤5 years schooling), 37% had middle level of education (6-

10 years schooling) while 18% had received more than high school level (>10 years schooling) education. Among fathers, 10% were uneducated or low educated (≤5 years schooling), 73% had middle level of education (6-10 years schooling) while 26% had received more than high school level (>10 years schooling) education. Based on monthly income, 54% households belonged to very poor (PKR ≤10000), 33% to poor (PKR 10000-20000) and 13% to middle class (PKR>20000).

Out of the 153 participant households, 70% (n=108) included extended family members living within the household. A caregiver besides the mother was reported by 87% of the total sample, with the child's grandmother most frequently mentioned (43%), followed by the aunt (20%) and father (17%). About half of these additional caregivers performed multiple functions. The top functions included holding the baby in lap, feeding, playing, and bathing. The mean daily amount of time spent by the additional caregiver was 4.75 hours (range 1-12 hours). Out of the 78% families with siblings who were older than the index child, 84% (n=100) reported that siblings also contributed to child care. About 1/3 of these siblings performed multiple functions, and the most frequent functions included playing and holding in the lap.

We observed additional caregivers in 94 (61%) families among which 89 belonged to extended and 5 to nuclear families. The observed additional caregivers in the extended families included grandmother (n=42), aunt (n=25), and father (n=7), while those in nuclear family were older sister (n=3) and father (n=2). Most of the older siblings reported as additional caregivers were in school during study visits to the household and were, hence, unavailable for observation. On the Perceived Social Support scale, out of a possible total score of 40, the participant mothers perceived a

mean level of 33.11 (SD3.92), with family being the biggest source (mean=14.09 SD 1.45) followed by non-familial significant person (mean=13.95 SD 1.62), and friend (mean=5.07 SD 3.20) as the providers of social support.

Inconsistent results were found when assessing differences between nuclear and extended family households for subscale and total scores using HOME and HOME+ (Table 4.4). For HOME, significantly higher "acceptance" and "organization" subscale scores were found among extended family households, but no difference by household type was found for the other subscales or for total HOME scores. The pattern of results was somewhat different when comparisons were repeated using HOME^{+} scores (although the cognitive environment items subscale comparisons were the same). All three socio-emotional subscales, as well as total scores, were significantly higher for extended family households than for nuclear family households (Table 4.4).

In the analytic subsample of families where both mother and additional caregiver were observed (n=94), we compared households with younger and older children (i.e., <1 year old vs. >1 year old) using HOME scores, HOME+ scores, and just the HOME+ items that addressed the additional caregiver (see Table 4.5). Across all three HOME assessment approaches, the mean scores for "acceptance" were not significantly different by child age, but "involvement" subscales and total scores were significantly higher for older compared to younger children. HOME assessment approaches produced differing results, however, for the "responsivity" subscale, for which no difference was found using the HOME tool and a significantly higher scores were found for older children when including information on additional caregivers.

Within the same analytic subsample (n=94), we also compared socio-emotional subscale and total scores for the low and high categories of mother's education, father's education, family income and the presence or absence of older siblings as well. For mother's education, across all three approaches, the mean scores of "responsivity" subscale were not significantly different while mean total scores were significantly higher for the households where mother had a higher level of education (Table 4.5). For subscale "acceptance", compared to HOME, the mean scores of additional caregiver and HOME+ both were significantly higher. For "involvement", both HOME and HOME+ scores were higher while the additional caregiver scores showed no meaningful difference. Analysis of the same subscales across father's education did not show any significant differences (Table 4.5). Similarly, the comparison of mean subscale and total scores across family's economic status as well as presence or absence of older siblings did not have any significant differences (Table 4.5).

The bivariate and multivariate analyses of family demographics with HOME and HOME^{+} scores produced similar correlations as described earlier. Child's age and mother's level of education had a strong correlation with both HOME ($p<.001$) and HOME+ scores ($p<.01$). Other characteristics including child's gender, father's education, family's monthly income, presence of older siblings and social support perceived by mother did not have significant associations (Table 4.6). Overall, the adjusted regression model explained about 40% variance ($R^2=.409$) of HOME and 43% ($R^2=.425$) of HOME^{+} scores.

Discussion

Our study brings a new dimension to the measurement of physical and social environment available to children in rural Pakistan. We found that majority (70%) of families were living in an extended family environment, which is consistent with other studies from Pakistan (NIPS 2008). Even in 60% of nuclear families, additional care was being provided by family members in addition to the primary caregiver i.e. mother. Overall, 87% children in our sample had access to additional care, and additional caregivers spent about 3-4 hours per day to carry out multiple activities with the child. These activities could enhance or perhaps detract from the child's development. In extended families, additional caregivers were mostly adult relatives who consistently provided care to children. As expected, children living in extended family households had significantly higher scores than nuclear families, but only when assessing the environment with HOME^{+} and not with HOME. These results support the construct validity of HOME+. A measurement approach that considers these caregivers while assessing a child's home environment may be a better predictor of ECD outcomes. Indeed, prior research in collectivist social groups has found that the original HOME inconsistently predicts ECD outcomes (Bradley 1994;Lozoff, Park, Radan, & Wolf 1995;Totsika & Sylva 2004;Wachs 1992), and this enhancement may improve both the content and predictive validity of HOME.

Both the HOME and HOME+ instruments indicated that the richness of the socio-emotional and cognitive environment increases as children age, which is what we expected. These improvements were more consistent with HOME+ than HOME in case of "responsivity". Being responsiveness to child's nutritional and psychological needs is

considered as one of the key areas for optimum child development (Black and Aboud 2011). Responsive parenting which includes cognitively stimulating activities, limit-setting, disciplinary practices, and parent warmth has been found to be associated with desired outcomes like maintaining a healthy weight (Avula et al. 2011). Responsive feeding is being increasingly recommended as a strategy to improve child health and development (Engle and Pelto 2011). Adopting HOME+ approach in assessment of this key domain can help in better understanding environment of children living in extended families.

Questions have been raised about the appropriateness of items belonging to socio-emotional dimensions that may vary along the continuum of age of the child across cultures. On the one end are U.S. mothers (where HOME originated) who rapidly stop holding their infants and start vocalizing by 2 months of age. From thereon, tactile responsiveness is replaced by acoustic, visual, and object-based communication (Bradley et al. 2001;Valsiner 2000). At the other end of spectrum are African mothers (Kenya, Namibia, Nigeria) who spend many hours in contact with their infants every day but are not particularly responsive in a verbal manner (Munroe & Munroe, 1980; Aina, 1993). ECD experts interviewed for our study also pointed out a few items that may not be appropriate for newborns and very young infants in Pakistan. For example, telling the child name of object or person or having at least 10 books (both socio-emotional items) or taking young children outside is non-normative in Pakistani communities, yet they constitute HOME items. Indeed, taking the infant outside of home is strictly prohibited in rural communities during *chilla*; the first 40 days of life (PAIMAN 2006;Rahman et al. 2012). Although some consider it superstitious, this is also deemed as being "responsive"

within this cultural context, as it prevents children from potential harms associated with going out in the sun in summers (dehydration) and infection (common cold) in the winters. On HOME, however, the newborns and young infants (13% of sample) may receive low scores because of inappropriate questions rather than lack of responsive behaviors from their caregivers.

Including additional caregiver to HOME and assessing social support perceived by the mother are important additions to the instrument both aimed at improving its content and construct validity. The parenting constructs of HOME are based on Euro American models of parenting, and past reviews have recommended adaptation of these constructs that make them appropriate to extended families and collectivist societies (Bradley & Corwyn 2005;Bradley, Corwyn, & Whiteside-Mansell 1996). However, no significant modifications have been reported in the published literature. One reason can be that HOME is mostly used to evaluate the ECD interventions delivered to mothers or primary caregivers. However, parenting programs focusing on ECD increasingly emphasize enhancement of family support for the mother (Lingam, Gupta, Zafar, Hill, Yousafzai, Iyengar, Sikander, Haq, Mehta, & Skordis-Worall 2013;Rahman et al. 2011;Zafar, Sikander, Haq, Hill, Lingam, Skordis-Worall, Hafeez, Kirkwood, & Rahman 2013) and future research should aim to better understand the relationship between the home environment and maternal social support for effective delivery of these programs.

There are several limitations to our findings. It focused on a representative sample, but from a sampling frame that included only a relatively small geographical area. The sample for reliability assessment was also small and number of extended family households within this sample was even smaller. Because of the overall small sample

size, we could not examine a child's environment across a wider range of economic disparities. However, we were able to examine both maternal and paternal education attainments which predict HOME scores and ECD outcomes in other studies. We could not assess the child's developmental status to ascertain the predictive validity of our modified HOME instrument, although future research should examine whether this instrument does better than the classic HOME instrument in predicting a child's cognitive, language or social-emotional development. Given the positive results in favor of including additional caregiver, we think including more than one additional caregiver where present, may also be considered for a more holistic picture of a child's environment. Larger studies with greater statistical power and samples that are representative of a broader population may be necessary to determine if this enhanced version of HOME functions similarly in other population segments and should be considered for ECD research and interventions.

Our study broadens the foundations for assessment of children's physical and social environment when they live in an extended family household. The questions we developed were based on the rural Pakistani context, but they may be useful adjuncts for research in other low- and middle-income countries, where most of the world's 217 million disadvantaged children live (Bradley & Corwyn 2005;Bradley, Corwyn, & Whiteside-Mansell 1996;Grantham-McGregor et al. 2007). Research to assess and address the physical, social and nutrition environment of children should consider using approaches like HOME+ to better capture the household context of child development.

Table 4.2: Study hypotheses

Number	Hypothesis
1.	Socio-emotional subscale and total scores of extended families will be higher than nuclear families.
2.	Socio-emotional subscale and total scores of children >1 year will be higher than children <1 year.
3.	Socio-emotional subscale and total scores of children with parents having ≥ 10 years of schooling will be higher than children with parents <10 year of schooling.
4.	Socio-emotional subscale and total scores of children from middle-class families will be higher than children from poor families.
5.	Socio-emotional subscale and total scores of children having no older siblings will be higher than children having older siblings.

Table 4.3: Demographic characteristics of the participant families (n=153)

Characteristic	Category	Nuclear (45)		Extended (n=108)		Total (n=153)
		Addl care observed (n=5)	Addl care not observed (n=40)	Addl care observed (n=89)	Addl care not observed (19)	
Age of child	< 1 year	5 (100%)	17 (43%)	53 (60%)	5 (26%)	80 (52%)
	>1 year	0 (0%)	23 (58%)	36 (40%)	14 (74%)	73 (48%)
Gender	Male	4 (80%)	16 (40%)	45 (51%)	9 (47%)	74 (48%)
	Female	1 (20%)	24 (60%)	44 (47%)	10 (53%)	79 (52%)
Mother's Schooling	≤5 years	3 (60%)	20 (50%)	42 (47%)	4 (21%)	69 (45%)
	6-10 years	1 (20%)	10 (25%)	38 (43%)	8 (42%)	57 (37%)
	> 10 years	1 (20%)	10 (25%)	9 (10%)	7 (37%)	27 (18%)
Father's Schooling	≤5 years	0 (0%)	5 (13%)	7 (8%)	3 (16%)	15 (10%)
	6-10 years	5 (100%)	25 (63%)	69 (78%)	13 (68%)	112 (73%)
	> 10 years	0 (0%)	10 (25%)	13 (15%)	3 (16%)	26 (17%)
Monthly income PKR	≤10000	2 (40%)	30 (75%)	43 (48%)	8 (42%)	83 (54%)
	10000-20000	2 (40%)	6 (15%)	33 (37%)	10 (53%)	51 (33%)
	>20000	1 (20%)	4 (10%)	13 (15%)	1 (5%)	19 (13%)
Older Sibs	No	0 (0%)	4 (10%)	21 (24%)	9 (47%)	34 (22%)
	Yes	5 (100%)	36 (90%)	68 (76%)	10 (53%)	119 (78%)

Note: Percentages are column percentage for each category

Table 4.4: Comparison of subscale and total scores among nuclear and extended families using HOME and HOME + scores (n=153)

	Socio-emotional Mean (SD)			**Cognitively stimulating environment** Mean (SD)			
Group	Responsivity	Acceptance	Involvement	Organization	Learning materials	Variety	Total
HOME							
Nuclear	6.91 (2.06)	5.31 (1.71)	4.36 (1.24)	4.02 (1.16)	3.33 (2.49)	3.04 (.87)	26.96 (6.43)
Extended	7.31 (2.14)	5.95* (1.23)	4.34 (1.25)	4.60** (1.16)	3.50 (2.12)	2.95 (1.08)	28.69 (5.28)
HOME+							
Nuclear	7.47 (2.39)	5.96 (2.70)	4.76 (1.81)	4.02 (1.16)	3.33 (2.49)	3.04 (.87)	28.58 (7.13)
Extended	12.67*** (4.47)	10.90*** (3.12)	7.42*** (2.56)	4.60** (1.16)	3.50 (2.12)	2.95 (1.08)	42.04*** (9.66)

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

Table 4.5: Within sample comparison of subscale and total scores across family demographics using mother's , additional caregiver's and combined HOME^{+} scores (n=94)

Category	Responsivity			Acceptance			Involvement			Total		
	HOME	Additional care only	HOME+	HOME	Additional care only	HOME+	HOME	Additional care only	HOME+	HOME	Addl. care	HOME+
Child's Age												
<1 year	7.31 (2.15)	5.60 (2.13)	12.91 (3.91)	6.09 (1.08)	5.83 (0.99)	11.91 (1.93)	3.91 (1.23)	3.07 (1.04)	6.98 (2.18)	26.14 (5.36)	-	40.69 (7.65)
>1 year	7.25 (2.23)	7.75*** (1.98)	15.00* (3.46)	6.03 (1.03)	5.86 (2.14)	12.03 (2.10)	4.92*** (.87)	4.81*** (0.95)	9.72*** (1.42)	31.53*** (4.41)	-	49.89*** (6.21)
Mother's schooling												
<10 years	7.16 (1.90)	6.40 (2.30)	13.56 (3.56)	5.95 (0.98)	5.61 (1.71)	11.61 (2.01)	4.02 (1.26)	3.56 (1.39)	7.58 (2.49)	26.65 (5.55	-	42.24 (8.31)
≥10 years	7.53 (2.63)	6.47 (2.37)	14 (4.46)	6.28 (1.17)	6.28* (0.96)	12.62** (1.79)	4.84** (0.88)	4.06 (1.07)	8.91** (1.75)	31.22*** (4.56)	-	48.03** (6.81)
Father's schooling												
<10 years	6.94 (1.72)	6.38 (2.24)	13.32 (3.42)	5.97 (1.06)	5.94 (1.12)	11.94 (2.08)	4.15 (1.08)	3.53 (1.08)	7.68 (2.07)	27.18 (5.47)	-	43.03 (8.21)
≥10 years	7.48 (2.38)	6.45 (2.36)	13.93 (4.11)	6.12 (1.06)	5.78 (1.71)	11.97 (1.95)	4.38 (1.28)	3.85 (1.42)	8.23 (2.47)	28.78 (5.71)	-	44.88 (8.29)
Monthly income PKR												
≤ 19,000	7.36 (2.01)	6.50 (2.25)	13.86 (3.52)	5.94 (1.03)	5.73 (1.62)	11.73 (1.98)	4.33 (1.18)	3.87 (1.31)	8.20 (2.34)	28.19 (5.85)	-	44.27 (8.41)
>20,000	7.08 (2.02)	6.21 (2.52)	13.29 (4.78)	6.42 (1.06)	6.17 (1.17)	12.62* (1.88)	4.21 (1.32)	3.33 (1.27)	7.54 (2.30)	28.25 (5.14)	-	44.04 (7.99)
Older siblings												
No	7.14 (2.45)	6.48 (2.58)	13.62 (4.62)	5.90 (1.04)	5.71 (1.06)	11.71 (1.92)	4.10 (1.30)	3.71 (1.58)	7.81 (2.86)	27.62 (6.57)	-	43.52 (9.83)
Yes	7.33 (2.10)	6.41 (2.25)	13.74 (3.66)	6.11 (1.06)	5.88 (1.64)	12.03 (2.01)	4.36 (1.18)	3.74 (1.23)	8.10 (2.19)	28.37 (5.39)	-	44.41 (7.83)

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

Table 4.6: Regression analysis predicting home environment using HOME and HOME+ scores (n=94)

Characteristic	HOME		HOME^{+}	
	Bivariate (St. error)	Adjusted	Bivariate (St. error)	Adjusted
Child's age				
<1 yr	1	1	1	1
>1 yr	0.47*** (.08)	0.43***(1.1)	0.54*** (0.07)	0.53***(1.6)
Gender				
Female	1	1	1	1
Male	0.17 (.10)	0.12 (1.07)	0.14 (.10)	0.11 (1.5)
Mother's schooling				
<10 years	1	1	1	1
≥10 years	0.39*** (.08)	0.31*** (1.8)	0.32*** (0.08)	0.24** (1.5)
Father's schooling				
<10 years	1	1	1	1
≥10 years	0.14 (.10)	0.001 (1.08)	0.10 (0.1)	-0.02 (1.5)
Monthly income PKR				
≤19000	1	1	1	1
>20000	-0.03 (.10)	-0.06 (1.2)	-0.03(0.10)	-0.05 (1.7)
Siblings				
No	1	1	1	1
Yes	0.08 (0.11)	0.15 (1.41)	0.07 (0.11)	0.18 (2.0)
Perceived support				
Person	-0.04 (.09)	0.32 (0.8)	-0.05 (0.10)	0.24 (1.2)
Family	-0.14 (.09)	-0.34(0.8)	-0.12 (0.10)	-0.24 (1.1)
Friend	-0.09 (0.10)	0.06 (0.17)	-0.10 (0.10)	0.06 (0.2)

**p<.01 ***p<.001

REFERENCES

Aboud, F.E. 2007. Evaluation of an early childhood parenting programme in rural Bangladesh. *Journal of Health Population and Nutrition* (1606-0997 (Print))

Aboud, F.E. 2006. Evaluation of an early childhood preschool program in rural Bangladesh. *Early Childhood Research Quarterly*, 21, (1) 46-60

Avula, R., Gonzalez, W., Shapiro, C., Fram, M., Beets, M., Jones, S., Blake, C., & Frongillo, E. 2011. Positive Parenting Practices Associated with Subsequent Childhood Weight Change. *The Journal of Primary Prevention*, 32, (5) 271-281 available from: http://dx.doi.org/10.1007/s10935-011-0256-6

Black, M.M. & Aboud, F.E. 2011. Responsive Feeding Is Embedded in a Theoretical Framework of Responsive Parenting. *The Journal of Nutrition*, 141, (3) 490-494 available from: http://jn.nutrition.org/content/141/3/490.abstract

Black, M.M., Sazawal, S., Black, R.E., Khosla, S., Kumar, J., & Menon, V. 2004. Cognitive and motor development among small-for-gestational-age infants: impact of zinc supplementation, birth weight, and caregiving practices. *Pediatrics*, 113, (5) 1297-1305

Bradley, R.H. 1994. The HOME inventory: Review and reflections. *Advances in child development and behavior*, 25, 241-288

Bradley, R. & Corwyn, R. 2005. Caring for children around the world: A view from HOME. *International Journal of Behavioral Development*, 29, (6) 468-478 available from: http://www.tandfonline.com/doi/abs/10.1080/01650250500146925 Accessed 27 October 2012.

Bradley, R.H., Corwyn, R.F., McAdoo, H.P., & Garcia Coll, C. 2001. The home environments of children in the United States part I: Variations by age, ethnicity, and poverty status. *Child Development*, 72, (6) 1844-1867

Bradley, R.H., Corwyn, R.F., & Whiteside-Mansell, L. 1996. Life at Home: Same Time, Different Places: An Examination of the HOME Inventory in Different Cultures. *Early Development and Parenting*, 5, (4) 251-269 available from: http://dx.doi.org/10.1002/(SICI)1099-0917(199612)5:4<251::AID-EDP137>3.0.CO;2-I

Bronfenbrenner, U. 1986. Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology*, 22, (6) 723

Caldwell, B.M.&.B.R.H. 2003. *Home Observation for Measurement of the Environment: Administration manual.* University of Arkansas, Little Rock, AR.

DeVellis, R.F. 2003. *Scale Development: Theory and Application*, 2nd ed. Thousand Oaks, Sage.

Engle, P.L., Fernald, L.C., Alderman, H., Behrman, J., O'Gara, C., Yousafzai, A., de Mello, M.C., Hidrobo, M., Ulkuer, N., Ertem, I., & Iltus, S. 2011. Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *The Lancet* (0) available from: http://www.sciencedirect.com/science/article/pii/S0140673611608891

Engle, P.L. & Pelto, G.H. 2011. Responsive Feeding: Implications for Policy and Program Implementation. *The Journal of Nutrition*, 141, (3) 508-511 available from: http://jn.nutrition.org/content/141/3/508.abstract

Frongillo, E. A., Tofail, F., Hamadani, J. D., Warren, A. M., & Mehrin, S. F. Measures and indicators for assessing impact of interventions integrating nutrition, health, and early childhood development. Annals of the New York academy of sciences . 2013.
Ref Type: In Press

Government of Punjab 2009, *Preinvestment Study on Rawalpindi District 2009*, Directorate of industries, Punjab Poonch House, Multan Road, Lahore.

Grantham-McGregor, S., Cheung, Y.B., Cueto, S., Glewwe, P., Richter, L., & Strupp, B. 2007. Developmental potential in the first 5 years for children in developing countries. *The Lancet*, 369, (9555) 60-70

Iltus, S. 2006, *Significance of home environments as proxy indicators for early childhood care and education*, UNESCO.

Lewis, M.A., Butterfield, R.M., Darbes, L.A., & Johnston-Brooks, C. 2004. The conceptualization and assessment of health-related social control. *Journal of Social and Personal Relationships*, 21, (5) 669-687

Lewis, M.A. & Rook, K.S. 1999. Social control in personal relationships: impact on health behaviors and psychological distress. *Health Psychology*, 18, (1) 63

Lingam, R., Gupta, P., Zafar, S., Hill, Z., Yousafzai, A., Iyengar, S., Sikander, S., Haq, Z., Mehta, S., & Skordis-Worall, J. Understanding care and feeding practices: building blocks for a sustainable intervention in India and Pakistan. Annals of New York Academy of Sciences . 2013.
Ref Type: In Press

Lozoff, B., Park, A.M., Radan, A.E., & Wolf, A.W. 1995. Using the HOME inventory with infants in Costa Rica. *International Journal of Behavioral Development*, 18, (2) 277-295

NIPS 2008, *Pakistan Demographic & Health Survey 2006-2007*, National Institute of Population Studies, Islamabad.

PAIMAN. Qualitative Formative Research Findings. 2006. 10-5-2011.
Ref Type: Online Source

Rahman, A., Haq, Z., Sikander, S., Ahmad, I., Ahmed, M., & Hafeez, A. 2011. Using cognitive behavioural techniques to improve exclusive breastfeeding in a low literacy disadvantaged population. *Maternal & Child Nutrition*

Rahman, A., Iqbal, Z., Roberts, C., & Husain, N. 2009. Cluster randomized trial of a parent-based intervention to support early development of children in a low-income country. *Child: Care, Health and Development*, 35, (1) 56-62 available from: http://dx.doi.org/10.1111/j.1365-2214.2008.00897.x

Rahman, A., Haq, Z., Sikander, S., Ahmad, I., Ahmad, M., & Hafeez, A. 2012. Using cognitive-behavioural techniques to improve exclusive breastfeeding in a low-literacy disadvantaged population. *Maternal & Child Nutrition*, 8, (1) 57-71 available from: http://dx.doi.org/10.1111/j.1740-8709.2011.00362.x

Sikander, S. 2009. *A CLUSTER RANDOMISED TRIAL OF A PSYCHOSOCIAL INTERVENTION FOR PERINATAL DEPRESSION IN RURAL PAKISTAN.* School of Medicine, Division of Psychiatry University of Manchester, Manchester, UK.

Totsika, V. & Sylva, K. 2004. The Home Observation for Measurement of the Environment Revisited. *Child and Adolescent Mental Health*, 9, (1) 25-35 available from: http://dx.doi.org/10.1046/j.1475-357X.2003.00073.x

Valsiner, J. 2000. *Culture and human development* Sage.

Wachs, T.D. 1992. *The nature of nurture* Sage Publications, Inc.

Walker, S.P., Wachs, T.D., Grantham-McGregor, S., Black, M.M., Nelson, C.A., Huffman, S.L., Baker-Henningham, H., Chang, S.M., Hamadani, J.D., Lozoff, B., Gardner, J.M.M., Powell, C.A., Rahman, A., & Richter, L. 2011. Inequality in early childhood: risk and protective factors for early child development. *The Lancet* (0) available from: http://www.sciencedirect.com/science/article/pii/S0140673611605552

Zafar, S., Sikander, S., Haq, Z., Hill, Z., Lingam, R., Skordis-Worall, J., Hafeez, A., Kirkwood, B., & Rahman, A. Integration of a scalable maternal psychosocial well-being (MPW) component into a child-development intervention: challenges and opportunities. Annals of New York Academy of Sciences . 2013.
Ref Type: In Press

Zimet, G.D., Dahlem, N.W., Zimet, S.G., & Farley, G.K. 1988. The Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment*, 52, (1) 30-41 available from: http://dx.doi.org/10.1207/s15327752jpa5201_2 Accessed 30 April 2012.

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

Interventions for early childhood development (ECD) are crucial for every country but more so for the LMICs. Every year, over 6 million children die because of preventable causes before age 5 (Jones et al., 2003) in these countries, and 4 out of every 10 continue living in extreme poverty. According to estimates there are 217 million disadvantaged children less than 5 years of age in developing countries, including those who are stunted or living in poverty (Grantham-McGregor et al., 2007) . Most of these children live in 10 countries accounting for 145 million (67%) of the 217 million disadvantaged children in the developing world. The nutritional and educational needs of these children need immediate attention.

Our review of the past studies also suggested that although efficacious interventions to promote ECD are available, very few have been implemented at large scale and half of those implemented at large scale tended to lose their effect compared to when they were implemented at the smaller scale. Engle and colleagues (2007) documented the low coverage of ECD programs recommending more research on approaches to deliver feasible effective child health and development programs at scale. In sequential reviews, they reiterated their findings highlighting that although all parenting education effectiveness trials affected parenting behaviors, only half of the

scaled-up programs showed similar effects (Engle et al., 2007; Engle et al., 2011). They concluded that knowing the program quality to improve effectiveness was important.

There is consensus that sustaining successful public health interventions requires the ability to identify key components, to identify for whom the intervention is effective, and to identify under what conditions the intervention is effective (Linnan L & Steckler A, 2002). This important objective can be achieved through process evaluation for which a few frameworks are available (Linnan L & Steckler A, 2002; Saunders et al., 2005a). Experts suggest that a "complete and acceptable delivery of the program" should be outlined first (Saunders et al., 2005a). This should be based on details of the program (e.g. program components, theory, and elements in logic model) that will be monitored through recommended elements of a process evaluation plan. These elements include fidelity (quality of implementation), dose (dose delivered-amount of intervention delivered by program implementers and dose received- extent to which participants absorb the intervention and use materials or other resources), and reach (degree to which intended audience participate in the program).

However, none of the published ECD studies describe its complete and acceptable delivery and nor have any elucidated the process elements. Most of the ECD interventions are multi-level in which research teams trained CHWs or volunteers who in turn visited households to tutor parents, and parents in turn modified their child rearing behaviors. Knowing how much of the dose was delivered and received across these levels, and with what fidelity could have helped in better understanding the relationship between "delivered " intervention and its effects during these studies.

The qualitative part of the present study that explored the implementation of early phase of a large-scale randomized trial highlights a number of contextual factors that may influence the integration of a new ECD innovation into the CHW program in Pakistan. Key enhancing factors included community acceptance of these CHWs, the commitment of CHWs to their work, especially to maternal and child health, their willingness to learn and take on additional roles, and their positive attitudes towards incorporation of new communication materials and activities into their preexisting work. Challenges included increasing CWH job responsibilities without their knowledge or involvement leading to reduced time for effective delivery of visit, occasional behaviors of health facility staff and CHW superiors that decrease their motivation level, and non-availability of husbands for participation during CHW visits to the household.

Past reviews suggests that characteristics of effective CHW programs are common in LMICs and include manageable workload, supportive supervision, supplies and equipment, and respect from health system and the community (Jaskiewicz & Tulenko, 2012). The findings from this study are consistent with suggestions that CHWs can work optimally if they are included in decision making, development of training module and intervention adaptation to ensure its cultural appropriateness (Dower, 2006), while also improving their work capacity and ongoing mentoring (Ariff et al., 2010; Haq & Hafeez, 2009). Addressing these contextual factors can enhance program delivery and effectiveness (World Health Organziation, 2007; Bhattacharyya, 2001), and contribute towards achieving the larger goals like reduction in maternal and child morbidity and mortality.

The study also highlights that social support provided to the mother by their family and CHW is critical for taking adequate nutritional and psychological care of the child. Mothers whose workload was shared with family members appeared to be clearer and more focused on their role as a caregiver, and CHWs reported that their families were performing well compared to families of less supported mothers. CHWs, too, were better able to engage families that already realized the need for sharing the workload of a pregnant or lactating mother, while facing difficulty in families where domestic relations were less favorable. Family environment is crucial for adequate nutrition, optimal health and early neuronal development of the child (Shonkoff, 2003; Irwin LG, 2007), and creating an optimal family environment is key to successful outcomes of maternal and child health promotion programs (Walker et al., 2011).

The study also explored some of the important implementation constructs with the help of CHWs. Their discussions revealed that *reach* which is the degree to which intended audience participate in the program, and is usually measured by attendance records (Linnan & Steckler, 2002), involves not only physical participation but also the mental engagement of participants documentation of which will be possible only if this aspect is realized by the program. Studies could improve their *reach* by focusing on strategies for dealing with difficult to engage families during the training sessions of their health workers.

Similarly *dose* which is the number or amount of intended units delivered and received is the extent to which the intended audience uses materials or recommended resources (Linnan & Steckler, 2002). A related concept is *fidelity* or quality with which an intervention is delivered. Both of these implementation concepts are emphasized in the

literature. This study, however, revealed that delivery of dose and its fidelity was dependent more on the context and work environment of CHW than her capability to understand and reproduce the intervention contents. Effective delivery of the new ECD intervention required adequate time for these visits which was not available because of competition with other activities like polio immunization. Before SPRING, the CHWs were spending 15-20 minutes with each family, as part of their time was being consumed by other duties. Addition of SPRING activities requiring 30 minutes for effective delivery posed a challenge to these workers and to long term sustainability of the intervention. Freeing the CHW from responsibilities other than household visits coupled with a training emphasis on key elements of a visit could enhance complete delivery.

One consequence of competing demands on CHW time was that the important step of behavioral activation was missed during her visit. Behavioral activation involved breaking down tasks into smaller activities and having mother and family members practice so that a "behavior" is introduced instead of leaving just a "message." In addition to the short time, a practical difficulty in behavioral activation concerned requirements that the child be awake and accessible. This difficulty could be offset by supplementing the visits with a monthly group meeting of participant mothers and children where new play activities, food recipes and feeding techniques are shared and practical coaching provided (Aboud et al., ; Aboud, 2007) .

In our study, the CHWs made changes or *adapted* the visits to address the important factors like domestic sensitivities, socioeconomic factors and religious rituals. According to implementation experts, interventions change during their course and study designs and reporting (e.g. consort) should include information on this change (Cohen et

al., 2008). They suggest that adaptation and fidelity can co-occur and programs should carefully document the adaptations rather than taking them as a failure (Durlak & DuPre, 2008b). The present trial and other similar studies are likely to benefit from allowing a certain amount of flexibility yet documenting it to ensure that essential elements of their intervention are delivered as intended. Furthermore, future research should aim to better understand whether encouraging specific adaptive strategies enhances study outcomes.

It can be concluded that CHWs are a critical resource that can integrate and deliver relatively complex public health interventions, however, their motivation level and system support are essential requirements for effective program delivery, as is the need to attend to and balance changes in their job responsibilities and daily routines. Given the short amount of time which they often face for a visit, their trainings should emphasize on key areas of a visit that must be delivered within a limited time. Moreover, their skills to handle difficult families and situations should be improved. Lastly, a degree of flexibility to enable the CHW to adapt the visit is desired.

More research should be carried out on the contextual factors that may have the maximum influence on the motivation level, work performance, and implementation capacity of both CHWs and mothers. Programs should not only document the "key ingredients" of their intervention that were most effective but also the "conditions" under which they were effective. Our study is a step towards that direction; however, it was carried out during a small amount of time. Exploring the implementation monitoring of a relatively prolonged phase can present a better and real world picture of the program implementation.

Another important area for future research is the involvement of more stakeholders into this research. We explored the views of the most important "actors" of the implementation i.e. LHWs and mothers. However, program managers at the policy level and family members like husbands at the household level can be important "influencers" of the implementation and sustainability. Both can provide valuable information at the macro level for policy and family respectively. Program managers for example can inform about the cost implications of including a few more pages into CHW curriculum for the workers of the entire province. Husbands can inform about the economical and social dynamics of their family and community that can positively or negatively influence the implementation of such interventions.

A third area of potential research is to assess the outcomes of the process of implementation. While keeping in touch with implementers (CHW and mother in this case) is important to know whether the implementation is going well or not, knowing whether this implementation is achieving the short-term objectives is also important. For example, SPRING trial in the short-term is aiming at improving social support for the mother and infant, which if there can have positive consequences on all of its long-term outcomes including child survival, growth, health and development. Assessing the level of social support as a process outcome therefore will be crucial for SPRING. Similarly other programs should assess process outcomes based on their theoretical framework in order to improve the internal validity of the study and likelihood of achieving the program outcomes.

Like effective implementation, the accurate measurement of a child's physical and social environment is also important for assessing the effectiveness of interventions

that aim to improve a child's life, health and development (Iltus, 2006). The period of early childhood from birth to 3 years is especially critical, as the environment can have profound effects on a child's health and development (Walker, 2011). Home environments may be even more critical to child development in resource-poor countries where preschool institutions are few in number or lack quality and resources (Engle, 2011). In those countries, the home environment and child care often includes extended family members. Interventions that aim to change the home environment to promote early childhood development (ECD) during this period would benefit from valid and reliable measurement of this key domain, including recognition and assessment of the different ways that families may be organized to care for children.

Present study aimed at adapting the HOME inventory to rural, extended family environment in Pakistan. In countries where household labor and childcare are organized around the extended family, such modifications would be helpful to adequately capture the socio-emotional environment of the child. The three socio-emotional domains (i.e., responsivity, acceptance, and involvement) of HOME only consider the mother or primary caregiver leaving out the other potential caregivers from this assessment. The adapted version provides space for including other caregivers into this assessment.

The present study brings a new dimension to the measurement of physical and social environment available to children in rural Pakistan. It found that majority (70%) of families were living in an extended family environment, which is consistent with other studies from Pakistan (NIPS, 2008). Even in 60% of nuclear families, additional care was being provided by family members in addition to the primary caregiver i.e. mother.

Overall, 87% children in our sample had access to additional care, and additional caregivers spent about 3-4 hours per day to carry out multiple activities with the child. These activities could enhance or perhaps detract from the child's development. In extended families, additional caregivers were mostly adult relatives who consistently provided care to children. As expected, children living in extended family households had significantly higher scores than nuclear families, but only when assessing the environment with HOME^{+} and not with HOME. These results support the construct validity of HOME+. A measurement approach that considers these caregivers while assessing a child's home environment may be a better predictor of ECD outcomes. Indeed, prior research in collectivist social groups has found that the original HOME inconsistently predicts ECD outcomes (Bradley, 1994; Wachs, 1992; Totsika & Sylva, 2004; Lozoff 1995), and this enhancement may improve both the content and predictive validity of HOME.

Both the HOME and HOME+ instruments indicated that the richness of the socioemotional and cognitive environment increases as children age, which is what we expected. These improvements were more consistent with HOME+ than HOME in case of "responsivity". Being responsiveness to child's nutritional and psychological needs is considered as one of the key areas for optimum child development (Black, 2011). Responsive parenting which includes cognitively stimulating activities, limit-setting, disciplinary practices, and parent warmth has been found to be associated with desired outcomes like maintaining a healthy weight (Avula, 2011). Responsive feeding is being increasingly recommended as a strategy to improve child health and development (Engle

& Pelto, 2011). Adopting HOME+ approach in assessment of this key domain can help in better understanding environment of children living in extended families.

Given the positive results in favor of including additional caregiver, we think including more than one additional caregiver where present, may also be considered for a more holistic picture of a child's environment. Larger studies with greater statistical power and samples that are representative of a broader population may be necessary to determine if this enhanced version of HOME functions similarly in other population segments and should be considered for ECD research and interventions.

This study highlights an important area in the measurement of physical and social environment available to a child living in an extended family. Many studies that focused on measurement properties of HOME across different cultures and continents indicate that HOME is correlated with the family context (Bradley & Caldwell, 1979; Bradley, 1993) and children's development (Bradley et al., 1996; Elardo et al., 1975). McGregor et al (2007) highlighted the 217 million disadvantaged children living in low and middle income countries whose physical, social and nutrition environment needs improvement. We think that majority of these children may be living in collectivist families and societies, and assessing as well as addressing their context may have important implications for successful program outcomes.

More studies need to be conducted on bigger samples and in diverse settings to improve this adapted version of HOME. The inter-item correlations found in a study with small sample size can vary when the same scale is administered on a different sample (DeVellis, 2003). Similarly the risk that the construct being asked by the researcher may not be understood in the same way by the respondents (non-representative population)

may be large. Large sample sized studies can remove this weakness and improve upon the findings of the present study. Moreover, simultaneously conducted developmental assessments of participating children can provide evidence on differences of developmental opportunities in nuclear and extended family households and improve the criterion validity of the adapted version of HOME inventory.

REFERENCES

Aboud, F. E. (2007). Evaluation of an early childhood parenting programme in rural Bangladesh. *Journal of Health Population and Nutrition*.

Aboud, F. E. (2006). Evaluation of an early childhood preschool program in rural Bangladesh. *Early Childhood Research Quarterly, 21,* 46-60.

Aboud, F. E., Singla, D. R., Nahil, M. I., & Borisova, I. Effectiveness of a parenting program in Bangladesh to address early childhood health, growth and development. *Social Science & Medicine*.

Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (1993). First grade classroom behavior: Its short and long term consequences for school performance. *Child Development, 64,* 801-814.

Anderson, L. M., Shinn, C., Fullilove, M. T., Scrimshaw, S. C., Fielding, J. E., Normand, J. et al. (2003). The effectiveness of early childhood development programs: A systematic review. *American journal of preventive medicine, 24,* 32-46.

Ariff, S., Soofi, S., Sadiq, K., Feroze, A., Khan, S., Jafarey, S. et al. (2010). Evaluation of health workforce competence in maternal and neonatal issues in public health sector of Pakistan: an assessment of their training needs. *BMC health services research, 10*, 319.

Armecin G, B. J. D. P. (2006). *Early childhood development through integrated programmes: evidence from the Philippines* Universities of Pennsylvania, and San Carlos, Population Council and World Bank.

Avula, R., Gonzalez, W., Shapiro, C., Fram, M., Beets, M., Jones, S. et al. (2011). Positive Parenting Practices Associated with Subsequent Childhood Weight Change. *The Journal of Primary Prevention, 32*, 271-281.

Baker, C., Kupersmidt, J. B., Voegler-Lee, M. E., Arnold, D. H., & Willoughby, M. T. (2010). Predicting teacher participation in a classroom-based, integrated preventive intervention for preschoolers. *Early Childhood Research Quarterly, 25*, 270-283.

Bang, A. T., Bang, R. A., Baitule, S. B., Reddy, M. H., & Deshmukh, M. D. (1999). Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. *The Lancet, 354*, 1955-1961.

Baqui, A. H., El-Arifeen, S., Darmstadt, G. L., Ahmed, S., Williams, E. K., Seraji, H. R. et al. (2007). Effect of community-based newborn-care intervention package implemented through two service-delivery strategies in Sylhet district, Bangladesh: a cluster-randomised controlled trial. *The Lancet, 371,* 1936-1944.

Behrman, J. R., Cheng, Y., & Todd, P. E. (2004). Evaluating Preschool Programs When Length of Exposure to the Program Varies: A Nonparametric Approach. *Review of Economics and Statistics, 86,* 108-132.

Bhattacharyya, K. (2001). Community Health Worker Incentives andn Disincentives: How They Affect Motivation, Retention and Sustainability.

Black, J. E. (1998). How a child builds its brain: some lessons from animal studies of neural plasticity. *Preventive medicine, 27,* 168-171.

Black, M. M. & Aboud, F. E. (2011). Responsive Feeding Is Embedded in a Theoretical Framework of Responsive Parenting. *The Journal of Nutrition, 141,* 490-494.

Black, M. M., Sazawal, S., Black, R. E., Khosla, S., Kumar, J., & Menon, V. (2004). Cognitive and motor development among small-for-gestational-age infants: impact of zinc supplementation, birth weight, and caregiving practices. *Pediatrics, 113,* 1297-1305.

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., de Onis, M. et al. (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*.

Boocock, S. S. (1995). Early Childhood Programs in Other Nations: Goals and Outcomes. *The Future of Children, 5,* 94-114.

Bradley, R. H. (1993). Children's home environments, health, behavior, and intervention efforts: a review using the HOME inventory as a marker measure. *Genetic, Social, and General Psychology Monographs*.

Bradley, R. H. (1994). The HOME inventory: Review and reflections. *Advances in child development and behavior, 25,* 241-288.

Bradley, R. H. & Caldwell, B. M. (1979). Home observation for measurement of the environment: a revision of the preschool scale. *American Journal of Mental Deficiency*.

Bradley, R. H. & Caldwell, B. M. (1984). The HOME Inventory and family demographics. *Developmental Psychology, 20,* 315-320.

Bradley, R. H. & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual review of psychology, 53,* 371-399.

Bradley, R. & Corwyn, R. (2005). Caring for children around the world: A view from HOME. *International Journal of Behavioral Development, 29,* 468-478.

Bradley, R. H., Corwyn, R. F., McAdoo, H. P., & Garcia Coll, C. (2001). The home environments of children in the United States part I: Variations by age, ethnicity, and poverty status. *Child Development, 72,* 1844-1867.

Bradley, R. H., Corwyn, R. F., & Whiteside-Mansell, L. (1996). Life at Home: Same Time, Different Places: An Examination of the HOME Inventory in Different Cultures. *Early Development and Parenting, 5,* 251-269.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology, 22,* 723.

Caldwell, B. M. &. B. R. H. (2003). *Home Observation for Measurement of the Environment: Administration manual.* University of Arkansas, Little Rock, AR.

Case, R., Griffin, S., & Kelly, W. (1999). Socioeconomic gradient in mathematical abilities and their responsiveness to intervention during early childhood. In D.Keating & C. Hertzman (Eds.), *Developmental Health and the Wealth of Nations: Social, Biological, and Educational Dynamics* (1st ed., Guilford Press.

Cesswell, J. W. (2013). *Qualitative Inquiry and Research Design: Choosing Among Five*

Approaches. (3rd ed.) Los Angeles: Sage.

Chen, L., Evans, T., Anand, S., Boufford, J. I., Brown, H., Chowdhury, M. et al. (2004). Human resources for health: overcoming the crisis. *The Lancet, 364,* 1984-1990.

Cohen, D. J., Crabtree, B. F., Etz, R. S., Balasubramanian, B. A., Donahue, K. E., Leviton, L. C. et al. (2008). Fidelity versus flexibility. *American journal of preventive medicine, 35,* S381-S389.

Currie, J. (2009). Healthy, Wealthy, and Wise: Socioeconomic Status, Poor Health in Childhood, and Human Capital Development. *Journal of Economic Literature, 47,* 87-122.

Cynader MS, F. B. (1999). Mechanisms of brain development: neuronal sculpting by the physical and social environment. In D.H.C.Keating (Ed.), *Developmental health and the wealth of nations* (New York: Guilford Press.

DeVellis, R. F. (2003). *Scale Development: Theory and Application*. (2nd ed.) Thousand Oaks: Sage.

Dower, C. (2006). *Advancing community health worker practice and utilization: the focus on financing*. National Fund for Medical Education.

Duflo, E. (2000). *Schooling and labor market consequences of school construction in*

Indonesia: Evidence from an unusual policy experiment National Bureau of Economic Research.

Duncan, G. J., Brooks Gunn, J., & Klebanov, P. K. (1994). Economic deprivation and early childhood development. *Child Development, 65,* 296-318.

Durlak, J. & DuPre, E. (2008). Implementation Matters: A Review of Research on the Influence of Implementation on Program Outcomes and the Factors Affecting Implementation. *American Journal of Community Psychology, 41,* 327-350.

Eickmann, S. H., Ana, C., Guerra, M. Q., Lima, M. C., Pedro, I., Huttly, S. R. A. et al. (2003). Improved cognitive and motor development in a community-based intervention of psychosocial stimulation in northeast Brazil. *Developmental Medicine & Child Neurology, 45,* 536-541.

Elardo, R., Bradley, R., & Caldwell, B. M. (1975). The relation of infants' home environments to mental test performance from six to thirty-six months: A longitudinal analysis. *Child Development,* 71-76.

Eng, E. & Parker, E. (2002). Natural Helper Models to Enhance a Community's Health and Competence. In R.DiClemente, R. Crosby, & M. Kegler (Eds.), (First ed., San Francisco: Jossey-Bass.

Engle, P. L., Black, M. M., Behrman, J. R., Cabral de Mello, M., Gertler, P. J., Kapiriri, L. et al. (2007). Strategies to avoid the loss of developmental potential in more than 200 million children in the developing world. *The Lancet, 369*, 229-242.

Engle, P. L., Fernald, L. C., Alderman, H., Behrman, J., O'Gara, C., Yousafzai, A. et al. (2011). Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *The Lancet*.

Engle, P. L. & Pelto, G. H. (2011). Responsive Feeding: Implications for Policy and Program Implementation. *The Journal of Nutrition, 141,* 508-511.

Ertem, I. O., Atay, G., Bingoler, B. E., Dogan, D. G., Bayhan, A., & Sarica, D. (2006). Promoting Child Development at Sick-Child Visits: A Controlled Trial. *Pediatrics, 118,* e124-e131.

Evans JL, S. PS. (1998). *Parenting in the early years: A review of programs for parents of children from birth to three years of age* Washington, DC: The World Bank.

Fernald, L. C., Gertler, P. J., & Neufeld, L. M. (2008). Role of cash in conditional cash transfer programmes for child health, growth, and development: an analysis of Mexico's Oportunidades. *The Lancet, 371,* 828-837.

Ficano, C. (2006). Child Care Market Mechanisms: Does Policy Affect the Quantity of Care? *Social Service Review, 80*, 453-484.

Fogel, A. (1993). *Developing through relationships*. University of Chicago Press.

Frongillo, E. A., Tofail, F., Hamadani, J. D., Warren, A. M., & Mehrin, S. F. Measures and indicators for assessing impact of interventions integrating nutrition, health, and early childhood development. *Annals of the New York academy of sciences*, (in press).

Ghuman, S., Behrman, J. R., Borja, J. B., Gultiano, S., & King, E. M. (2005). Family background, service providers, and early childhood development in the Philippines: Proxies and interactions. *Economic Development and Cultural Change, 54*, 129-164.

Glasgow RE, F. A. U., Vogt TM, F. A. U., & Boles, S. M. (1999). Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *Am J Public of Health*.

Glasgow, R. E., Klesges, L. M., Dzewaltowski, D. A., Estabrooks, P. A., & Vogt, T. M. (2006). Evaluating the impact of health promotion programs: using the RE-AIM framework to form summary measures for decision making involving complex

issues. *Health Education Research, 21,* 688-694.

Government of Punjab (2009). *Preinvestment Study on Rawalpindi District 2009* Lahore: Directorate of industries, Punjab Poonch House, Multan Road.

Grantham-McGregor, S. M., Walker, S. P., Chang, S. M., & Powell, C. A. (1997). Effects of early childhood supplementation with and without stimulation on later development in stunted Jamaican children. *The American Journal of Clinical Nutrition, 66,* 247-253.

Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., & Strupp, B. (2007). Developmental potential in the first 5 years for children in developing countries. *The Lancet, 369,* 60-70.

Grantham-McGregor, S., Schofield, W., & Powell, C. (1987). Development of Severely Malnourished Children Who Received Psychosocial Stimulation: Six-Year Follow-up. *Pediatrics, 79,* 247-254.

Griffin, J. A. (2010). Research on the implementation of preschool intervention programs: Learning by doing. *Early Childhood Research Quarterly, 25,* 267-269.

Hafeez, A., Mohamud, B. K., Shiekh, M. R., Shah, S. A. I., & Jooma, R. (2011). Lady

health workers programme in Pakistan: challenges, achievements and the way forward. *JPMA-Journal of the Pakistan Medical Association, 61,* 210.

Haines, A., Sanders, D., Lehmann, U., Rowe, A. K., Lawn, J. E., Jan, S. et al. (2007). Achieving child survival goals: potential contribution of community health workers. *The Lancet, 369,* 2121-2131.

Hamadani, J. D., Huda, S. N., Khatun, F., & Grantham-McGregor, S. M. (2006). Psychosocial Stimulation Improves the Development of Undernourished Children in Rural Bangladesh. *The Journal of Nutrition, 136,* 2645-2652.

Haq, Z. & Hafeez, A. (2009). Knowledge and communication needs assessment of community health workers in a developing country: a qualitative study. *Human resources for health, 7,* 59.

Haq, Z., Iqbal, Z., & Rahman, A. (2008). International Journal of Mental Health Systems. *International Journal of Mental Health Systems, 2,* 15.

Heaney C & Israel B (2008). Social Ntworks and Social Support . In R.B.&.V.K.Glanz K (Ed.), *Health Behavior and Health Education: Theory, Research and Practice* (4 ed., pp. 189-207). San Francisco: Jossey-Bass.

Hofstede, G. (1983). National cultures in four dimensions: A research-based theory of

cultural differences among nations. *International Studies of Management & Organization, 13,* 46-74.

Iltus, S. (1-1-2007). Significance of home environments as proxy indicators for early childhood care and education. Paper commissioned for the EFA Global Monitoring Report.
Ref Type: Online Source

Iltus, S. (2006). *Significance of home environments as proxy indicators for early childhood care and education* UNESCO.

Irwin LG, S. A. H. C. (2007). *Early Child Development : A Powerful Equalizer* World Health Organization's Commission on the Social Determinants of Health.

Jaramillo A, T. K. (2002). *Early childhood development in Africa: Can we do more or less? A look at the impact and implications of preschools in Cape Verde and Guinea.* World Bank.

Jaskiewicz, W. & Tulenko, K. (2012). Increasing community health worker productivity and effectiveness: a review of the influence of the work environment. *Hum Resour Health, 10,* 38.

Jones, G., Steketee, R. W., Black, R. E., Bhutta, Z. A., & Morris, S. S. (2003). How many

child deaths can we prevent this year? *Lancet, 362,* 65-71.

Kagitcibasi, C., Sunar, D., & Bekman, S. (2007). Long-term effects of early intervention: Turkish low-income mothers and children. *Journal of Applied Developmental Psychology, 22,* 333-361.

Karr-Morse, R. & Wiley, M. S. (1997). *Ghosts from the nursery: Tracing the roots of violence*. Atlantic Monthly Press.

Kim, U. & Choi, S. H. (1994). Individualism, collectivism, and child development: A Korean perspective. *Cross-cultural roots of minority child development,* 227-257.

Kumar, V., Mohanty, S., Kumar, A., Misra, R. P., Santosham, M., Awasthi, S. et al. (2008). Effect of community-based behaviour change management on neonatal mortality in Shivgarh, Uttar Pradesh, India: a cluster-randomised controlled trial. *Lancet, 372,* 1151-1162.

Lambrechts, T., Bryce, J., & Orinda, V. (1999). Integrated management of childhood illness: a summary of first experiences. *Bulletin of the World Health Organization, 77,* 582.

Lewin, S. A., Babigumira, S. M., Bosch-Capblanch, X., Aja, G., Van Wyk, B., Glenton,

C. et al. (2006). Lay health workers in primary and community health care: A systematic review of trials. Geneva: World Health Organization .

Ref Type: Online Source

Lewis, M. A., Butterfield, R. M., Darbes, L. A., & Johnston-Brooks, C. (2004). The conceptualization and assessment of health-related social control. *Journal of Social and Personal Relationships, 21,* 669-687.

Lewis, M. A. & Rook, K. S. (1999). Social control in personal relationships: impact on health behaviors and psychological distress. *Health Psychology, 18,* 63.

Lingam, R., Gupta, P., Zafar, S., Hill, Z., Yousafzai, A., Iyengar, S. et al. Understanding care and feeding practices: building blocks for a sustainable intervention in India and Pakistan. *Annals of New York Academy of Sciences,* (in press).

Linnan L & Steckler A (2002). Process evaluation for public health interventions and research. In Linnan L & Steckler A (Eds.), *Process evaluation for public health interventions and research* (1 ed., pp. 1-24). San Francisco: Jossey-Bass.

London School of Hygiene and Tropical Medicine. (2013). The Intervention Package: Sustainable Programme Incorporating Nutrition and Games. 7-28-2013.

Ref Type: Online Source

Love, J. M., Kisker, E. E., Ross, C., Raikes, H., Constantine, J., Boller, K. et al. (2005).

The effectiveness of early head start for 3-year-old children and their parents: lessons for policy and programs. *Developmental Psychology, 41*, 885.

Lozoff, B., Park, A. M., Radan, A. E., & Wolf, A. W. (1995). Using the HOME inventory with infants in Costa Rica. *International Journal of Behavioral Development, 18*, 277-295.

Maxwell, J. (2005). *Qualitative Research Design: An Interactive Approach*. (2nd ed.) Thousand Oaks: Sage Publications.

McEwen, B. S. & Stellar, E. (1993). Stress and the individual: mechanisms leading to disease. *Archives of internal medicine, 153,* 2093.

Mercy, J. A. & Steelman, L. C. (1982). Familial influence on the intellectual attainment of children. *American Sociological Review,* 532-542.

Miles, M. & Huberman, M. (1994). *Qualitative data analysis: an expanded sourcebook*. (2 ed.) Thousand Oaks: Sage.

Morris, S. S., Olinto, P., Flores, R., Nilson, E. A., & Figueiro, A. C. (2004). Conditional cash transfers are associated with a small reduction in the rate of weight gain of preschool children in northeast Brazil. *The Journal of nutrition, 134,* 2336-2341.

Moustakas, C. (1994). *Phenomenological research methods*. Sage.

Mumtaz, Z. & Salway, S. M. (2007). Gender, pregnancy and the uptake of antenatal care services in Pakistan. *Sociology of Health & Illness, 29*, 1-26.

Nahar, B., Hamadani, J. D., Ahmed, T., Tofail, F., Rahman, A., Huda, S. N. et al. (2008). Effects of psychosocial stimulation on growth and development of severely malnourished children in a nutrition unit in Bangladesh. *Eur J Clin Nutr, 63*, 725-731.

NIPS (2008). *Pakistan Demographic & Health Survey 2006-2007* Islamabad: National Institute of Population Studies.

Nishtar, S. & Mehboob, A. B. (8-20-2011). Pakistan prepares to abolish Ministry of Health. The Lancet 378[9792], 648-649.
Ref Type: Abstract

NP for FP & PHC. (2011). Lady Health Workers Programme. 10-5-2011.
Ref Type: Online Source

PAIMAN. (2006). Qualitative Formative Research Findings. 10-5-2011.
Ref Type: Online Source

Patton M Q (2002). *Qualitative Research & Evaluation Methods*. (3 ed.) California: Sage Publications.

Pianta, R., Egeland, B., & Sroufe, L. (1993). 10 Maternal stress and children's

development: prediction of school outcomes and identification of protective factors. *Risk and protective factors in the development of psychopathology,* 215.

Powell, C., Baker-Henningham, H., Walker, S., Gernay, J., & Grantham-McGregor, S. (2004). Feasibility of integrating early stimulation into primary care for undernourished Jamaican children: cluster randomised controlled trial. *BMJ: British Medical Journal, 329,* 89.

Powell, C. & Grantham-McGregor, S. (1989). Home Visiting of Varying Frequency and Child Development. *Pediatrics, 84,* 157-164.

Psacharopoulos, G. & Harry, A. (2004). Returns to investment in education: a further update. *Education economics, 12,* 111-134.

Rahman, A., Iqbal, Z., Roberts, C., & Husain, N. (2009). Cluster randomized trial of a parent-based intervention to support early development of children in a low-income country. *Child: Care, Health and Development, 35,* 56-62.

Rahman, A., Haq, Z., Sikander, S., Ahmad, I., Ahmad, M., & Hafeez, A. (2012). Using cognitive-behavioural techniques to improve exclusive breastfeeding in a low-literacy disadvantaged population. *Maternal & Child Nutrition, 8,* 57-71.

Rahman, A., Iqbal, Z., Bunn, J., Lovel, H., & Harrington, R. (2004). Impact of Maternal

Depression on Infant Nutritional Status and Illness: A Cohort Study. *Archives of General Psychiatry, 61,* 946-952.

Rahman, A., Malik, A., Sikander, S., Roberts, C., & Creed, F. (2008). Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: a cluster-randomised controlled trial. *The Lancet, 372,* 902-909.

Raikes, H., Luze, G., Brooks-Gunn, J., Raikes, H. A., Pan, B. A., Tamis-LeMonda, C. S. et al. (2006). Mother-Child Bookreading in Low-Income Families: Correlates and Outcomes during the First Three Years of Life. *Child Development, 77,* 924-953.

Rao, N. (2005). Childrens rights to survival, development, and early education in India: The critical role of the Integrated Child Development Services program. *International Journal of Early Childhood, 37,* 15-31.

Riaz, H. & Rehman, A. (2013). Polio vaccination workers gunned down in Pakistan. *The Lancet Infectious Diseases, 13,* 120.

Rodier, P. M. (2004). Environmental causes of central nervous system maldevelopment. *Pediatrics, 113,* 1076-1083.

Rosenthal, E. L., Brownstein, J. N., Rush, C. H., Hirsch, G. R., Willaert, A. M., Scott, J. R. et al. (2010). Community health workers: part of the solution. *Health Affairs, 29,* 1338-1342.

Ruxin, J. N. (1994). Magic bullet: the history of oral rehydration therapy. *Medical History, 38,* 363.

Sanford DeRousie, R. M. & Bierman, K. L. (2012). Examining the sustainability of an evidence-based preschool curriculum: The REDI program. *Early Childhood Research Quarterly, 27,* 55-65.

Saunders, R. P., Evans, M. H., & Joshi, P. (2005a). Developing a Process-Evaluation Plan for Assessing Health Promotion Program Implementation: A How-To Guide. *Health Promotion Practice, 6,* 134-147.

Schellenberg, J. A., Victora, C. G., Mushi, A., de Savigny, D., Schellenberg, D., Mshinda, H. et al. (2003). Inequities among the very poor: health care for children in rural southern Tanzania. *The Lancet, 361,* 561-566.

Shonkoff, J. P. (2003). From Neurons to Neighborhoods: Old and New Challenges for Developmental and Behavioral Pediatrics. *Journal of Developmental & Behavioral Pediatrics, 24*.

Shore, R. (1997). Rethinking the brain: New insights into early development.

Siddiqi A., I. L. H. C. (2007). *The Total Environment Assessment Model ofEarly Child Development. Evidence Report for theCommission on Social Determinants of Health,World Health Organization.*

Sikander, S. (2009). *A CLUSTER RANDOMISED TRIAL OF A PSYCHOSOCIAL INTERVENTION FOR PERINATAL DEPRESSION IN RURAL PAKISTAN.* School of Medicine, Division of Psychiatry University of Manchester, Manchester, UK.

Singh, P. & Sachs, J. D. (2013). 1 million community health workers in sub-Saharan Africa by 2015. *diabetes, 14,* 17.

Super, C. M., Herrera, M. G., & Mora, J. O. (1990). Long-Term Effects of Food Supplementation and Psychosocial Intervention on the Physical Growth of Colombian Infants at Risk of Malnutrition. *Child Development, 61,* 29-49.

Sweet, M. A. & Appelbaum, M. I. (2004). Is Home Visiting an Effective Strategy? A Meta-Analytic Review of Home Visiting Programs for Families With Young Children. *Child Development, 75,* 1435-1456.

The College of Physicians of Philadelphia. (1-1-2013). The Development of the

immunization Schedule.

Ref Type: Online Source

Thompson, R. A. & Nelson, C. A. (2001). Developmental science and the media: Early brain development. *American Psychologist, 56,* 5-15.

Totsika, V. & Sylva, K. (2004). The Home Observation for Measurement of the Environment Revisited. *Child and Adolescent Mental Health, 9,* 25-35.

UNICEF. (2013). ECD Resource Pack.

Ref Type: Online Source

Valsiner, J. (2000). *Culture and human development*. Sage.

Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L. et al. (2008). Maternal and child undernutrition: consequences for adult health and human capital. *The Lancet, 371,* 340-357.

Waber, D. P., Vuori-Christiansen, L., Ortiz, N., Clement, J. R., Christiansen, N. E., Mora, J. O. et al. (1981). Nutritional supplementation, maternal education, and cognitive development of infants at risk of malnutrition. *The American Journal of Clinical Nutrition, 34,* 807-813.

Wachs, T. D. (1992). *The nature of nurture*. Sage Publications, Inc.

Walker, S. (2011). Promoting equity through early child development interventions for children from birth through three years of age. In H.Alderman (Ed.), *No Small Matter: The Impact of Poverty, Shocks, and Human Capital Investments in Early Childhood Development* (Wsahington D.C.: The World Bank.

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

Walker, S. P., Wachs, T. D., Grantham-McGregor, S., Black, M. M., Nelson, C. A., Huffman, S. L. et al. (2011). Inequality in early childhood: risk and protective factors for early child development. *The Lancet*.

Walker, S. P., Wachs, T. D., Meeks Gardner, J., Lozoff, B., Wasserman, G. A., Pollitt, E. et al. (2007). Child development: risk factors for adverse outcomes in developing countries. *The Lancet, 369,* 145-157.

Watanabe, K., Flores, R., Fujiwara, J., & Tran, L. T. H. (2005). Early Childhood Development Interventions and Cognitive Development of Young Children in Rural Vietnam. *The Journal of Nutrition, 135,* 1918-1925.

Webb, S. J., Monk, C. S., & Nelson, C. A. (2001). Mechanisms of Postnatal Neurobiological Development: Implications for Human Development. *Developmental Neuropsychology*, *19*, 147-171.

White, K. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin; Psychological Bulletin*, *91*, 461.

World Health Organization (1984). A programme for controlling acute respiratory infections in children: memorandum from a WHO meeting. *Bull World Health Organ*, *62*, 47-58.

World Health Organziation (2007). *Community health workers: What do we know about them?* Geneva: World Health Organization.

Zafar, S., Sikander, S., Haq, Z., Hill, Z., Lingam, R., Skordis-Worall, J. et al. Integration of a scalable maternal psychosocial well-being (MPW) component into a child-development intervention: challenges and opportunities. *Annals of New York Academy of Sciences*, (in press).

Zill, N., Moore, K. A., Smith, E. W., Stief, T., & Coiro, M. J. (1995). The life circumstances and development of children in welfare families: A profile based on national survey data. *Escape from poverty: What makes a difference for children*, 38-59.

Zimet, G. D., Dahlem, N. W., Zimet, S. G., & Farley, G. K. (1988). The

Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment, 52,* 30-41.

APPENDIX A

Study Instruments

Interview Guide for Lady Health Workers (LHWs)

Main Question: What does a Lady Health Worker's work and life look like, how she currently promotes maternal and child health, and how the new intervention fits into her context?

Respondent: Lady Health Worker **Activity:** Semi-structured interview

Time point: After the training, before the implementation

No.	Question	Sub-questions	Domain assessed
1.	Let us begin by listening from you about your work. So, please tell us something about yourself and your job as a Lady Health Worker.	a) How long have you been working with the LHW Program? b) Do you belong to the community where you work? c) How did you make the decision to be part of this program? d) What do you see your primary responsibility as a LHW? e) You fulfill your responsibilities by carrying out visits to the families. How do you organize visits to 200 families in a month? f) In a given visit how do you prioritize issues to address for that specific household?	Personal and professional Context
2.	You have been working with the LHWP for X years. Would you please share your views about the work that you have been asked to do over these years?	a) Have you been doing the same things over the years? Can you tell us any new things that were added to the LHW work? b) Were you or LHWs like you involved while decisions were being made to make these modifications to the LHW work? c) What are your views about the decision-making process regarding incorporation of new interventions into LHW work? d) What are the implications for the implementation of a new idea if LHW is not involved in the decision making process? e) How this process can be improved?	LHW system context
3.	How would you describe your work that you were doing to promote maternal and child health?	a) In the past, what comprised LHW's work to promote maternal health and similarly child health? b) What have been some achievements from the perspective of LHW? c) What were some of the challenges that LHW faced in this specific area? d) Any thoughts specifically on child development?	Child health context
4.	How would you describe your experience of learning the new	a) Tell us things that you liked about this new component and training? b) Tell us things that you did not like about this new component and training.	Completeness, acceptability and adaptability

	early child health and development component?	c) You have received training manual, a set of counseling cards and a health calendar as part of this program. Which one of these is most useful and which one is not. Why? d) Do you think this new component is compatible with your preexisting work? e) Do you think you will be able to adapt your MCH work according to the new component?	
5.	What are your views about the prospective implementation of this intervention as part of your routine field visits?	a) How this new component will be different from the MCH work you were already doing? b) Do you think the training and job-aids have sufficiently equipped you to talk about a new topic like child development? c) What are your perceptions about 'coaching' the mothers rather than 'teaching' them? d) What challenges do you expect during the monthly visits to implement this new component?	Adoption

Main Question: After having implemented the new maternal and child health intervention for some time, what are the views of the LHW about various implementation aspects including Dose, Reach, Fidelity, Adoption and Sustainability of this new intervention? What has been the context of this implementation?

Respondent: Lady Health Worker **Activity:** Semi-structured interview**Time point**: During implementation

No.	Question	Sub-questions	Domain assessed
1.	Let us begin by listening from you about the new maternal and child health component. So, please tell us something about your experiences.	a) How many visits you conducted during the past X months? In how many visits, you talked about the new component? b) What other topics you discussed during these visits? c) Which of the 3 components of new intervention i.e. maternal nutrition, child nutrition and child interaction & play are easy to implement and why? Which one is difficult and why? d) What is your level of comfort on incorporating this new component to your preexisting visits?	Adoption
2.	Please tell us something about the proceedings of a visit in which you addressed the new component?	a) How did you begin the discussion? Which topic was addressed first and why? b) On average, how much time you gave to other topics and how much to the new component? c) Did you carry all the 3 job-aids for the visit? How did you use them? d) Which of the job-aids was most helpful? Any modifications required to these job-aids?	Fidelity
3.	Families can have the environment and context of their own. Tell us about how at times you may have adapted the content and conduct of a visit?	a) What were the usual situations in which you adapted the visit? b) What were the main reasons in your mind when you adapated or modified a visit? c) In what ways did you modify a visit?	Adaptation

4.	What are your views about the backup support that was available to you during the period while you were carrying out these visits?	a) Did you attend the routine supervision meetings headed by your supervisor at your health center? How the new component was attended and issues addressed during these meetings? b) Did you find any additional support during those meetings or outside of those meetings? Was it helpful; how? c) How important was this additional support for the new component? Could you do your visits without this support? Can other LHWs do this?	Completeness
5.	How do you think the mothers and their families are reacting to you and to the new component?	a) How would you describe your relationship with the mother? Do you face any challenges in effectively communicating with her? b) Is there anything that can further improve your relationship with the mother? c) What is the level of enthusiasm of mother, father and family members about this new component? d) Which of the 3 components is easy for the mother to grasp and which one difficult? Why?	Adoption, Reach
6.	Is there anything that can be helpful to enhance the implementation at the mother and family level?	a) What are your observations on challenges faced by families while acting upon a child intervention? b) The new intervention relies on building mother's knowledge and capacity. Do you see that happening? Can we do something to further improve it? c) Increasing family support to mother and child is also part of this new component. What has been the role of your counseling towards this? Are there any challenges and how can we address them?	Adoption

7.	What is your advice on improving the chances for sustainability of new programs like *Roshan kal*?	a) Do you think other LHWs can incorporate this component into their existing visits? What can be some difficulties in it and how we can address them? b) Which of the job-aids are really helpful and should be provided to all LHWs? c) Do you recommend any changes to the job-aids or to the training program?	Sustainability

Interview Guide for Mothers

Main Question: What does a mother's work and life look like, how she and her family members were taking care of child's health and development, and what are her views about the new child health messages?

Respondent: Mother **Activity:** Semi-structured interview

Time point: 3 months after the beginning of intervention

No.	Question	Sub-questions and probes	Domain assessed
1.	Let us begin by listening from you about your life. So, please tell us something about your daily life and your role as a mother.	1. How does a typical day of your life look like? 2. What are your priorities as a housewife and as a mother? 3. How would you describe the role of your LHW in dealing with your own as well as your child's health issues?	Context
2.	In the past couple of months; have you heard something new about your child's health and development from your LHW?	1. If yes, what were these new things? 2. What was the most important among these new things that the LHW talked about?	
3.	How would you describe your child care activities before these new messages?	1. How were you taking care of child's nutrition a. Exclusive breastfeeding b. Complementary feeding 2. How were you taking care of child's development? a. Playing b. Education 3. How much was the father/family involvement?	Context
4.	How would you describe your experience of feeding and taking care of the child after receiving new messages?	1. Tell us things that you liked about the new messages? 2. Tell us things that you did not like about new messages? 3. Do you think these messages are compatible with your preexisting work? 4. Do you think you will be able to incorporate new learning into your daily life?	Adoption
5.	What are your views about acting upon new messages on a long-term basis?	1. What are some factors that might facilitate implementation of this new advice? 2. What would be some likely challenges in this implementation? 3. How can we minimize these challenges? 4. What steps would likely improve the the LHW visits and ultimately the child care at your home?	Adoption/sustainability

APPENDIX B

Additional Analyses

Table B.1: Inter-observer agreement scores for HOME and HOME+ using KR-20 formula

	Mother	Addl.		Mother	Addl.
I. RESPONSIVITY	0.87	0.79	24. Child has a special place for toys and treasures. E	0.76	
1. Parent permits child to engage in "messy" play. I	0.80	0.80	25. Child's play environment is safe. O	0.79	
2. Parent spontaneously vocalizes to child at least twice. O	0.71	0.70	**IV. LEARNING MATERIALS**	0.87	N/A
3. Parent responds verbally to child's vocalizations or verbalizations. O	0.90	0.85	26. Muscle activity toys or equipment. E	0.82	
4. Parent tells child name of object or person during visit. O	0.91	0.89	27. Push or pull toy. E	0.74	
5. Parent's speech is distinct, clear, and audible. O	0.73	0.74	28. Any big toy with wheels e.g. stroller or walker etc. E	1	
6. Parent initiates verbal interchanges with Visitor. O	0.89	0.85	29. Cuddly toy or role-playing toys. E	0.89	
7. Parent converses freely and easily. O	0.61	0.65	30. Learning facilitators—home items like table and chair or home-made toys E	0.91	
8. Parent spontaneously praises child at least twice. O	1	0.90	31. Simple eye-hand coordination toys. E	0.80	
9. Parent's voice conveys positive feelings toward child. O	0.60	0.60	32. Complex eye-hand coordination toys. E	0.84	
10. Parent caresses or kisses child at least once. O	0.90	0.91	33. Toys for literature like pictorial books E	1	
11. Parent responds positively to praise of child offered by Visitor. O	0.79	0.75	34. Parent provides toys for child to play with during visit. O	0.82	
II. ACCEPTANCE	0.87	0.86	**V. INVOLVEMENT**	0.75	0.72
12. No more than 1 instance of physical punishment during past week. I	1	1	35. Parent talks to child while doing household work. I	0.79	0.76
13. Family has a pet. E	1	1	36. Parent consciously encourages developmental advance. I	0.63	0.66
14. Parent does not shout at child. O	1	0.90	37. Parent invests maturing toys with value via personal	0.79	0.70

			attention. I		
15. Parent does not express overt annoyance with or hostility to child. O	0.73	0.74	38. Parent structures child's play periods. I	0.90	0.75
16. Parent neither slaps nor spanks child during visit. O	1	1	39. Parent provides toys that challenge child develop new skills. I	0.70	0.70
17. Parent does not scold or criticize child during visit. O	0.68	0.70	40. Parent keeps child in visual range, looks at often. O	0.69	0.75
18. Parent does not interfere or restrict child more than 3 times during visit. O	0.76	0.80	**VI. VARIETY**	0.88	N/A
19. At least 5 books are present and visible. E	0.80	0.78	41. Father provides some care daily. I	0.90	
III. ORGANIZATION	0.91	N/A	42. Parent reads stories to child at least 3 times weekly. I	0.80	
20. Child care, if used, is provided by one of 3 regular substitutes. I	0.88		43. Child eats at least one meal a day with mother and father. I	0.88	
21. Child is taken to grocery store at least once a week. I	1		44. Family visits relatives or receives visits once a month or so. I	0.80	
22. Child gets out of house at least 4 times a week. I	1		45. Child has 3 or more books of his/her own. E	1	
23. Child is taken regularly to doctor's office or clinic. I	1				

NA=not applicable to alternative caregiver

Table B.2: Sensitivity analysis of HOME using subscale and total scores as continuous and dichotomous variable (n=153)

Group	**Responsivity**		**Acceptance**		**Involvement**		**Organization**		**Learning materials**		**Variety**		**Total**	
Continuous														
	M (SD)		M (SD)		M (SD)		M (SD)		M (SD)		M (SD)		M (SD)	
Nuclear	6.91 (2.06)		5.31 (1.71)		4.36 (1.24)		4.02 (1.16)		3.33 (2.49)		3.04 (.87)		26.96 (6.43)	
Extended	7.31 (2.14)		5.95* (1.23)		4.34 (1.25)		4.60** (1.16)		3.50 (2.12)		2.95 (1.08)		28.69 (5.28)	
Categorical														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Nuclear	23	13	22	9	26	19	16	16	14	15	14	14	15	12
Extended	31	39	35	36	47	61	22	65	27	37	41	45	24	31
Pearson χ^2		3.66		4.11*		2.59		6.57**		0.30		0 .05		1.03

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

Table B.3: Sensitivity analysis of HOME^{+} using subscale and total scores as continuous and dichotomous variable (n=153)

Group	**Responsivity**		**Acceptance**		**Involvement**		**Organization**		**Learning materials**		**Variety**		**Total**	
Continuous														
	M (SD)		M (SD)		M (SD)		M (SD)		M (SD)		M (SD)		M (SD)	
Nuclear (45)	7.47 (2.39)		5.96 (2.70)		4.76 (1.81)		4.02 (1.16)		3.33 (2.49)		3.04 (.87)		28.58 (7.13)	
Extended (108)	12.67*** (4.47)		10.90*** (3.12)		7.42*** (2.56)		4.60** (1.16)		3.50 (2.12)		2.95 (1.08)		42.04*** (9.66)	
Categorical														
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Nuclear (45)	25	0	33	2	30	1	16	16	14	15	14	14	25	0
Extended (108)	19	46	15	60	35	46	22	65	27	37	41	45	16	48
Pearson χ^2		36.2***		53.13***		26.41***		6.57**		0.30		0 .05		40.70***

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

Table B.4: Sensitivity analysis by comparing mean HOME scores with full and half weighted HOME^{+} scores

Group (n)	**Responsivity** Mean (SD)	**Acceptance** Mean (SD)	**Involvement** Mean (SD)	**Organization** Mean (SD)	**Learning materials** Mean (SD)	**Variety** Mean (SD)	**Total** Mean (SD)
HOME							
Nuclear (45)	6.91 (2.06)	5.31 (1.71)	4.36 (1.24)	4.02 (1.16)	3.33 (2.49)	3.04 (.87)	26.96 (6.43)
Extended (108)	7.31 (2.14)	5.95* (1.23)	4.34 (1.25)	4.60** (1.16)	3.50 (2.12)	2.95 (1.08)	28.69 (5.28)
HOME^{+}							
Nuclear (45)	7.47 (2.39)	5.96 (2.70)	4.76 (1.81)	Same as above	Same as above	Same as above	28.58 (7.13)
Extended (108)	12.67*** (4.47)	10.90*** (3.12)	7.42*** (2.56)	Same as above	Same as above	Same as above	42.04*** (9.66)
½ weighted HOME^{+}							
Nuclear (45)	7.19 (2.09)	5.63 (2.06)	4.56 (1.43)	Same as above	Same as above	Same as above	27.78 (6.40)
Extended (108)	9.99*** (3.10)	8.43*** (2.03)	5.88*** (1.79)	Same as above	Same as above	Same as above	35.35*** (6.95)

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