Integration and Expansion of Prevention of Mother-to-Child Transmission (PMTCT) of HIV and Early Childhood Intervention Services

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The named authors alone are responsible for the views expressed in this publication.
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<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AED</td>
<td>Academy for Educational Development</td>
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<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
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<tr>
<td>ANECCA</td>
<td>African Network for the Care of Children Affected by HIV/AIDS</td>
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<tr>
<td>ART</td>
<td>Antiretroviral therapy for HIV (triple therapy)</td>
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<td>ARV</td>
<td>Antiretroviral drugs for treatment and/or prophylaxis of HIV virus</td>
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<td>AZT</td>
<td>Zidovudine</td>
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<tr>
<td>CHW</td>
<td>Community Health Worker</td>
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<tr>
<td>CSDH</td>
<td>World Health Organization’s Commission on the Social Determinants of Health</td>
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<td>DBS</td>
<td>Dried Blood Spot testing for HIV</td>
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<tr>
<td>ECD</td>
<td>Early Childhood Development</td>
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<tr>
<td>GFATM</td>
<td>Global Fund to Fight AIDS, TB, and Malaria</td>
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<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>JLICA</td>
<td>Joint Learning Initiative on Children and HIV/AIDS</td>
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<tr>
<td>LG3</td>
<td>Learning Group 3 of JLICA: Expanding Access to Services And Protecting Human Rights</td>
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<tr>
<td>NNRTI</td>
<td>Non-Nucleoside Reverse Transcriptase Inhibitors</td>
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<tr>
<td>NVP</td>
<td>Nevirapine</td>
</tr>
<tr>
<td>OVC</td>
<td>Orphans and Vulnerable Children</td>
</tr>
<tr>
<td>PEPFAR</td>
<td>President’s Emergency Plan For AIDS Relief</td>
</tr>
<tr>
<td>PITC</td>
<td>Provider Initiated Testing and Counselling</td>
</tr>
<tr>
<td>PMTCT</td>
<td>Prevention of mother-to-child transmission of HIV</td>
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<tr>
<td>PMTCT-plus</td>
<td>The integration of PMTCT and HIV care and treatment services for women and their families</td>
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<tr>
<td>TBA</td>
<td>Traditional Birth Attendant</td>
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<tr>
<td>UNAIDS</td>
<td>Joint United Nations Programme on HIV/AIDS</td>
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<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>VCT</td>
<td>Voluntary Counseling and Testing</td>
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ABSTRACT

Background: A significant gap remains between global policy commitments to reduce mother-to-child transmission of HIV and access to PMTCT interventions in resource-poor settings. As late as 2005, less than 10% of HIV-positive pregnant women had access to PMTCT services worldwide. Although there has been some improvement in recent years in PMTCT coverage (increasing to 20–25%), the fact remains that the large majority of women and infants who require these services do not receive them. High HIV/AIDS-burdened societies are at critical risk for “toxic stressors,” such as chronic poverty, that may impair pediatric brain architecture, compromising language development and lifelong psychosocial and physical health. This paper reviews the evidence for integrating PMTCT and early childhood development (ECD) services as a viable, effective strategy that addresses these challenges.

Methods: The methods used for this paper included a comprehensive review of published and gray literature of PMTCT and ECD sources. PubMed and relevant gray literature were reviewed for both topics. For PMTCT, relevant UN documents (e.g. WHO report on PMTCT, 2006) as well as abstracts from IAS 2006, IAS 2007, CROI 2007 and CROI 2008 conferences were reviewed. For ECD, additional relevant search engines were also used, including PSYCHInfo and ERIC. Also included were references cited by Engle et al. (2007) in their Lancet review of ECD in developing countries. LG3 members’ programmatic experience in both content areas as well as representative field “cases” from the literature provided additional resources.

Results: There is science-based evidence that optimal PMTCT practices in resource-poor settings are possible and can significantly reduce HIV transmission, morbidity, and mortality. Factors that may facilitate access to and quality of PMTCT services include but are not limited to: increasing access to early antenatal care; routine HIV testing for all pregnant women; virologic testing for HIV among all HIV-exposed infants by 4–6 weeks of age; universal ART provision for all HIV-positive infants less than 12 months of age; providing PMTCT regimens no later than 28 weeks of gestation and offering most efficacious regimens for women and infants; and providing a safe and supportive environment for replacement feeding for infants. In addition, ECD interventions can be successfully implemented in resource-poor settings, particularly if the interventions: promote health care access and nutritional support; utilize community health workers or other paraprofessionals to perform ECD intervention activities; offer home-based programs; facilitate parent and family involvement; provide regular training and re-training sessions for program implementers; and offer ECD intervention sessions with families frequently (weekly or bi-monthly) over a long-term period (e.g. 1–3 years). Integrating ECD and PMTCT program components may enhance health and psychosocial outcomes. Although significant barriers remain, a long-term service approach can deliver social and health value that far exceeds implementation costs. This perspective can enhance continuity of care and promote a family-based approach to service provision.

Policy/action implications: Effective strategies to enhance access to high quality, integrated PMTCT and ECD programs may include: advancement of government policy and financial investment from all stakeholders that support PMTCT, basic health care, nutrition, ECD, and integration of these services; offering routine HIV testing for all pregnant women; promotion of community-based leadership; a focus on mothers and family-centered services; consideration of local and regional barriers in access to care; provision of training and re-training of health care providers and parents; consideration of payment for community health workers; and enhanced access to services and quality of care through the promotion of continuity of care. Implementation failures, such as situations where infant replacement feeding caused excess morbidity and mortality, should not prohibit future consideration of the most efficacious approach; rather these failures should be viewed as opportunities to elucidate factors that can prevent positive outcomes to advance program development in the direction of minimizing risk and offering the highest standard of care.
PART ONE: Introduction

The Joint Learning Initiative on Children and HIV/AIDS (JLICA) aims to identify and promote strategies that will improve outcomes for vulnerable children affected by HIV/AIDS through an integrated approach to the care of affected families. Learning Group 3 (LG3) addresses the needs of HIV-affected families, beginning with appropriate prevention of mother-to-child transmission of HIV (PMTCT) intervention regimens. In this regard, PMTCT is seen as an “entry point” for access to a broad range of family-centered services. Through outreach and provision of PMTCT, access to HIV testing and antiretroviral therapy (ART) for all affected family members can be expanded in order to prevent transmission and more broadly treat mothers, children and their families (Abrams et al., 2007). Following birth, infants can be followed for primary care access as well as progress in early childhood development (ECD). Successful ECD programs offer support for mothers and other family members (Magill-Evans, Harrison, Rempel, & Slater, 2006; Powell et al., 2004) and engage communities in program development and implementation (Irwin et al., 2007; AED, DCOF, & USAID, 2007).

Integration of PMTCT and ECD interventions would promote a family-centered, holistic approach that would include the following components:

- routine testing and counseling for HIV among pregnant women;
- access to medications, including prophylaxis;
- prenatal care before delivery;
- nutrition supplementation during pregnancy, if indicated;
- safe delivery environment and postnatal care;
- appropriate prenatal antiretroviral (ARV) regimens, including ART for mother when indicated;
- HIV testing for other family members and ART offered (when indicated);
- infant feeding counseling and promotion of safe environment for replacement feeding in order prevent transmission as well as infant and child mortality;
- ongoing access to reproductive health care and family planning services;
- HIV testing for infants;
- access to pediatric care, including ART for infants when indicated;
- a comprehensive early child development (ECD) intervention for the child that includes significant involvement and support of the mother as well as other family members and supplemental nutrition when indicated; and
- social protection of the most vulnerable families to offer adequate external support for the care and protection of children.

This paper outlines and discusses the evidence for supporting and integrating these key components and the evidence for barriers to implementation. It argues that recent science-based evidence on early neural development and the effects of deprivation and “toxic” stress on the young child is directly relevant for children affected by HIV/AIDS in resource-poor settings. Long-term, consistent, well-designed and aggressive intervention at this critical period in human development can make best use of synergistic opportunities to integrate PMTCT with ECD. An integrated implementation approach is a cost-effective means for achieving successful outcomes and meeting JLICA goals. Integrated implementation of PMTCT and ECD will enable children affected by HIV/AIDS to move beyond marginal physical survival to attain their developmental potential in society and make positive contributions to a global economy for the next generation. Research confirms a strong association between child survival and child development; such an investment at this critical window of opportunity in early childhood promises economic returns that far exceed cost outlay, even when accounting for inflation factors. PMTCT and ECD programs share many common features and can build from common resources. There are multiple ways that any society may develop potential models to successfully integrate these approaches at low cost. This paper offers short vignettes that summarize only a few of the existing programs that successfully apply one or more of the proposed program components. These “case studies” represent programs that members of the LG3 team identified from their program experiences as well as comprehensive internet and literature searches. Selected case studies were chosen that
illustrate exemplary and creative means of overcoming common ECD and PMTCT program implementation challenges; for further information on these programs, contact afuller@hsph.harvard.edu. The purpose of this paper is to review the experiences and lessons learned by programs that apply some or all of the above components of care in their service to children and families affected by HIV/AIDS in resource-poor settings. These programs illustrate the possibilities for “real-life” application of the conceptual framework we propose here.
PART TWO: Background

2.1 Access to PMTCT

Early childhood intervention services for families affected by HIV/AIDS begin during the prenatal period with adequate access to prenatal care and effective programs to prevent and treat mother-to-child transmission of HIV. Yet access to PMTCT programs is significantly lacking in areas hit hardest by the HIV/AIDS epidemic. Although the United Nations General Assembly Special Session (UNGASS) on HIV/AIDS in 2001 identified PMTCT as one of five priorities, there has been only preliminary progress in making this goal a reality. Although one hundred heads of state had indicated commitment to reduce the proportion of infants infected with HIV by 20% (160,000) by 2005, and 50% by 2010 (Wilfert, 2002), only eleven of the 33 most affected countries met the 2005 goal, far short of the aim for global change (UNAIDS, 2006). UNAIDS indicates that there has been only a 10% reduction in mother-to-child transmission of HIV between 2001 and 2005 (UNAIDS, 2006). It is estimated that 90% of HIV infected children worldwide became infected via mother-to-child transmission; this rate increases to 95% in sub-Saharan Africa (ANECCA, 2006; UNAIDS, 2006).

By 2005, fewer than 10% of HIV-positive pregnant women had access to PMTCT services worldwide (UNAIDS, 2006). This low coverage rate is abysmal, considering that approximately 35% of infants born to HIV-positive mothers will acquire HIV infection without treatment before, during, and after birth (UNAIDS and World Health Organization, 2006). Although regimens to reduce the risk of mother-to-child transmission of HIV have existed since the 076 trial results were released in 1994 (Connor et al., 1994), millions of children (an estimated 90% of cumulative AIDS cases) have been born infected by HIV since that time (UNAIDS, 2006); and most of these infants and children have died. While 15-30% of infants born to HIV-positive mothers who do not breastfeed will acquire infection without provision of PMTCT regimens, the risk increases to 20-45% for breastfed infants in the absence of a treatment regimen (De Cock et al., 2000). Offering comprehensive PMTCT services can result in HIV transmission of less than 2% (Cooper et al., 2002).

These estimates alone make it clear that preventable child deaths from HIV number in the millions. Yet this situation is beginning to improve in many settings. Women have much greater access to ART now compared to only five years ago, through initiatives such as WHO’s 3x5 program, the Global Fund to Fight AIDS, TB, and Malaria (GFATM), and the President’s Emergency Plan For AIDS Relief (PEPFAR). Despite improved global access to ART, its availability among pregnant women remains low (UNAIDS, 2006).

Recent data also suggest modest improvements in access to PMTCT services. International and country-specific political will has generated interest and mobilized resources to expand PMTCT coverage. The G8 Communiqué (2007) called for countries to offer effective and integrated PMTCT and pediatric HIV services to 80% (minimum) of pregnant women and their infants. Some countries are clearly working toward this target, and recent data from East and Southern Africa reflect an increase from 9% to 14% coverage (Global Partners Forum, 2007). Yet despite these efforts and recent trends, the large majority of women and infants who need PMTCT services are still not receiving them, resulting in a significant level of preventable morbidity and mortality.

2.2 A rationale for integrating ECD with PMTCT programs

Early childhood intervention services for HIV/AIDS offer ideal opportunities for promoting early childhood development (ECD). Studies have amply demonstrated that health and education are intimately linked during a child’s early developmental years (Palfrey et al., 2005). It has also been shown that early childhood development (ECD) interventions in the first few years of life can influence not only child survival, but also the trajectory of health and development leading into adulthood (Shonkoff & Phillips, 2000). Societies with a high social burden of HIV/AIDS are at high risk for the “toxic stressors” that may impair a young child’s brain architecture in the early years of life. These “toxic stressors” have been demonstrated to directly affect a child’s potential for...
language development as well as lifelong social and physical health. Chronic poverty as well as crises within the family such as maternal depression, caregiver illness or death, divorce, and family violence may cause persistent elevation of stress hormones in children that, without the buffered protection of adult support, disrupt brain chemistry and can lead to impaired learning, memory, social development and increased susceptibility to physical illness in adulthood (Center on the Developing Child at Harvard University, 2007). These risks can be minimized and prevented by strengthening the family environment through means such as the provision of consistent, safe, high quality programs for early childhood development and child and family educational opportunities (Center on the Developing Child at Harvard University, 2007; Irwin, Siddiqi, and Hertzman, 2007). The research base is now strong for the core concepts and key interventions such as nutritional supplementation, home visiting programs, and formal pre-school. Yet the evidence base for implementing comprehensive programs in community settings remains sparse (Engle et al., 2007). Nor is there yet published data on the effectiveness of integrating PMTCT with ECD interventions. Additionally, there is limited information on any proven ECD interventions in low-resource settings.

Although no single approach is a “magic bullet,” the basic principles of developmental neuroscience and child development are equally valid across societies and economies, whatever the program category and administrative structure (Center on the Developing Child at Harvard University, 2007). A recent report on ECD by the World Health Organization’s Commission on the Social Determinants of Health (CSDH) (Irwin, Siddiqi, & Hertzman, 2007) offers science-based evidence for an “equity-based approach” to providing nurturing environments for all children. The report emphasizes the role of the child as a social actor whose development depends on relationships that extend from the family to influence factors at the regional, national and global levels. It has been estimated that every dollar used to enable a child to reach school age while thriving can yield as much as $17 in social benefits over the next forty years, even when controlling for inflation (Schweinhart, Barnes & Weikart, 1993; Schweinhart, 2004; both sources as cited in Siddiqi, Irwin, & Hertzman, 2007). A successful civil and global society depends on investing in early child development. Models such as the CSDH’s Total Environment Assessment Model of Early Child Development (TEAM-ECD) (Siddiqi, Irwin & Hertzman, 2007) do not depend on a wealthy society. Such models have direct relevance for young children and their families affected by HIV/AIDS in resource-poor settings. While the CSDH Final Report is not targeted explicitly to HIV/AIDS-affected children, its observations and recommendations offer much to support the integration of ECD with PMTCT. The CSDH also includes (in its “Appendix B”) ten examples of ECD programs and services that are intentionally linked to health care settings, many in low-resource environments, as well as several community and media models for ECD that do not necessarily depend on integration with health care systems. The available evidence in this small sample of studies strongly suggests a need for the deliberate inclusion of ECD interventions in the context of community program support for PMTCT.

The ECD concept has developed over time to incorporate a variety of components that measurably improve children’s physical, cognitive, social and emotional growth (Anderson et al., 2003). The ECD concept has recently expanded further to include providing adequate nutrition and enhancing maternal literacy as central elements in ECD programs in order to most effectively stimulate positive child development. Within the context of limited resources, the JLICA focuses on ECD programs for children 0 to 3 years of age because of the opportunities afforded through intervention in this age range and the link to the PMTCT intervention.

2.3 Implementation challenges

Effective implementation of ECD, as well as integrated PMTCT/ECD, depends on locally-appropriate models. But this is only one of the challenges for adaptation and scale-up of existing interventions and the creation of new programs. Another obstacle is the logistical challenge of working in settings with few trained child development professionals. However, certain well-established factors provide clear guidance for creating ECD programs.
Research from developed countries has identified three aspects of parenting that are consistently related to young children’s cognitive and social emotional competence: (1) cognitive stimulation, (2) caregiver sensitivity and responsiveness to the child, and (3) caregiver affect (emotional warmth or rejection of the child) (Shonkoff & Phillips, 2000; Walker et al., 2007). These parenting behaviors affect children in developed and developing countries in similar ways (Bradley & Corwyn, 2005; Posada et al., 2002). However, when caregivers are affected by HIV/AIDS, the severity and effects of the illness may limit their capacity to fulfill these roles, placing the child at high risk for impaired cognitive and social/emotional development. A study by Engle et al. (Engle et al., 2007) on recently-evaluated programs in low resource countries illustrated both the feasibility and successes of programs that integrate parenting and nutritional skills into primary care. Other programs that attempted similar interventions were shown to improve both children’s development and the mother’s knowledge and practices of childrearing (Powell, Baker-Heningham, Walker, Gernay, & Grantham-McGregor, 2004). These studies, together with extensive evaluations of existing programs, provide a practical basis for understanding how to create PMTCT programs in developing countries. New approaches are needed, however, to work most effectively with diverse cultural groups within settings that are characterized by severely limited human and material resources, in order to improve the situation of children facing compounded adversity such as children made vulnerable by HIV/AIDS and poverty. In a broader sense, the potential impact of an integrated PMTCT and ECD program will be constrained by conditions of poverty. Therefore, nutritional supplementation and social protection in cases of severe poverty need to be considered to promote adequate uptake and adherence to services. Below we provide evidence to support the implementation of an evidence-based PMTCT program combined with a home-visit and nutritional supplementation based ECD intervention for families living with HIV/AIDS. Mechanisms to offer social protection for the most vulnerable families will also be considered.

Box 1.
Challenge: Addressing low uptake of HIV testing: Cameroon Baptist Convention Health Board (CBCHB) Case Study

The CBCHB PMTCT Program successfully integrated PMTCT into routine prenatal care services provided by CBCHB’s outreach branch: the Life Abundant Primary Health Care Program. Beginning in 1982, CBCHB trained traditional birth attendants (TBAs) to assess obstetrical risk and perform low risk deliveries. Before starting the PMTCT component, CBCHB staff met with village health committees for input on and approval of the program. In 2002, they began training TBAs in confidential HIV counseling and testing using Ora Quick oral HIV tests. A typical first-time prenatal visit included a group education session on the importance of HIV testing and ARV prophylaxis, pre-test counseling, a prenatal exam with the midwife while waiting for the results, and then post-test counseling with the same provider when the results from the lab returned that same day. Over four years this program was expanded to 115 health facilities in six of Cameroon’s 10 provinces, including large hospitals as well as remote clinics, training 690 health workers and testing 68,635 women. In this population, 63,094 women were screened (92% acceptance), of whom 9% were HIV-positive and were offered a PMTCT regimen. Important factors that may have contributed to this success rate include: HIV testing and PMTCT offered as a routine part of prenatal care; well trained educators, nurses and TBAs; HIV test result available on the same day; a decentralized and sustainable prenatal program; community support and awareness; as well as intensive follow-up, quality assurance, and supervision. The program is funded continuously by EGPAF, and received a grant from Columbia University’s MTCT-plus program. NVP and HIV tests were donated from pharmaceutical companies, and the clinics are run by the government and faith-based organizations (Welty et al., 2005).

PART THREE. 
PMTCT - Evidence for best practices

This section reviews the evidence for and concerns surrounding each component in a comprehensive PMTCT program. The integration of ECD, which may or may not be formally linked to PMTCT services, will be discussed in the following section.

3.1 HIV testing strategies for pregnant women

Routine testing for pregnant women, the entry-point into a PMTCT program, is a primary goal.
HIV testing for PMTCT is often available within the context of prenatal care settings in the developing world, and is offered based on the Voluntary Counseling and Testing (VCT) or the Provider-Initiated Testing and Counseling (PITC) approach (UNAIDS and WHO, 2006). Although both methods are employed, the PITC approach, which provides routine testing for HIV, has resulted in a higher uptake of HIV testing (Zimba, Kamanga, & Chilongozi, 2006). WHO recently indicated that PITC should be considered, given the recent evidence for increased uptake (World Health Organization, 2006a). Findings presented at the 2006 IAS conference indicated that changing the HIV testing strategy for PMTCT programs in Malawi, from opt-in (VCT) to opt-out (PITC) methods, resulted in a significant uptake increase, from 76% to 98% (Zimba, Kamanga, & Chilongozi, 2006). In Cameroon, the PITC method offered to women during their first prenatal visit with a battery of routine tests (see Box 1), resulted in an uptake rate of 92% (Welty et al., 2005). A more recent PMTCT study in Zimbabwe also demonstrated a high acceptance rate of routine (opt-out) HIV testing (99.9%) compared with uptake of opt-in testing (65%) (Chandisarewa et al., 2007). Additionally, re-testing for HIV may need to occur if pregnant women are initially tested early in their pregnancy. One approach is to re-test all women at 34-36 weeks of gestation. Testing may also be warranted following an HIV risk exposure or a suspected sero-conversion illness (Nuttall, Eley, & Honikman, 2004).

Door-to-door home-based VCT has proven to be a successful alternative strategy in Uganda. Among the homes approached, 86% of prospective participants were at home and accepted pretest counseling. Of those who accepted, 98% accepted testing and received test results (Nuwaha et al., 2006). The door-to-door strategy may also serve to reduce the stigma associated with HIV if appropriate outreach and education can occur simultaneously. It also provides an opportunity to engage and test the rest of the family, as well as synergistic opportunities for the integration of PMTCT with ECD. Another strategy to increase uptake of HIV testing was piloted in Uganda, where routine intrapartum counseling and testing for HIV was introduced. They found high levels of uptake from women (97%) and accompanying men (97%) and observed a 12% increase in detection of HIV infection in that setting (Homsy, Kalamya, Obonyo, Ojwang, Mugumya, Opio, et al., 2006). However, this strategy did not follow up couples to determine if any adverse effects resulted from this approach (e.g. domestic violence). Further studies may be needed to identify any possible adverse events resulting from this strategy before implementing it on a broader scale.

3.2 HIV testing strategies for infants and young children

HIV testing in infants poses a greater challenge than testing in older children or adults. Due to the circulation of maternal antibodies in infants until 18 months of age, polymerase chain reaction (PCR) testing is needed to accurately diagnose infants with HIV infection. However, many resource-limited settings do not have access to PCR testing for HIV in infants. In a study from Zambia, most of the infants enrolled to receive ART had very low weight-for-age and presented with a WHO clinical stage of 3 or 4, indicating advanced HIV disease (Mbewe et al., 2006). This suggests that infants may benefit from diagnosis of HIV infection earlier than can be achieved with HIV antibody testing.

Access to PCR and highly sensitive reverse transcriptase tests are required to detect HIV DNA (Fischer et al., 2004) and/or HIV RNA (Nesheim et al., 2003; Rouet et al., 2001; Rouet et al., 2003) among infants less than 18 months of age (Orne-Gliemann et al., 2006). Early diagnosis will improve the prognosis and increase the survival of infants infected by HIV and is encouraged by the WHO (World Health Organization, 2006b). The WHO has recently revised their recommendations for diagnostic testing, initiation of treatment and treatment regimens for HIV exposed and infected infants (WHO, 2008). This revision particularly highlighted the role of early infant diagnosis in HIV prevention and initiation of life-saving ART: infants who are exposed to HIV/AIDS should undergo HIV testing as early as 4-6 weeks of age, and all infants under 12 months of age confirmed to be HIV-infected should be immediately started on ART.

Even in remote rural areas, specimens can be collected using the dried blood spot (DBS) method. After transfer onto filter paper the DBS specimen is non-infectious and, depending on the
method of storage, can be tested for HIV for more than 3 months after collection (Brambilla et al., 2003). The DBS method has been widely used and has demonstrated feasibility in resource-limited settings (Sherman, Jones, Coovadia, Urban, & Bolton, 2004).

Tests for HIV DNA and HIV RNA are highly sensitive and specific for infant diagnosis of HIV, but rely on sufficient laboratory capacity. More recent technologies include real time PCR and highly sensitive reverse transcriptase (RT) tests; both are available at limited cost (Orne-Gliemann et al., 2006; Rouet et al., 2005; Rouet et al., 2003). Rouet et al. (2005) provide a summary of these newer technologies. A recent study in India demonstrated preliminary data that supported using the CD4/CD8 ratio as a surrogate marker for HIV status among infants. However, given the small study sample (n=88), additional empirical data from larger studies and other settings may be necessary before any policy recommendations can be made (Swaminathan et al., 2007).

3.3 PMTCT regimens

Once a pregnant woman is identified as HIV positive, PMTCT regimens, consisting of ARV prophylaxis and/or ART, are offered to the woman and newborn. The time of PMTCT initiation depends upon the regimens used. One regimen suggested by WHO PMTCT guidelines is estimated to achieve transmission rates less than 2% if women begin receiving ARVs at 28 weeks of gestation and if the infants are not breastfed (Lallemant et al., 2004). Various organizations and government ministries recommend different regimens and it is important to note that transmission rates vary widely. See Appendix 1 for a table reflecting the different PMTCT regimens and expected vertical transmission rates. The WHO regimen (2006a) combines different strategies from existing evidence and balances efficacy with risk of toxicity for mother and infant.

It is important to note that the single-dose NVP regimen among those who did not receive ARVs during the prenatal period demonstrated a transmission rate of 8% (Jackson et al., 2003); in addition, single-dose NVP promotes drug resistance among women (Shapiro et al., 2006) and infants (Martinson et al., 2007). However, levels of NVP resistance (and resistance to NNRTIs more generally) among women receiving single-dose NVP can be lowered by providing women with 4-7 days of postpartum zidovudine/lamivudine (McIntyre et al., 2005) or by offering NVP as part of maternal HIV treatment six or more months after the single-dose NVP is provided (Lockman et al., 2007). One cautionary note regarding the administration of short course 3TC, however, is the associated increase in virologic failure (OR=6.86; 95% CI: 1.10, 42.93) among women who initiated ART in Abidjan, Cote d’Ivoire (Coffie, Ekouevi, Chaix, Tonwe-Gold, Clarisse, Becquet, et al., 2008). Recent data also suggest that NVP resistance can be reduced if women receive an intrapartum dose of tenofovir/ emtricitabine (when added to a regimen of single-dose NVP and short course zidovudine); however, lowered resistance levels were only documented among women and no data were available on prevalence of resistance in infants (Chi et al., 2007).

The regimens outlined in Appendix 1 illustrate the complexity of implementing evidence-based PMTCT regimens in low resource and rural settings. Implementation requires many factors: routine counseling and testing of all pregnant women, access to prenatal care, laboratory facilities able to perform a CD4 count, ready access to all appropriate medications, and personnel specifically trained in PMTCT medical regimens and ART provision. Some of these factors can be potentially addressed by working with community health workers, as Partners In Health has demonstrated in Rinkwavu, Rwanda (see Box 2). This NGO trains and employs community members to visit the homes of each woman participating in a PMTCT program to ensure she is adhering to the prescribed regimen and that she returns for each follow-up appointment (Stulac et al., 2007).

In addition to antiretroviral regimens, both adequate nutritional status and opportunistic infection prophylaxis also play a critical role in maximizing outcomes for pregnant women and infants. Nutrition, both macronutrient (caloric) and micronutrient (vitamin and mineral) interventions, can improve birth outcomes. In a study in Tanzania, women who lost weight during pregnancy were at
a higher risk of intrauterine mother-to-child transmission of HIV compared with women who gained 167 g/week or more (Villamor, 2005). Nutritional assistance and food security for families may improve outcomes of PMTCT programs in resource-poor settings. In terms of the interaction between nutritional status and ART, a study in Kenya observed a link between zidovudine administered through HAART and anemia in pregnant women (Thomas et al., 2008). Therefore, hemoglobin should be monitored closely and ZDV-associated anemia should result in a potential ART regimen change. NVP-based ART was also associated with low birth weight among infants born in Cote d’Ivoire, after controlling for CD4 count, WHO staging, maternal body mass index, and maternal age (Koumav-Ekouevi et al., 2008). Cotrimoxazole prophylaxis is another important intervention for pregnant women with CD4 count < 350 cells/mm³. Cotrimoxazole prophylaxis will improve the woman’s own prognosis (World Health Organization, 2006c) and may reduce the incidence of preterm birth and neonatal mortality among infants born to women with CD4 count < 200 cells/mm³ (Walter et al., 2006). While there is some concern regarding the risk of congenital abnormalities resulting from cotrimoxazole, WHO recommends administering the drug throughout pregnancy, given that the benefits outweigh the risks (World Health Organization, 2006c). Offering supplemental folic acid (6 mg/day) may offset some of the congenital abnormalities that may result from cotrimoxazole administration during pregnancy (Forna et al., 2006). WHO also indicates that all HIV-exposed infants receive cotrimoxazole prophylaxis starting at 4 weeks of age until the infant’s HIV-negative status is confirmed (World Health Organization, 2006c). At that point, for infants who are HIV-negative, the cotrimoxazole is discontinued. Cotrimoxazole is used to prevent Pneumocystis pneumonia and has demonstrated reduced risk of lower respiratory tract infections among infants born to HIV-infected mothers (Coutsoudis et al., 2001).

3.4 Infant feeding

In implementing effective programs, infant feeding in the context of HIV infected mothers presents a major challenge. For HIV-negative women there is overwhelming evidence for the benefits of breastfeeding; breast milk not only provides adequate nutrition for infants (up to 6 months of age among well-nourished mothers) and promotes mother and infant bonding, but further protects infants from common infections by providing maternal antibodies to the infant (Bhandari et al., 2003; Jones et al., 2003; Arifeen et al., 2001).

Breastfeeding without ART or ARV prophylaxis increases the risk of mother-to-child transmission of HIV by 10-20% (ANECCA, 2006; Nduati, Mbori-Ngacha, John, Richardson, & Kreiss, 2000), elevating the overall transmission up to 45% (De Cock et al., 2000). Approximately 40% of children infected by mother-to-child transmission of HIV become infected during breastfeeding (Kourtis, Lee, Abrams, Jamieson, & Bulterys, 2006). More recent data indicate that among women who exclusively breastfed in rural South Africa, mother-to-child transmission was 4% (Newell, 2006). However, exclusive formula feeding from birth is the only way to eliminate the risk of HIV transmission through breastfeeding. Mixed feeding (the giving of both breast milk and any other supplemental foods or liquids, including infant formula and water) has been associated with a higher risk of HIV transmission compared with either no breastfeeding or exclusive breastfeeding (Coovadia et al., 2007; Coutsoudis et al., 2001; Iliff et al., 2005). In addition, if mothers choose exclusive breastfeeding during the early months of life, the transition time for weaning should be minimized in order to reduce exposure to mixed feeding (ANECCA, 2006). However, efforts should also safeguard against infant mortality during this vulnerable period; in a study conducted in Zambia, infants who experienced an abrupt cessation of breastfeeding demonstrated a higher level of mortality (57%) compared to those infants who were breastfed longer (29%) (Sinkala et al., 2007). The issue of drug resistance, however, comes into play for women who breastfeed longer who are also on ART. Infants who are breastfed while the mother is on ART are at potential risk for developing resistance to antiretrovirals, in particular to NVP. Antiretroviral drug resistance developed in infancy would pose additional challenges to treating those infants who become HIV-positive (Bulterys, Weidle, Abrams, & Fowler, 2005).

There is documented evidence indicating the reduction of HIV transmission as a result of exclusive formula feeding, as reflected by HIV-positive pregnant women in the U.S. or similar...
settings (Cooper et al., 2002). There is also evidence that exclusive formula feeding is feasible in relatively resource-limited settings. For example, in Cote d'Ivoire there were no differences in risks of diarrhea/ respiratory infection, malnutrition, hospitalization, or death in breastfed versus formula-fed infants of HIV-positive women. The authors of this study suggested that access to clean water, free supply of breast milk substitutes, and access to counseling support—another opportunity for integrating ECD—may have reduced the risk of negative health outcomes among formula-fed infants in this urban setting (Becquet et al., 2006). These findings were also sustained after a two year follow-up period (Becquet et al., 2007). A study in rural Haiti documented a rate of transmission less than 2% if the mother received triple therapy during pregnancy and the infant was not breastfed (Ivers et al., 2005). The Rwanda program described in Box 2 is one model of a successful program that promotes formula feeding.

Box 2.
Challenge: Infant feeding choices in the context of HIV and the developing world.
Case Study: Partners In Health – Rwanda PMTCT Program

Partners In Health, a US-based international NGO, has designed and implemented a pediatric HIV program with the explicit goal of reducing transmission rates of HIV from mother-to-child to less than 2% (rates comparable with the west) at their hospital and satellite clinics in Rwanda. In addition to following the Rwandan national protocols regarding care during pregnancy and birth, PIH has focused on infant feeding to further reduce transmission. For each HIV-positive mother with a child under 18 months who does not have confirmed HIV status, PIH provides a water jug, pot, kerosene stove, bottles, adequate amounts of formula (distributed every two weeks), and culturally appropriate complimentary foods (sosoma) beginning at 6 months of age. The provision of safe replacement feeding exists within a context of complete care: cotrimoxazole is given at monthly visits, diarrheal disease assessments are done at 1-2 months, nutritional assessments are performed at a clinic at 2-3 months, and follow-up is done with home visits by a trained accompagnateur (community health worker) when a visit is missed. Preliminary results of this new program have shown improvements in survival, diarrheal disease incidence, and nutritional status, at or above that of breastfed children, and preliminary transmission of HIV is extremely low. The total cost of the pediatric HIV prevention program is $430 USD per child ($23 a month for 18 months), 78% of which goes to formula and sosoma provision. This short-term cost is very low in contrast with the cost of pediatric HIV drugs, which is approximately $431 USD a year for the duration of the child’s lifetime. PIH attributes their success to close monitoring, accompaniment, education, access to formula and clean water, and a program that is integrated with the primary health care system (Stulac et al., 2007).

However, there is also evidence on the increased risks of formula feeding on infant and child mortality in resource-poor settings. In one study in Botswana, while more breastfed infants were infected with HIV at 18 months, more formula-fed infants died; the predominant causes of death were diarrheal disease and pneumonia (Thior et al., 2006). Evidence from this study also indicates that when ARVs are taken during breastfeeding, the transmission risk is higher at 7 months of age among infants who were breastfed (9.0%) compared with those who were formula-fed (5.6%). Following the children up to 18 months of age indicated that the combined risk of HIV transmission and mortality was comparable for formula-fed versus breastfed groups (Thior et al., 2006). A significant outbreak of diarrhea in Botswana (2006) demonstrated the mortality risk of formula feeding. Creek et al. (2007a) reported that during a period of heavy rains that resulted in contaminated water, 22% of infants hospitalized for diarrhea died. The authors indicated that none of the infants who were breastfed died. Further examination also demonstrated a stock-out of infant formula among 20 infants who died (Creek et al., 2007a). These results reflect the complexity of infant feeding within the context of HIV. In particular, when formula feeding is used,
appropriate safeguards during crisis situations need to be established in both the planning and the execution of the program to protect infant and child survival.

Each of the qualifications in the WHO recommendation on formula feeding—that it must be “acceptable, feasible, affordable, sustainable, and safe”—identifies distinct challenges common to resource-poor settings (WHO, 2006a). Yet the risks associated with formula feeding are not insurmountable. Evidence from South Africa offers a more complex picture of infant feeding outcomes in the context of HIV. It is likely that aggressive measures to improve water quality may reduce the child deaths associated with provision of infant formula. For example, in a recent study in South Africa, formula feeding demonstrated a protective effect on HIV transmission and death (RR= 0.32-0.53). However, this population had access to piped water (Doherty, 2006). In the same study, those without access to piped water demonstrated an increased risk of mortality related to formula feeding (RR=3.5) (Doherty, 2006).

One program that addresses the variability in outcomes experienced in South Africa and similar settings is the mothers2mothers (m2m) program (Khan et al., 2007). The m2m program was highlighted in the UNICEF stocktaking report (UNICEF, 2007) as a model program. The goals of the program are to offer psychosocial support to women who have recently been diagnosed with HIV and to promote adherence to PMTCT regimens and feeding recommendations. “Mentor mothers” have previous experience with PMTCT programs and are compensated for their efforts. One interesting component of the program is that the mentors do not advocate for exclusive breastfeeding or formula feeding; however, they do promote an exclusive feeding method to avoid the risks of mixed feeding on vertical transmission. Women in the m2m program were more likely to adhere to exclusive feeding and were more likely to choose formula feeding. By informing the women of the risks of specific feeding practices, they were more likely to play an educated role in their infant feeding decisions (Khan et al., 2007). Psychosocial support, as this program offers, is yet another opportunity for integrating PMTCT interventions with early childhood development.

Although replacement feeding (e.g. infant formula) is the only currently available option to prevent vertical transmission through breastfeeding, careful consideration of the safety of replacement feeding is necessary to prevent infant and child mortality. Engaging community members through development of community health worker (CHW) networks as well as involvement of affected women themselves through peer support efforts may allow for sustainable and creative strategies to address the infant feeding dilemma related to HIV. Context-specific factors that need to be considered to ensure safety include: improvement in water quality; access to materials for formula feeding; infrastructure development (i.e. to improve capacity of mothers to receive formula); adequate distribution mechanisms of infant formula to prevent stock-outs; increased access to postnatal and pediatric care; availability of oral rehydration therapy (ORT); local infant feeding preferences; safety of complimentary foods; and ongoing education, counseling, and support of mothers.

PART FOUR: Early Child Development - Essential components for low resource settings

4.1 Importance of ECD interventions

The importance of ECD intervention as a critical support to families and societies challenged by HIV/AIDS has been summarized above. Evidence-based examples of model ECD interventions (Irwin, Siddiqi, & Hertzman, 2007, appendix B) suggest that a close programmatic integration of ECD within health care services is the most logical and cost-effective use of resources. Yet effective ECD may also be implemented independent of healthcare services, for example through media (e.g. radio) or community group initiatives. Village-based support, important in successful PMTCT, is also an ingredient for successful ECD. For example, Irwin, Siddiqi and Hertzman (Irwin, Siddiqi & Hertzman, 2007) describe a village engagement agreement in the Lao PDR, based on a child rights framework that could be adapted to the particular needs of different ethnic groups, that included curricular interventions that did not depend on immediate external assistance. JLICA LG3 encourages a spectrum of imaginative models. For infants and young
children affected by HIV/AIDS, however, effective ECD most logically succeeds when closely integrated with PMTCT programs and trained community health workers who can encourage and enable the full spectrum of services and opportunities. In this section we review the importance of ECD, essential components for ECD in low-resource settings, and several “case study” examples.

The National Scientific Council on the Developing Child report, From Neurons to Neighborhoods: The Science of Early Childhood Development (Shonkoff & Phillips, 2000), highlights the negative impact of exposure to stress, toxic environments, and poor nutrition on long-term developmental trajectories. Similarly, compromised caregiving relationships and stress have been shown to disrupt the architecture of the developing brain, thus limiting children’s developmental potential. The JLICA targets a population of children who are vulnerable to all of the challenges to development highlighted by the Council’s report (Shonkoff & Phillips, 2000).

Interventions that enrich early childhood environments contribute to improved health, and social and economic outcomes in adulthood, particularly among children in resource-poor settings (Hawkins, Kosterman, Catalano, Hill, & Abbott, 2005). Experimental early childhood interventions have produced a range of positive health and social outcomes including improved school achievement, reduced risk of emotional and behavioral problems, fewer high risk behaviors (drug & alcohol abuse, sexual decision making, early pregnancy), reduced incidence of smoking, reduced antisocial behaviour (less violence, fewer arrests), and positive economic outcomes such as lower use of public assistance, higher earnings, greater effort at savings and increased home ownership (Hawkins et al., 2005; Reynolds & Temple, 1998; Schweinhart, Barnes, & Weikert, 1993).

The ECD literature in relation to vulnerable children focuses on the need for early identification of “at risk” pregnant women, mothers who have difficulty coping in the perinatal period, and mothers and their infant children who appear to be having difficulties in the early postpartum period. It is now evident that the mother and child’s intimate relationship should be considered in tandem and that interventions aimed solely at the child will not be sufficient. Data also support the importance of involving fathers and the extended family in supporting mothers’ efforts to nurture their children (Magill-Evans, Harrison, Rempel, & Slater, 2006). This concept of community involvement is crucial in considering potentially marginalized populations such as HIV affected mothers and their children. The components of successful ECD programs are fully compatible with, and closely overlap, the components, values, and goals of successful PMTCT. ECD programming is now promoted within the health sector as a vital program ingredient for children at risk (Engle et al., 2007). The World Bank has financed loans to 52 developing countries for ECD programs and at least 30 developing countries have policies on early child development. UNICEF has supported parenting programs in at least 60 countries (UNICEF, 2006). Two other examples of community program support for children at risk are illustrated in Box 3 and Box 4.
4.2 Integration of nutrition and healthcare with ECD

It has long been recognized that nutritional deficiencies, such as the lack of vitamin A, iodine, iron, and inadequate caloric and protein intake, affect both physical and cognitive development (Engle et al., 2007; Barrett et al., 1987). Household food insecurity is also associated with developmental risk in infants and toddlers (Rose-Jacobs et al., 2008; Chilton et al., 2007). The importance of sufficient nutrition is heightened in the context of children affected by HIV/AIDS due to the depleting effects of persistent diarrhea and upper respiratory infections (Grantham-McGregor, 2007), the emotional burden on the parents of living with HIV/AIDS, the need for sufficient food with which to take medications, and the detrimental effects of malnutrition and physical weakness caused by AIDS. Recent research further demonstrates that adequate nutrition is necessary to actualize potential cognitive growth and functioning (Engle et al., 2007; Shonkoff & Phillips, 2000), and that the combination of nutrition with psychosocial interventions was more effective than either alone (Grantham McGregor, Powell, Walker, & Himes, 1991). Children with growth stunting before age two have poorer emotional and behavioural outcomes in late adolescence, but these effects may be reduced by psychosocial stimulation (Walker et al., 2007). These findings were demonstrated in a study of an ECD program that combined a nutritional intervention with cognitive stimulation in Jamaica. In a randomized controlled trial, the authors compared the effects of giving 1kg of milk-based formula per week for two years only, with the same nutritional intervention combined with weekly home-based play sessions with a trained community health aide. The combination intervention benefited motor and cognitive development more than a single intervention alone (Grantham McGregor, et al., 1991). Similar findings were observed for physical health outcomes in a randomized study performed in Colombia—the interaction of the nutrition supplementation and early childhood development intervention was highly significant with respect to weight-for-age and height-for-age outcomes at three years and six years of age. In addition, it is worthwhile to note that this ECD intervention was home-based (Super, Herrera, & Mora, 1990).

Box 3.
Challenge: Training community health workers in ECD
Case Study: Speak for the Child, training module

Speak for the Child, a project developed by the Academy for Educational Development (AED) in 2000, supports communities and families in Kenya to improve the health, nutrition, and psychosocial care of young children orphaned and affected by HIV/AIDS. The project is broad in scope, providing support for 16,000 children and their caregivers in Western and Nyznza provinces of Kenya. Speak for the Child, working closely with local NGOs, conducted a four-day community mobilization session with activities that included: training existing community leaders to be facilitators, meeting with members of the community; conducting exercises in problem listing; ranking, prioritizing, and solution brainstorming. Session facilitators identified vulnerable households and solutions to previously defined problems. They also plotted out pieces of land for potential ECD centers. On the last day, the community decided on an action plan. Out of this, Speak for the Child developed extensive training materials for community health workers (CHWs) that are readable, pertinent, and succinct. This resource is intended to assist program managers to plan, design, implement, monitor, and evaluate community-based programs for young orphans and vulnerable children. Their materials constantly reiterate the importance of adapting the program to each community and, in fact, include a module that explains how to do a community assessment. The end product, which is available online (AED, DCOF, & USAID, 2007) provides information on nutrition, health, and early childhood development written in an easily accessible style for the CHWs. LG3 has adapted parts of this module for use in its own training curriculum.
4.3 Home-based ECD intervention

Home visiting is a core concept in the implementation of programming to support ECD in low-resource settings. Similarly, a decentralized approach that includes CHWs who visit families in the home has also been identified as a vital and effective ingredient in successful VCT and PMTCT programs. Home visits are more likely than center-based programs (i.e., formal preschool) to include the most vulnerable mothers and children by lowering or eliminating barriers such as transportation, financial strain, conflicts with work, and other factors that limit center-based participation (Hamadani, Huda, Khatun, & Grantham-McGregor, 2006; Watanabe et al, 2005). The effectiveness of home visiting for vulnerable young children and their parents has been demonstrated (Gardner, Walker, Powell, & Grantham-McGregor, 2003). Home visiting has also been shown to benefit mothers' psychological well-being (Meyer et al., 1994) and improve the quality of their involvement with infants (Minde et al., 1980). Children's subsequent development is also enhanced by parent teaching through home visits (Achenbach, Howell, Aoki, & Rauh, 1993). There is much evidence on methods for supporting mothers' active engagement in both early stimulation and the range of ECD activities. The basic principles of successful parental ECD education include modelling, demonstration and repetition (Powell et al., 2004). Fathers also, when included in the ECD plan, are able to provide beneficial support to the mothers and enhance the child's well-being (Magill-Evans et al., 2006). Successful PMTCT also calls for fathers' support and participation. A family-centered approach to integrated PMTCT and ECD programs may improve program retention and may offer a more sustained impact over time.

The home environment is a powerful determinant of a child's cognitive development (Duncan, Brooks-Gunn, & Klebanov, 1994; Kagitcibasi, 1991). One study in Turkey concluded that the model for care should support the “intersecting needs of women and children” (Kagitcibasi, 1991). Psychosocial stimulation programs have been successful in developing countries (Grantham-McGregor, Powell, Walker, Chang, & Fletcher, 1994), although long-term effects remain unclear. In Brazil, a mother-centered, home-based intervention (Eickmann et al., 2003) demonstrated that when maternal intervention was intensively supported for 5 months, there was clear evidence of enduring effects on the child’s mental and social development. The Brazilian program is particularly noteworthy because the mothers were the key providers of the psychosocial stimulation once they were supported through workshops and home visits. This study also made
the important observation that mothers as well as children benefited from the program. A second key finding was that in order to ensure sustainability, the intervention needed to be neighborhood based. Unique models for training the trainers of this program were articulated by Eickmann et al. (Eickmann et al., 2003) and offer useful models for the JLICA projects.

4.4 Characteristics of model ECD program identification

A recent paper in the *Lancet* (Engle et al., 2007) reviewed the evidence through 2005 for using early intervention in developing countries. The investigators reviewed programs which met the following criteria: 1) scientific evaluation employing a randomized controlled design or matched comparison group; 2) a focus on ECD prior to age six; 3) evidence of real-world adaptation (effectiveness trials rather than highly-controlled efficacy trials); 4) a focus on assessing child development outcomes; 5) a focus on disadvantaged children; and 6) evidence of the effectiveness of the implemented intervention in a developing country.

LG3 staff reviewed the case models already considered in the *Lancet* review while also searching the literature for new models using the following search terms: early childhood intervention, developing countries, early intervention. In our literature review, we included programs that met the above criteria plus: 1) a focus on children 0–3 (the age which easily overlaps with PMTCT), and 2) a focus on nutrition. Using these guidelines, programs were sorted based on which met the most inclusion criteria. Programs were selected and summarized into table form. We included summaries of programs from The Philippines, Jamaica, Bolivia, Vietnam, China, Bangladesh, Brazil, Thailand, Columbia, and Indonesia (See Appendix 2).

Although it is clear that there is not one standard ECD curriculum that can be implemented successfully across different cultures and contexts, there are a number of common elements shared by these model ECD programs. These include:

1. Nutritional support for children: as previously mentioned, the provision of food is an essential component for an effective ECD program in contexts of food insecurity. Nutritional supplementation will ensure that children are reaching their physical and cognitive developmental potentials. An integrated approach of ECD with growth

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<th>Box 4. Challenge: Government involvement, support and funding for ECD programs</th>
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<td><strong>Case Study: Cuba: “Educate Your Child Program”</strong></td>
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The Cuban government provides some form of ECD services to 99.5% of children 0-6 through two channels. One is institutional, in centers known as “Children’s Circles” (first established 1961) which serves children from ages 1–6. The other, non-institutional, alternative is called “Educate Your Child”. “Educate Your Child” is an alternative for children who do not attend an educational establishment, and it is coordinated by the Ministry of Education. The program aims to coach families to stimulate their children’s integrated development. It is targeted to children in rural areas where there are no children’s circles or primary schools, and it is rooted in community participation. The program covers topics that include healthy physical and emotional development, meals/nutrition, sleep, hygiene, and bathing. The “Educate Your Child” program involves families in two ways: individually, for families with children ages 0–2; and in small groups of families with their children who receive guidance weekly from trained counsellors. Counsellors are selected by agencies and organizations that participate in the program and include members of the child’s family. Counsellors receive training from supervisors known as promoters. In 2005, Cuba had 116,165 counsellors and 52,777 promoters. The Educate Your Child program is staffed by family doctors and nurses, teachers and volunteers. Educators working in children’s circles are trained in preschool education in tertiary schools for a period of five years. Other educators receive post-graduate education through six year training courses.

As of June, 2005, 99.5% of Cuba’s children 0-6 were enrolled in some form of ECD program: 15.5% of children in children’s circles, and 15% in preschool programs, and 69% in Educate Your Child. These high rates may be due to government funding and legislative support. (UNESCO, 2006)
monitoring and other aspects of health care can foster improved health and developmental outcomes;
2. Utilizing community health workers or paraprofessionals as program implementers, especially with home-based ECD programs, serves as a cost-effective and valuable way to ensure adherence, monitor progress, educate parents and create trusting relationships. In decentralized systems where community health workers are already visiting homes, it may be fairly easy to piggyback ECD programs onto existing health services. Adequate resources should be made available to compensate community health workers to protect their time and reduce staff turnover;
3. Home-based interventions: conducting ECD programs at home eliminates the financial and institutional barriers of attending center-based programs;
4. Parent and family involvement: Educating and training parents in early child care and development can help engage parents in their child’s lifelong learning process;
5. Successful programs often provided a long-term intervention of 1-3 years (many were for two years in duration) with intensive and frequent follow-up (e.g. weekly or bi-monthly); and
6. Regular training sessions for program implementers are important to sustain good program performance

4.5 Derived Principles of Successful ECD Program Implementation

There are three important implementation steps or phases in creating a new ECD program in any low resource setting. First, the process should begin by assessing the setting for implementation, exploring and clearly identifying the current configuration of resources and systems of care that are already in operation. The assessment should identify the most pressing child development issues at that site and the political and economic barriers to implementation. Second, once this assessment has been made, program planners need to consider the existing principles, based on research and experience in other settings to understand the core themes that promote high-quality ECD in any new context. Integrating the particular context-specific assessment with the available science on what works will determine the degree to which these core principles can be applied. The third phase uses the information gathered in the prior two phases either to select an existing model of ECD intervention that can be adapted to this setting, or to decide if and how to create a new model that addresses the particularities of the target setting.

Parent-focused intervention, where parents are trained to teach various skills to their preschool children, has proven both feasible and cost-effective (Slater, 1986). Programs that combine cognitive enrichment of children with parent involvement and support reported long-term gains (Provence & Naylor, 1983; Seitz, Rosenbaum, & Apfel, 1985). Child- and parent-focused approaches should not be mutually exclusive choices, since evidence suggests that combining both approaches is more beneficial than either alone (Kagitcibasi et al., 2001; Seitz, 1990). With sustained gains for children, mothers and families, the investment becomes cost-effective and applicable on a wide scale (Kagitcibasi et al., 2001).

PART FIVE: Barriers to care for scale-up of PMTCT services and ECD

Certain barriers challenge both PMTCT service development and scale-up as well as the scale-up of ECD programs. These are outlined below.
5.1 Barriers to effective PMTCT scale-up and effective strategies to increase access

Despite the fact that there are highly effective strategies to prevent mother-to-child transmission of HIV, UNAIDS reported less than 10% coverage of PMTCT services among pregnant HIV-positive women throughout the world (UNAIDS, 2006). While the overall statistic is low, there is a wide variability in coverage for different countries (UNICEF, 2007). Moreover, each component of a complete PMTCT program—family planning and pregnancy prevention, HIV counseling and testing, HIV treatment for women and infants (when indicated), prenatal services, intra-partum care, and postnatal follow-up including infant feeding decisions—has its own barriers to scale-up. Components that present barriers to a complete PMTCT scale-up include fear of stigma and health outcomes, inadequate and/or centralized health services (including limited access to prenatal care and safe delivery), uncoordinated services (see Box 5), lack of education and literacy, and a lack of human and material resources. Limited access to early prenatal care is a key barrier in many settings (Abrams et al., 2007; WHO, 2003). Even when prenatal care services are accessible and adequate for routine care, this precondition does not always correlate with high utilization rates of PMTCT services. Programs that can identify and address the reasons for this dissonance are then better able to address what the program needs, and how to best scale-up services.

Box 5.
Challenge: Reducing loss to follow-up of HIV-positive women and their infants through decentralized, family-centered HIV prevention and care
Case Study: The Family Care Consortium, Uganda

The Family Care Consortium (FCC) program is one example of decentralized, family-centered HIV/AIDS care that provides quality HIV prevention, care, treatment, and support services to families at a “one stop shop center” in satellite clinics. The FCC was formed in August 2005 as a partnership between area organizations working on HIV/AIDS care and treatment that included: the Kampala City Council, the local government that owns the health facilities; Protecting Families Against HIV/AIDS, an NGO which provides PMTCT services; Mulago-Mbarara Teaching Hospitals’ Joint AIDS Program, which provides adult HIV care and treatment, and Baylor College of Medicine/Paediatric Infectious Diseases Institute, which provides pediatric HIV care and treatment. The FCC aims to overcome the barrier to care that is caused by the loss to follow-up of mothers that is common in centralized hospital systems as a result of many factors, including disparate and uncoordinated services. In an attempt to decongest Mulago National Referral Hospital by establishing satellite HIV clinics in Kampala, FCC expanded existing PMTCT services at two peri-urban health facilities in the Kawempe and Naguru divisions. To coordinate efforts, consortium partners conducted regular meetings at several different levels to share information. Program clients were registered using unique identifiers that allowed researchers an easy and confidential tool to identify factors linked with maternal-infant loss to follow-up. The result was a family care approach which links PMTCT, pediatric, and adult HIV/AIDS care and treatment services. PMTCT clinics operated daily while adult and pediatric HIV clinics were held twice a week. The two clinics offered routine HIV counseling and testing; pediatric and adult HIV/AIDS care and treatment; community-based HIV testing, care and support through health workers, including Pediatric AIDS Corps participants, as well as home visits for HIV-positive clients. Additional services included a Basic Care Package (2 mosquito nets, safe water vessel, water-guard and condoms), home visits, and psychosocial support to groups and families that tested HIV-positive (Serukka, 2007).

A significant barrier to PMTCT scale-up discussed in the literature is the lack of routine and patient-centered testing and counseling. During the initial phase of the free PMTCT program in Botswana a low rate of HIV testing was observed in Fransistown when the services were offered by midwives providing prenatal care (33%). However, acceptance of HIV testing increased to 60% when “lay counselors” were trained to offer PMTCT counseling services (Creek et al., 2007b; Kagitcibasi et al., 2001). In a study by Karamagi et al. (2006a), conducted in the Mbale
region of Uganda, the authors found that 97% of pregnant women use prenatal care, but only 4% of women received and made full use of PMTCT services. Shortage of trained staff, lack of staff motivation, and a shortage of materials hindered access to HIV testing in this setting. Similar findings were observed in a qualitative study in South Africa—over 25% of women interviewed did not receive adequate PMTCT services due to what the authors referred to as “health systems failure,” including missed opportunities for HIV testing, receipt of the result, and access to NVP. Other health systems failures reported were shortages of supplies and consent forms, lack of counselor availability, and health staff offering incorrect information (Nkonki et al., 2007) or education that was not well understood by the local population. Finally, offering the rapid HIV test to pregnant women may improve the rate of receiving HIV test results, since it has been found that there can be a loss to follow-up for women who do not return for their test results (Sarker, Sanou, Snow, Ganame, & Gondos, 2007).

In addition to limitations in health worker knowledge, women’s knowledge of PMTCT may also influence access. In Dar es Salaam, Tanzania, for example, women’s lack of knowledge of the risk of mother-to-child transmission affected HIV test acceptance; in addition, lower family support and fewer prenatal care visits were associated with refusal of HIV testing (Kominami et al., 2007). Lack of knowledge may also be linked with limited education—in Cote d’Ivoire HIV-positive women with less education and whose partners had low-ranked employment were less likely to participate in a PMTCT program (Painter, Diaby Matia, Lin, Sibailly, & Kouassims, et al., 2005). Based on these findings, it is likely that developing locally acceptable PMTCT interventions that address local barriers and are effectively integrated into existing services (e.g. maternal and child health services, primary healthcare) may increase access to PMTCT services (van’t Hoog, Mbori-Ngacha, Marum, Otieno, Misoere, Nganga, et al., 2005). For example, community-based participatory research in Tanzania revealed that although women understood that there was a risk of HIV transmission through breastfeeding, the level of risk of transmission was greatly overestimated. Locally appropriate materials (e.g. a visual image through a counseling card) demonstrated that the transmission risk was lower than local perceptions and could also be reduced through safer infant feeding practices (Leshabari, Koniz-Booher, Astrom, de Paoli, & Moland, 2006). However, the broader limitations in health infrastructures and systems may also need to be addressed (e.g. limited access to skilled birth attendants in a given setting) before access to PMTCT can be maximized. Given the weakened health infrastructure in many high HIV burden countries, inadequate donor funding (Fowler et al., 2007) has played a significant role in limiting access to PMTCT services in the developing world.

HIV-related stigma, concerns regarding status disclosure, and the potential of domestic violence also contribute to low testing acceptance rates (Medley, Garcia-Moreno, McGill, & Maman, 2004; Semrau et al., 2005). Perception of male partner approval is the strongest predictor for accepting testing in a study implemented in Uganda (Bajunirwe & Muzoora, 2005), and fear of partner violence is often prohibitive (Medley et al., 2004). These barriers illustrate the importance of gender roles when considering PMTCT program plans and structures. Other deterrents to testing include fear of stigma from community members, including health care workers, (Kebaabetswe, 2007) and a feeling of hopelessness due to lack of knowledge about possible treatment (Karamagi et al., 2006a). Enabling satellite prenatal clinics that can perform HIV testing and promote community awareness, including the increased availability of ART if applicable, may decrease stigma and increase rates of uptake of testing and adherence to PMTCT regimens (Orne-Gliemann et al., 2006). Indeed, the decentralized and community-based approach in a PMTCT program in Cameroon (described in Box 1) resulted in a 92% acceptance rate for HIV testing, much higher than in many parts of sub-Saharan Africa (Welty et al., 2005). This program overcame human resource shortages by obtaining support from community health leaders and by training Traditional Birth Attendants (TBAs) who practice in remote rural areas to provide confidential HIV testing and dispense NVP to HIV-positive mothers.

Accessible care during labor and delivery can facilitate successful PMTCT programming. Many existing programs suffer from high attrition rates and incomplete PMTCT follow-up due to the fact that many women, especially in rural areas, deliver at home rather than traveling to a facility or hospital (Manzi et al., 2005; Perez et al., 2004). For example, a pilot program in rural Zimbabwe
experienced a very high attrition rate in its first 18 months: only 24% of mothers and children received a complete regimen of antiretroviral prophylaxis through their program (Perez et al., 2004). The authors identified distance from treatment as the primary barrier in this program, which was limited to the district hospital and had not yet expanded into the community. To address these issues, they suggested decentralizing services to satellite clinics. Similar findings were observed at a district hospital in rural Malawi, which reported both a high uptake of HIV testing (95%) and significant loss to follow-up, with only 45% returning for NVP at 36 weeks’ gestation and 34% of infants receiving NVP at the hospital (Manzi et al., 2005). The authors also attribute this to a centralized strategy at the district hospital (i.e. a hospital-based implementation strategy). In this study as well, many women chose to deliver at peripheral sites closer to their homes, thereby decreasing the potential to receive NVP during labor and to the infant after birth (Manzi et al., 2005).

These findings suggest that satellite clinics need to provide or facilitate access to skilled birth attendants trained in both prenatal and intrapartum care for HIV positive women and their infants. Anticipating lack of follow-up, the PMTCT program in Cameroon distributed NVP at the woman’s first prenatal visit for self-administration at the start of labor. They advised women during each prenatal visit to bring the infant back to the clinic for NVP administration by the third day of life (Welty et al., 2005). However, one limit of this strategy is that it does not ensure adherence to the NVP regimen. Adherence can be promoted through additional home visits by community health workers, who might both encourage delivery in health facilities and decrease the fear of stigma that may prevent women from delivering in designated sites. Partners In Health has demonstrated a successful model of promoting adherence to HIV medications by using paid community health workers who visit each patient at home (or location of her choice) ensuring treatment adherence through directly observed therapy, as well as including referral for HIV testing with regular clinic visits, subsidizing the transportation costs, and providing medications free of charge (Mukherjee, Ivers, Leandre, Farmer, & Behforouz, 2006). This successful model of adherence promotion and follow-up could also improve the performance of PMTCT programs. Adherence, particularly to infant feeding recommendations, is challenging (Shapiro et al., 2003) unless women receive adequate support.

Follow-up and treatment is essential after delivery for both mother and infant. Important components of a PMTCT program include: counseling on infant feeding options, the provision of free formula and access to clean water, PCR testing for the infant, ARV provision (prophylaxis) for both mother and child, as well as ART when indicated. Each of these components contains its own barriers to scale-up. Some providers cite stigma surrounding formula feeding, and the fear that using replacement food suggests a positive HIV status, as issues that prevent mothers from adhering exclusively to formula rather than breastfeeding (Thairu, Pelto, Rollins, Bland, & Ntshangase, 2005). However, the impact of stigma and barriers to access can be overcome, as accelerated access to PMTCT services in Botswana demonstrated. PMTCT coverage was only 7% prior to a July 2000 roll-out of PMTCT services, but increased to 83% by 2005. Factors that contributed to this increased coverage in a relatively short period of time included: strong investment from the Ministry of Health with the goal of all public health facilities providing PMTCT services; integration of PMTCT services in maternal and child health care (utilizing the same infrastructure and staff); aggressive community mobilization and media strategy; availability of routine HIV testing using the rapid test; provision of psychosocial support for women; involvement of civil society; and the availability of ART for women with CD4 less than 200 as well as ARV prophylaxis beginning at 28 weeks of gestation for women with CD4 of 200 or greater (Puvimanasinghe et al., 2006). Many of these factors contributing to increased coverage in Botswana were cited at the Global Partners Forum in Johannesburg (November, 2007) as “lessons learned” through evidence available to date.

Teeraratkul and colleagues (2005), reviewed PMTCT programs at two hospitals in Thailand between 1999 and 2001. During the first year of their national program, Thailand achieved nearly 70% PMTCT coverage (Amornwichet et al., 2002). PMTCT services at two large hospitals with extensive maternity services offered routine HIV testing and counseling during antenatal care and labor for those who did not present sooner (Teeraratkul et al., 2005). Women in the study
demonstrated high access to antenatal care (91%); the median for initial access to antenatal care was 4 months of gestation. Women born in rural areas demonstrated a higher access to antenatal care compared with women born in urban areas (94% vs. 87%). The most frequently cited cause of not accessing antenatal care in this population was not having enough money to pay for services (60%); the second most frequent problem was transportation problems (33%) followed by being afraid of blame or mistreatment at the clinic or fear that HIV status would be disclosed (24%), and the need to take care of other children/dependents (22%). For women who received AZT during the antenatal period, 50% reported missing one dose in the week before delivery; the most frequently cited reason for missing a dose was failure to keep an ANC appointment. For newborn AZT use, 29% of children had missed doses, with the most frequently cited reason as the parent forgetting (57%). The large majority of women did not breastfeed (free formula was provided), but for those who did (2%), the main reason was being urged by others to do so.

One possible reason for Thailand’s success in PMTCT coverage, is that the program is integrated with a strong maternal and child health and public health program as reflected in a number of indicators: maternal mortality ratio of 44/100,000 live births; 1,204 obstetrician/gynecologists for 60.6 million population; infant mortality rate of 26/1,000 live births; access to safe drinking water (89% urban; 77% rural); 83% having 4 or more antenatal care visits; and 95% delivering at healthcare facilities (Kanshana & Simonds, 2002). In addition, antenatal care is free with the exception of laboratory services; however, funds are available for families who cannot afford the laboratory fee ($2-7 US). Other factors contributing to Thailand’s success include: implementing pilot PMTCT projects to develop protocols and address problems; providing training and retraining for staff on a periodic basis; enhancing counseling skills of staff; encouraging open communication and clear delineation of tasks and responsibilities; and developing a simple and effective monitoring and evaluation system (developed collaboratively with CDC). In 1998, Thailand was the first resource-limited country to develop a national PMTCT program; this program was integrated into the existing maternal-child health program (Kanshana & Simonds, 2002).

In summary, barriers to PMTCT can occur at any point in the “PMTCT cascade” as Stringer and colleagues refer to it (2008), beginning with limited access to HIV testing, laboratory errors, women not returning after HIV test, limited access to antenatal care and facility-based delivery, lack adherence to ARV regimen (if self-administration at home is expected), and challenges adhering to infant feeding recommendations. Evidence suggests that a decentralized approach may circumvent some of the loss to follow-up throughout the “PMTCT cascade,” including offering greater outreach through community health worker networks, providing more follow-up care at local clinics (rather than district hospital), increasing training of personnel at peripheral sites, enhancing capacity (e.g. laboratory capacity) at additional sites, promoting access to antenatal care and facility-based delivery, and linking PMTCT with close monitoring and care of infants post-natally such as strengthening peer- and community-based support for infant feeding to reduce risk of HIV transmission.

5.2 Barriers to effective ECD scale-up

 Mothers intuitively understand that children require nurture and support early in life. However, there is a significant gap in the understanding of what can be done to support very young children who may be more vulnerable due to illness or family or community stress. Mothers who live with the multiple challenges of HIV/AIDS, maternal depression, and lack of family and economic support need consistent resources that will enable them to promote their infants’ social and cognitive development. There is strong evidence that providing mothers with ECD tools and support also improves maternal self-confidence and supports human dignity. Lack of awareness of the importance of interventions to support early childhood development is a major barrier to its
implementation. There are many examples of how medical provider and community efforts may work together to increase the awareness of options for stimulating, educating and otherwise supporting young children at risk. However, other common barriers that make it difficult to sustain these programs include: lack of consistent funding, lack of informed leadership and difficulties with access to mothers. These and other barriers are discussed elsewhere in the JLICA LG3 report, particularly as they relate to PMTCT.

Very few countries have national policies that provide legislative and financial support for ECD. Most ECD programming in the developing world is funded by NGOs or international donor agencies. ECD funding is frequently discontinued (Gardner et al, 2003). Although local and site-specific ECD programs in the developing world have demonstrated effectiveness (see Appendix 2), without adequate political will, leadership, and commitment of national governments, the likelihood for sustained program development and investment of funders remains limited.

Funding should include specific interventions but, first and foremost, it should provide training for those who can work with mothers and who can educate the community and community workers about the importance of ECD, including culturally-appropriate implementation of successful ECD programs (Gardner et al, 2003). Access and sustained intervention is crucial for effective ECD. Center-based ECD programs face transportation barriers and related access impediments for vulnerable populations (Eickmann et al, 2003). Home visiting programs have easier access to mothers and fathers. In addition, HIV/AIDS-affected mothers are especially vulnerable across many other dimensions that influence ECD. For example, fatigue, depression and malnutrition may all limit a woman’s ability to participate in an ECD program (Cooper et al., 1999). Thus the lack of availability of clinical services that can provide both general health care and mental health support may create additional barriers.

PART SIX: Core concerns for effective programming and scale-up of PMTCT and ECD integration and services

6.1 The role of the community

Successful PMTCT and ECD integration depends on the role of the community in supporting families at risk. The theoretical factors associated with well functioning communities are now well understood, although the research estimating community effects is not strong (Duncan & Raudenbush, 1999; Manski, 1993; Shonkoff & Phillips, 2000). Effective work in developing countries requires respect for and a full appreciation of the social organization of the particular community. Research performed in Western countries has demonstrated the importance of avoiding generalizations (Klebanov, Brooks-Gunn, Gordon, & Chase-Lansdale, 1997). Field experiences from stable African communities suggest that the concept of “collective efficacy” may be relevant (Sampson, Raudenbush, & Earls, 1997). Collective efficacy combines social cohesion with informal social control resulting in the capacity for collective action. The demonstration of “collective efficacy” may play an important role for a community to adopt PMTCT, nutritional supplementation and ECD programs. The “Baby Friendly Community Initiative” in Gambia, described in Box 6, outlines one example of collective efficacy.

6.2 Maternal depression

Both mothers and fathers need adequate support to ensure the healthy cognitive, social and emotional growth of their children. This is a challenge in both the developed and developing world, though overcoming certain barriers in the developing world requires additional inputs. Maternal depression is a known risk factor for adverse child outcomes across a number of dimensions (Beardslee, Gladstone, Wright, & Cooper, 2003; Weissman et al., 1999), and affects maternal child rearing behaviors (Rahman, Harrington, & Bunn, 2002). Maternal depression is a common finding in HIV-positive mothers, and is often linked with high rates of stigma (Murphy, Austin, & Greenwell, 2006). Reduced levels of cognitive function and higher rates of behavior problems are reported in the young children of depressed mothers in South Africa (Richter, Griesel, & Barbarin, 2000), Barbados (Galler, Harrison, Ramsey, Forde, & Butler, 2000), and
India (Patel, DeSouza, & Rodrigues, 2003). The effects of maternal depression are observable in infants, who show a greater degree of “stress” response (a higher heart rate and increased cortisol levels) than infants of non-depressed mothers (Tu et al., 2007). In addition, maternal depression (and increased levels of cortisol at 30 weeks of pregnancy) is known to affect infant temperament and reactivity (Davis et al., 2007). If providers fail to address maternal depression, it will undermine a woman’s adherence to treatment and participation in the program components of both PMTCT and ECD. This inextricable link between caregivers and infants, combined with the context of HIV/AIDS in the developing world, further reinforces the need for programs that target both the mother/caregiver and her child.

6.3 Maternal literacy

Maternal literacy may be an important factor in the success of ECD programs (Eickmann et al., 2003), and improving maternal literacy has positive effects on child development. The most successful programs have devoted efforts to actively engage mothers not only in learning about child development but also in learning skills that can enhance their self esteem and encourage further growth. A few studies have shown that ECD that actively involves parents in the learning process can propel mothers to new levels of personal achievement (Eickmann et al., 2003), enhanced self-esteem (Kagitcibasi, Sunar, & Bekman, 2001), safer health practices (Grantham-McGregor, Schofield, & Harris, 1983) and improved physical and cognitive development for the child (Armecin et al., 2002; Bao, Sun, & Wei, 1999; Eickmann et al., 2003; Powell et al., 2004; Semega-Janneh, 1998; Watanabe, Flores, Fujiwara, & Tran, 2005). Maternal involvement in ECD programs should, at a minimum, include ECD play and conversation (UNICEF, 2001). A home-based intervention would best address these concerns and benefit mothers.
6.4 Impact of poverty on families and communities

Even with a well-designed and highly integrated PMTCT and ECD program, the impact may be limited for some families and communities due to severe poverty. For example, even when nutrition supplementation is offered to the infant, chronic hunger, stress, and issues of household food insecurity experienced by the parents may limit their ability to sensitively respond to their infant’s needs (Rose-Jacobs et al., 2008; Gershoff et al., 2007). In addition, the stress of finding adequate material support for one’s child or listening to a child’s cries of hunger may seriously constrain effectiveness of integrated PMTCT/ ECD programming. Similarly, parents and children living in poor economic conditions are more likely to become acutely ill, also potentially limiting the impact of PMTCT/ECD programs. For example, a child that experiences recurrent episodes of diarrhea and lower respiratory infection may not feel well enough for a long enough period of time to benefit from ECD interventions, even when the mother and other family members are fully engaged and committed to the child’s development. For services that need to be accessed at the clinic or district hospital, limited funds may constrain the ability to find transport when follow-up visits are necessary. In addition, harsh living conditions may also disrupt the effectiveness of these programs. For example, during heavy rains, families living under thatched roofs may need to invest significant time repairing their homes, resulting in less time to engage with their infants and young children. Those living in impoverished environments also need more time for daily household tasks, such as preparing food and obtaining water for the family, which may limit time the parents have to spend with their children. Overall, the effort needed to ensure the daily survival of the family may supersede efforts to ensure infants’ successful emotional, social, and cognitive development. Interventions such as family-based cash transfers can be used to address the relationship between these immediate issues of material hardships, emotional stressors, and parenting behaviours to support community investment in children’s health (Adato, 2008; Gershoff et al., 2007).

6.5 Policies for program development

The relationship between research, policy development and program implementation varies by country (Boocock, 1995). Problems associated with interpreting international studies include: how ECD is defined, the level of research rigor, and how outcomes are assessed. While Boocock’s 1995 review of ECD programs (Boocock, 1995) did not focus on Africa, studies in the developing nations of Latin America and Asia offer relevant information that suggest the challenges of sustaining ECD in developing countries. Preschool projects in the developing world are largely funded by outside sources, such as private foundations, the World Bank and UN agencies. Programs can be sustained through involvement of government agencies and local communities in terms of investment of resources, design, operation and evaluation of the programs (Philip & Chetley, 1988).

Policy barriers to developing and sustaining effective PMTCT/ECD programs as they are outlined in this paper may result from the lack of political will, the marginalized status of the affected population, and stigma associated with HIV/AIDS. Unfortunately, the UN Convention on the Rights of the Child has had less than optimal impact on policy development, and the need for further advocacy and organization is critical.
PART SEVEN: Recommended principles for assessing, designing, and sustaining the impact of evidence-based PMTCT and ECD programs

In selecting case models to consider in developing a care program extend from the prenatal period through the critical early childhood years, certain principles, listed below, were derived from the experiences in implementing a broad range of programs in resource-poor and resource-rich countries. These principles offer guidance in assessing the capacity for developing and implementing evidence-based programs. The principles are as follows:

1) Government policy should be identifiable that will support both PMTCT, basic health care including nutritional support and ECD. This government policy should not only identify or allocate financial resources but promote inter-sectoral collaboration, such as consideration of improved literacy, economic development, and the potential role of cash transfers for vulnerable families to promote social protection. Evidence demonstrates that programs can begin as early as 0-3 years of age and investment should be made to target this group for ECD services in addition to targeting pre-school aged children.

2) Stakeholders from all sectors of society need to be identified and incorporated in the effort to develop a locally accepted program. The challenge is to foster collaboration between NGOs, involved citizens and community leaders, as well as community-based organizations, government agencies, bilateral and multilateral organizations. Consideration of adequate financing and sources of funding should be a central aspect of planning and program development.

3) Communities need to be involved with program development and planning at the outset of programs of PMTCT, nutrition, healthcare and ECD. Without community leadership and active involvement, programs are rarely sustainable.

4) Programs that also focus on mothers and the broader family network have a greater capacity to improve health outcomes. Consideration of ART access among women enrolled in PMTCT/ ECD programs is crucial.

5) PMTCT and ECD are logically synergistic, share many common resources, and need to be integrated with overall health and nutrition programs, particularly with women’s and reproductive health care. Routine HIV testing available in prenatal care and primary care settings will increase access to integrated PMTCT/ ECD programs.

6) Lessons learned from implementation failure related to replacement feeding should inform current and future initiatives to minimize HIV transmission and maximize survival. Prior implementation failure of replacement feeding should not prohibit future consideration of this PMTCT strategy.

7) Local and region-specific barriers to accessible and integrated PMTCT and ECD programs need to be considered during the program development phase. Barriers such as degree of poverty, HIV-related stigma, gender differentials and inequality, and potential for violence should be carefully considered. Other important barriers to consider include the local health infrastructure, issues of transport and access, human resources available to implement the program, necessary training of project personnel, and adequate supervision and follow-up.

8) Provision for continuous training of providers, parents, and community workers is needed. Training should be monitored and quality controlled. Budgets should include adequate funding for training that is appropriate to the specific community.

9) Utilizing trained and paid community health workers that conduct community outreach and home visits, benefits continuity of care, follow-up, family involvement and helps combat some of the many barriers that women face in seeking care.
10) Programs should include elements of long-term continuity and periodic re-evaluation in order to demonstrate lasting impact on cognitive and physical development.

PART EIGHT: Conclusion

This report suggests that health outcomes for HIV-positive mothers and their infants would be enhanced if PMTCT and ECD programs are implemented together, engaging families as well as communities in planning, implementing, and evaluating program performance. An integrated PMTCT/ECD program considers the interrelated nature of pregnancy, birth, nutrition, infant feeding, and the development of children 0-3 years of age, and reflects a comprehensive approach to promoting the health and well-being of HIV-positive women and their infants. This report demonstrates, based on analysis of the literature and online searches for existing ECD programs in different regions of Africa and other parts of the developing world, that a program based on home ECD visits, made by trained and paid community health workers, is a viable option for expanding access to services. Such a program that engages community health workers may result in fewer women and infants lost to follow-up and may promote greater continuity of care. Consistently combining PMTCT with ECD is a logical integration with a strong evidence-base for long-term social benefits that far exceed implementation costs. In addition, this model makes it possible to scan the environment and identify factors, such as family stability and poverty, affecting early childhood development and PMTCT access that may not be reported in a clinic visit. With advice and attention from trained personnel on issues such as parent-child interaction, nutrition, hygiene, and ARV dissemination, children and families made vulnerable by HIV/AIDS may gain the resources they need for improved health outcomes and increased quality of life. The evidence reviewed indicates that the presently dismal prognosis for HIV-exposed infants worldwide can be altered for each child if the appropriate resources, political will, and scientific knowledge are combined to create a new trajectory of implementation that promotes the well-being of children and families in resource-limited settings.
References


### Appendix 1: Comparison of PMTCT Regimens

<table>
<thead>
<tr>
<th>Source</th>
<th>Prenatal</th>
<th>Labor</th>
<th>Postnatal (mother)</th>
<th>Postnatal (infant)</th>
<th>Transmission rate and resistance information</th>
</tr>
</thead>
</table>
| WHO (World Health Organization, 2006)  
<350 cells/mm³ (or HIV clinical stage 3 or 4) | ART (triple therapy)  
First line: AZT, 3TC, NVP twice daily (beginning at 28 weeks of gestation if regimen has not yet started)  
For NVP, monitor liver function in first 12 weeks of therapy for CD4 count 250-350 cells/mm³  
For AZT, monitor for anemia and neutropenia  
EFV must be discontinued in first trimester, but can be given in 2nd and 3rd trimesters  
If woman becomes pregnant while taking TDF, continue drug since benefit outweighs risk  
Avoid combination of d4T and ddI | Continue ART | 7-day regimen of AZT | Expected: < 2% (Cooper et al., 2002) |
| WHO (World Health Organization, 2006)  
≥ 350 cells/mm³ | From 28 weeks of gestation offer:  
300 mg AZT twice daily | 300 mg AZT every 3 hours  
200 mg NVP at onset of labor  
3TC (150 mg at onset of labor and every 12 hours until delivery)  
(note: If delivery is imminent omit single-dose NVP for mother) | 7-day regimen of AZT (300 mg twice a day) and 3TC (150 mg twice a day) (prevents NVP resistance) | 7-day regimen of AZT (4 mg/kg) 2 times a day  
7-day regimen of 3TC (2 mg/kg) twice a day  
Single-dose NVP immediately following birth (2 mg/kg or 6 mg after birth)  
If mother receives less than 4 weeks of the prenatal regimen then offer same AZT regimen as above for 4 weeks to the infant | Expected (Lallemant et al., 2004):1.9% (resistance should be offset by offering combination of AZT/3TC to mother and infant as indicated) |
<table>
<thead>
<tr>
<th>Source</th>
<th>Prenatal</th>
<th>Labor</th>
<th>Postnatal (mother)</th>
<th>Postnatal (infant)</th>
<th>Transmission rate and resistance information</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO (World Health Organization, 2006)</td>
<td></td>
<td>Single-dose NVP at onset of labor (200 mg) (note: must be taken &gt;2 hrs before delivery, if not offer infant NVP as soon as possible after birth)</td>
<td>Single-dose NVP 2 mg/kg as soon as possible after delivery (note: can be given up to 7 days of life)</td>
<td>8.1% (Jackson et al., 2003) Martinson reported 45% NVP resistance in infants exposed to single-dose NVP offered to the mother and infant (Martinson et al., 2006); 45% of women also experienced NVP resistance following single-dose NVP (Shapiro et al., 2006)</td>
<td></td>
</tr>
<tr>
<td>ANECCA (ANECCA, 2006)</td>
<td></td>
<td>At 32-36 weeks of gestation, 300 mg AZT twice a day. However, it is important to note that progression increases rapidly as pregnancy enters its later stages (Kourtis, Lee, Abrams, Jamieson, &amp; Bulterys, 2006). Also, since initiation of therapy is after 28 weeks, there is a missed opportunity to prevent infections of some infants who become infected between 28 and 32 weeks of gestation.</td>
<td>300 mg AZT every 3 hours during labor</td>
<td>7-day regimen of AZT twice a day (2 mg/kg)</td>
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<tr>
<td>Low resource settings</td>
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<td>HIVNET 012</td>
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<td>ANECCA (ANECCA, 2006)</td>
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<tr>
<td>Short-course AZT Regimen (Modified Thai)</td>
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<td>Unknown transmission rate but suspect rate between 4.7% and 10.5% (Lallemant et al., 2000); From 36 weeks' gestation and no infant regimen: 9.4% (Shaffer et al., 1999)</td>
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</tbody>
</table>
## ART (triple therapy) for all pregnant women

**First line:** AZT, 3TC, NVP twice daily (beginning at 28 weeks of gestation if regimen is not indicated for woman’s HIV status or if regimen has not yet started)

- For NVP, monitor liver function closely for one week after initiation of ART and every two weeks or if symptoms of hepatitis develop
- If evidence of hepatitis, stop NVP and 3TC and continue AZT through delivery
- EFV should be discontinued and changed to another ARV
- Avoid d4T, ddi, and TDF during pregnancy

**Source:** Partners In Health (Partners In Health, 2006)

<table>
<thead>
<tr>
<th>Source</th>
<th>Prenatal</th>
<th>Labor</th>
<th>Postnatal (mother)</th>
<th>Postnatal (infant)</th>
<th>Transmission rate and resistance information</th>
</tr>
</thead>
</table>
| Partners In Health (Partners In Health, 2006) | ART (triple therapy) for all pregnant women  
First line: AZT, 3TC, NVP twice daily (beginning at 28 weeks of gestation if regimen is not indicated for woman’s HIV status or if regimen has not yet started)  
For NVP, monitor liver function closely for one week after initiation of ART and every two weeks or if symptoms of hepatitis develop  
If evidence of hepatitis, stop NVP and 3TC and continue AZT through delivery  
EFV should be discontinued and changed to another ARV  
Avoid d4T, ddi, and TDF during pregnancy | If woman does not present until labor offer single-dose NVP | If single-dose NVP is offered, provide a 14-day course of AZT and 3TC  
If woman’s CD4 is ≥350 cells/mm³ then stop NVP at first postpartum visit and continue AZT and 3TC for two weeks after ending administration of NVP | 7-day regimen of AZT (4 mg/kg) 2 times a day  
Regimen of TMP/SMZ prophylaxis starting at 4 weeks of age until HIV-negative status is confirmed  
If mother did not receive ART prior to 36 weeks of gestation, offer single-dose NVP after delivery and continue AZT regimen for six weeks | Expected rate: < 2% (Cooper et al., 2002) |

<table>
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<tr>
<th>Source</th>
<th>Prenatal</th>
<th>Labor</th>
<th>Postnatal (mother)</th>
<th>Postnatal (infant)</th>
<th>Transmission rate and resistance information</th>
</tr>
</thead>
</table>
| Lallemant (Lallemant et al., 2004) | From 28 weeks of gestation offer: 300 mg AZT twice daily | 300 mg AZT every 3 hours  
200 mg NVP at onset of labor | 7-day regimen of AZT (2 mg/kg) 4 times a day  
Single-dose (6mg) NVP (added to above regimen)  
If mother receives less than 4 weeks of the prenatal regimen then offer same AZT regimen as above for 4 weeks | 2.8%  
1.9% (not statistically significantly different from 2.8% above; p=0.216) |
<table>
<thead>
<tr>
<th>Source</th>
<th>Prenatal</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Shapiro (Shapiro et al., 2006)</td>
<td>All women received AZT from 34 weeks of gestation through delivery</td>
<td>Randomized to: Single-dose NVP Placebo</td>
<td>All infants enrolled in study received AZT from birth through one month and a single dose of NVP at birth (6 mg) except for infants who were &lt; 2 kg at birth and born &lt; 35 weeks of gestation who received 3mg; authors suggest there is a post-exposure prophylaxis effect</td>
<td>Transmission at one-month (some infants were breastfed) NVP during labor: 4.3% Placebo during labor: 3.7% (not a statistically significant difference) Authors suggest withholding NVP in mother and offering to infant postnatally to prevent NVP resistance in women</td>
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<tr>
<td>Combination strategy (WHO and PIH)</td>
<td>ART (triple therapy) First line: AZT, 3TC, NVP twice daily (beginning at 28 weeks of gestation if regimen has not yet started)</td>
<td>300 mg AZT every 3 hours If woman does not present until labor also offer single-dose NVP</td>
<td>If single-dose NVP is offered, initiate triple therapy including NVP to prevent resistance Continue ART if woman was already receiving regimen prior to delivery</td>
<td>7-day regimen of AZT (4 mg/kg) 2 times a day&lt;sup&gt;1&lt;/sup&gt; Single-dose NVP after delivery if woman did not present until labor 7-day regimen of 3TC (2 mg/kg) twice a day (if NVP offered) Regimen of TMP/SMZ prophylaxis starting at 4 weeks of age until HIV-negative status is confirmed</td>
<td>Expected rate: &lt; 2% (Cooper et al., 2002)</td>
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</table>

<sup>1</sup>If mother receives less than 4 weeks of the prenatal regimen then offer AZT regimen (4 mg/kg two times per day) for 6 weeks to infant.
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<tr>
<th>Source</th>
<th>Prenatal</th>
<th>Labor</th>
<th>Postnatal (mother)</th>
<th>Postnatal (infant)</th>
<th>Transmission rate and resistance information</th>
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<tbody>
<tr>
<td>Combination strategy (WHO and PIH) ≥ 350 cells/mm³</td>
<td>From 28 weeks of gestation offer: 300 mg AZT twice daily (note: for women receiving NVP with CD4 cell counts between 250-399 cells/mm³, fatal symptomatic hepatitis was observed for 0.4%; this rate increased to 1.1% among women with CD4 cell count greater than 400 cells/mm³) (WHO, 2006); however, fatal outcome can be prevented with close monitoring for liver toxicity)</td>
<td>300 mg AZT every 3 hours 200 mg NVP at onset of labor 3TC (150 mg at onset of labor and every 12 hours until delivery) (note: If delivery is imminent omit single-dose NVP for mother)</td>
<td>7-day regimen of AZT (300 mg twice a day) and 3TC (150 mg twice a day) (prevent NVP resistance)</td>
<td>7-day regimen of AZT (4 mg/kg) 2 times a day¹</td>
<td>Expected (Lallemant et al., 2004): 1.9%</td>
</tr>
</tbody>
</table>

¹If mother receives less than 4 weeks of the prenatal regimen then offer AZT regimen (4 mg/kg two times per day) for 6 weeks to infant.
Appendix 2. Early childhood development programs: an international literature review.

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<th>THE PHILIPPINES</th>
<th>STRATEGIES AND OUTCOMES</th>
<th>REFLECTION ON PROGRAM</th>
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<tbody>
<tr>
<td>PROGRAM</td>
<td>CORE COMPONENTS</td>
<td>LOGISTICS</td>
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<tr>
<td>The Early Childhood Development Program (Armecin et al., 2006), (Behrman et al., 2004)</td>
<td>5 year ECD initiative of the Philippine government, covering wide range of health, nutrition, early education, and social services programs.</td>
<td>Implemented by rural health midwives, barangay health workers and day care workers. Child development workers were enlisted to assist in providing nutritional supplements, monitor children’s growth and educate parents about ECD. Health facilities, day care centers, and home-based programs</td>
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<tr>
<td>JAMAICA (1)</td>
<td>PROGRAM</td>
<td>CORE COMPONENTS</td>
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<tr>
<td>Name: Not identified (Grantham-McGregor 1983, Grantham-McGregor et al., 1994)</td>
<td>Psychosocial stimulation in the form of structured play sessions were added to the treatment of severely malnourished children.</td>
<td>Community health aides (Jamaican government health para-professionals) made home visits. Daily session of structured play sessions in hospitals, and 1 hr long weekly home-based psychosocial stimulation for 2 years. Weekly visits included a focus on mothers to increase their effectiveness as teachers</td>
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### JAMAICA (2)

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<thead>
<tr>
<th>PROGRAM</th>
<th>CORE COMPONENTS</th>
<th>LOGISTICS</th>
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<tr>
<td>None identified</td>
<td>Home-based program incorporating nutritional supplementation and psychosocial stimulation</td>
<td>Community health aide visited undernourished group weekly. Nutritional supplement (1 kg milk-based formula) was provided per week for 2 years, and psychosocial stimulation home-based hour-long play sessions were held weekly with a community health aide. In these sessions, mothers were taught and encouraged to play with their children, and homemade toys were provided.</td>
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<thead>
<tr>
<th>POPULATION AND DESIGN</th>
<th>ASSESSED (TOOLS USED)</th>
<th>RESULTS</th>
<th>REFLECTION ON PROGRAM</th>
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<tr>
<td>Poor neighborhoods in Kingston, Jamaica n = 129 undernourished children aged 9–24 months, compared to n = 32 non-stunted control children.</td>
<td>Cognitive development (Griffiths mental development scales for development quotient, locomotor, hand/eye coordination, hearing/speech &amp; performance), verbal IQ (Peabody picture vocabulary test), home stimulation (Bettye Caldwell index)</td>
<td>Over two years, stimulation significantly improves all subscales and DQ (p &lt; 0.01), and supplementation significantly improved locomotor and performance subscales and DQ (p &lt; 0.01). The three intervention groups showed significant improvement compared to the control group in all DQ (p &lt; 0.01), controlling for possible covariates. The combined intervention showed significant improvements over the stimulation-only (p &lt; 0.05) and supplement only (p &lt;0.01) groups. Follow-up study showed no significant effects of supplementation. Regression analyses showed that stimulated children received significantly higher scores on full scale and verbal IQ, verbal analogies, vocabulary and reading comprehension (all p &lt; 0.05). Effect size of home based stimulation compared to none was 0.4–0.6 SD.</td>
<td>Griffiths test not developed or standardized for Jamaica. While all intervention groups showed improvements and caught up to non-stunted group, the non-stunted group’s development was behind that reported for middle class Jamaican children. More effective supplementation, or longer duration of supplementation may yield greater benefits in later life.</td>
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</table>

Griffiths test not developed or standardized for Jamaica. While all intervention groups showed improvements and caught up to non-stunted group, the non-stunted group’s development was behind that reported for middle class Jamaican children. More effective supplementation, or longer duration of supplementation may yield greater benefits in later life.
**JAMAICA (3)**

<table>
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<tr>
<th>PROGRAM</th>
<th>CORE COMPONENTS</th>
<th>LOGISTICS</th>
<th>POPULATION AND DESIGN</th>
<th>ASSESSED (TOOLS USED)</th>
<th>RESULTS</th>
<th>DISCUSSION and LIMITATIONS</th>
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<tbody>
<tr>
<td>None identified, (Powell et al., 2004)</td>
<td>Integrated early psychosocial stimulation into primary care services for undernourished children</td>
<td>Community health aides were paraprofessionals with 6–8 weeks training in MCH, give advice on health and nutrition. Those who were to give the intervention attended 2 additional 1-week workshops. Nutrition clinic and home-based intervention Weekly half-hour home visits for one year (50 in total).</td>
<td>18 nutrition clinics in Kingston, St. Andrew and St. Catherine in urban Jamaica n = 139 mother-child dyads, undernourished children ages 9 to 30 mo. and their mothers Cluster randomized control trial (by clinic), n = 70 mother-child dyads in intervention clinics and n=69 dyads in control clinics, follow up for 1 year Intention to treat and multiple regression analyses</td>
<td>Development (Griffiths mental development subscales on locomotor skills, hearing and speech, hand/eye coordination and performance) Mother’s knowledge about childrearing (questionnaire) Anthropometry (weight and length/height)</td>
<td>Regression analyses showed that the intervention had significant benefits in developmental quotient, hearing and speech, hand-eye coordination, and performance (p &lt; 0.001), adjusting for clinic, age, initial score, tester effects, father living with child and mother’s education. The intervention also significantly improved mother’s knowledge of childbearing (p &lt; 0.001) and childrearing practices (p&lt;0.01), controlling for the same factors.</td>
<td>Pilot testing of intervention illustrated a preference of home-visits to clinic, as mothers often failed to attend clinics because of expense and transportation. Community health aides were already visiting undernourished children, thus it was easy to “piggyback” ECD home-visits. Weekly visits by the community health aides were not achieved due to pressure of other clinic work, but frequency of visitation was not reported as affecting success of intervention. Full time aides with less competing work would facilitate more frequent visits. Sufficient resources are needed to fund community health aide and clinic nurse training, hiring of a full time coordinator, and costs of curriculum manuals, tools and materials.</td>
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<tr>
<td>Bolivia</td>
<td>Program</td>
<td>Core Components</td>
<td>Logistics</td>
<td>Population and Design</td>
<td>Assessed (Tools Used)</td>
<td>Results</td>
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| Proyecto Integral de Desarrollo Infantil (PIDI) - Integrated Child Development Program  
(Behrman, et al., 2000; Behrman, Cheng & Todd, 2004) | Integrated daycare program providing better nutrition and educational services, adequate supervision and stimulating environments to improve health and early cognitive/social development. | Women, with similar socioeconomic background as parents, act as home day care mothers. They are given training in child care, and loans and grants (up to $500) to upgrade their home facilities to be used as the care centers.  
Child care centers provides food, health and nutrition monitoring, and educational activity programs. | Predominantly poor, urban areas in Bolivia  
Round 1: n=1198  
Round 2: n=2420  
Children aged 6–72 months.  
Longitudinal, cross-sectional design (2 rounds); Comparisons between three subsamples: participants, non-participants from feeder area, and children living in similar areas without the program | Nutrition (weight and height percentile for age)  
Cognitive skill development (battery of tests of bulk motor skills; fine motor skills; language and auditory skills)  
Psychosocial skills development | The program had significant positive effects on cognitive achievement and psychosocial test scores, but impacts were highly dependent on age and duration of exposure. The program seems to have cumulative effects such that impacts increase as duration of participation increases.  
Test score gains depend strongly on duration of exposure to program (positive effects seen if duration > 7 mo.), and health impacts are conditional on age.  
Significance was determined at a level of 10%. | Paper also outlines a model for the decision to enroll children into preschool programs. Predictors of participation were presence of mother in the household, education level of the mother, number of children, educational level of father, and income level of the father.  
Cost effectiveness analysis posits possible effects of this program on lifetime earnings, including direct effects (greater physical stature and cognitive skills) and indirect effects (less time spent in school to achieve a given level of education). |
**VIETNAM**

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>CORE COMPONENTS</th>
<th>STRATEGIES AND OUTCOMES</th>
<th>POPULATION AND DESIGN</th>
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<th>RESULTS</th>
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<tbody>
<tr>
<td>Save the Children Japan (Watanabe et al., 2005)</td>
<td>Nutrition intervention consisting of growth monitoring, nutrition education rehabilitation program. Additional integrated ECD intervention which strengthened center-based preschooling through material support, teacher training and parent rearing skills</td>
<td>Local health volunteers conducted growth monitoring and a nutrition education rehabilitation program. Teachers were given additional training on child-centered teaching methods. Nutrition program included 9 sessions of a 12-day education program conducted every month. ECD intervention strengthened existing daycare services and provided 1-day training sessions every month for mothers and fathers on child care and development.</td>
<td>Vinh Loc district, Thanh Hoa province, rural Vietnam. n = 313 (4–5 year olds exposed to a nutrition project when they were 0–3 years old).</td>
<td>Cognitive Development (Raven's Progressive Matrices Test). Anthropometry (height and weight).</td>
<td>There was a significant decrease in the proportion of stunting for both intervention groups. The adjusted proportions of stunted children was reduced by 16% (p &lt; 0.01) and 13% (p = 0.01) in the nutrition+ECD and nutrition groups, respectively. Nutrition + ECD intervention significantly decreased the proportion of severe stunting by 7.8% (p &lt; 0.01) and showed significantly higher test scores (p = 0.05), particularly among stunted children (controlling for household income, maternal education, child's age and grandparent presence).</td>
<td>Lack of data on parental behaviors and its effect on child development. While government is currently establishing ECD/nutrition program, it is difficult to reach ethnic minorities living in mountainous regions. The greater effect of combined interventions (physical/cognitive) may be attributable to 3 different points in time: “at child level, between the child and caregivers, and in the design and delivery of programs.”</td>
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- **Cognitive Development (Raven's Progressive Matrices Test).**
- **Anthropometry (height and weight).**

There was a significant decrease in the proportion of stunting for both intervention groups. The adjusted proportions of stunted children was reduced by 16% (p < 0.01) and 13% (p = 0.01) in the nutrition+ECD and nutrition groups, respectively. Nutrition + ECD intervention significantly decreased the proportion of severe stunting by 7.8% (p < 0.01) and showed significantly higher test scores (p = 0.05), particularly among stunted children (controlling for household income, maternal education, child’s age and grandparent presence). Lack of data on parental behaviors and its effect on child development.

While government is currently establishing ECD/nutrition program, it is difficult to reach ethnic minorities living in mountainous regions.

The greater effect of combined interventions (physical/cognitive) may be attributable to 3 different points in time: “at child level, between the child and caregivers, and in the design and delivery of programs.”
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<th>CHINA</th>
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<td><strong>PROGRAM</strong></td>
<td><strong>CORE COMPONENTS</strong></td>
<td><strong>LOGISTICS</strong></td>
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</table>
| Early Intervention of Premature Infants Cooperative Research Group (Bao, Shuzhen & Wei, 1999) | Home-based early child development training for parents, concentrating on motor, cognitive, speech development and social behaviour | Parents were taught by members of research group to visually and audibly stimulate their children, perform infant exercises, as well as use age appropriate toys, books and pictorials. Small classes were sometimes organized to explain patterns of child development | Hospital settings in China  
$n = 156$ | Motor functioning  
(Psychomotor Development Index)  
Cognitive functioning  
(Mental Development Index)  
Anthropometry  
(height, weight, head circumference)  
Infant Development Tests (Child Development Center of China Scale) | Those in the intervention group showed significant improvements in cognitive development compared to the conventional care group. MDI scores were increased by 13.8 and 14.6 points at the age of 1.5 and 2 years, respectively, with $p<0.000001$ in both cases.  
At 2 years of age, the intervention group had significantly higher MDI and PDI scores than the normal control group ($p < 0.05$). | Early intervention can promote the intellectual development of premature infant. The key to the success of the program was identified to be the engagement of parents and families to bring their initiative into full play. |
<p>| | | | Children born prematurely at gestational age 28–36.9 weeks, followed up until reached 1.5–2 years of age | | | | |
| | | | Prospective randomized trial of survived premature infants: intervention group ($n = 52$), conventional group ($n = 51$) and control group of normal newborn infants ($n = 53$) | $\chi^2$, t and F tests were used for analysis | | | |
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<tr>
<td>Bangladesh Integrated Nutrition Program (BNIP) (Hamadani et al., 2006)</td>
<td>Addition of psychosocial stimulation to the government nutritional surveillance and supplementation program (BINP), which provides nutrition supplements through community nutrition centers (CNCs).</td>
<td>‘Play leaders’ who led the intervention were literate women from the village who received 2 weeks of training from 2 supervisors. Psychosocial intervention consisted of weekly group meetings at the CNC for 10 months followed by meetings every 2 weeks for 2 months, coupled with individual home visits twice weekly for 8 months and weekly for 4 months.</td>
<td>Developmental assessment (Bayley Scales of Infant Development, includes MDI and PDI)</td>
<td>Regression analyses controlling for initial scores, age and treatment group found significant treatment effects on MDI ($p = 0.007$), response to examiner ($p = 0.001$), cooperation ($p=0.005$), emotional tone ($p = 0.03$), vocalization ($p = 0.04$) and maternal knowledge of childrearing ($p &lt; 0.001$). The number of home visits significantly impacted PDI scores ($p = 0.003$). The number of group sessions did not significantly affect MDI or PDI scores.</td>
<td>Study shows that it is possible to integrate child development activities into existing nutritional interventions. Extra village women were hired to run the stimulation program, but other programs may find it feasible to train staff members of feeding centers. Some possible barriers of the study may include the time needed for mothers to bring children to CNC weekly.</td>
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Monohardi, a poor rural farming area in Bangladesh

n = 313

Moderate and severely undernourished children aged 6–24 mo.

Cluster randomized control trial between 10 control CNC’s (n = 102) and 10 intervention CNCs (n = 104); and 107 better-nourished children

Independent sample t test, Pearson’s correlation, intention to treat analysis, multiple regression

Anthropometry (weight, height, mid-upper arm, and head circumference)

Mother’s knowledge of childrearing (questionnaire assessing knowledge of nutrition, health and hygiene, child development practices)
<table>
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<th><strong>BANGLADESH (2)</strong></th>
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<td><strong>PROGRAM</strong></td>
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<td><strong>LOGISTICS</strong></td>
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<tr>
<td>Plan Bangladesh (Aboud 2006)</td>
<td>Preschool half-day program aimed at developing language and cognition skills, improving social and emotional development and awareness if the environment through free play, stories and preparation in literacy and math.</td>
<td>Teachers were recruited by communities, and had at least a grade 10 education level. They received 26 days of training and 16 days of refresher courses over 2 years. Each preschool also had one volunteer mother. The ratio of adults to students was 1:12. Preschools were located in community spaces. The half-day program was held 6 days a week.</td>
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<td>PROGRAM</td>
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<td>None identified, (Eickmann, et al., 2003)</td>
<td>Mother-centered and home-based psychosocial stimulation program aimed at providing skills and educating mothers to enable them to improve their children’s development</td>
<td>Intervention delivered by 2 trainers (occupational therapists with specializations in child development) and 5 home visitors. Intervention delivered at home. Intervention consisted of 14 contacts over 5 months: an initial home visit, 3 workshops at age 14, 15, and 16 months, and 10 reinforcement weekly home visits between 14 and 18 months of age.</td>
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Intervention delivered by 2 trainers (occupational therapists with specializations in child development) and 5 home visitors. Intervention delivered at home. Intervention consisted of 14 contacts over 5 months: an initial home visit, 3 workshops at age 14, 15, and 16 months, and 10 reinforcement weekly home visits between 14 and 18 months of age. | Urban resource-poor areas of 4 small towns in the state of Pernambuco, Brazil n=156 Brazilian children, 12 months of age, divided equally into intervention and control groups Longitudinal cohort study, followed up for 6 months | $\chi^2$ test for proportions, ANOVA, multiple linear regression | This was not a randomized trial, but baseline characteristics for both groups were comparable for a range of socioeconomic, demographic, environmental and biological variables. Aspects of this intervention may not be entirely sustainable (providing transportation to and from workshops, using highly trained professionals as leaders). Weekly, intensive contact is necessary if programs are to be effective; a low cost neighborhood based program might be possible through community mobilization of mothers’ groups and training of mothers as group leaders, reinforced by community health workers, and supervised by child developmental specialists. This program may have larger social benefits as well, as the workshops brought mothers together and facilitated interaction, confidence strengthening and skills building. This could be further developed to enhance income-generating activities. |
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<th><strong>THAILAND</strong></th>
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<th><strong>CORE COMPONENTS</strong></th>
<th><strong>LOGISTICS</strong></th>
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<th><strong>RESULTS</strong></th>
<th><strong>REFLECTION ON PROGRAM</strong></th>
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<tr>
<td>Integrated Family Based Early Childhood Development (IFBECD) Project (Kotchabhadhi 1999)</td>
<td>Integrated and community-based program in 16 rural villages: consisting of health, nutrition, early education, ECD day care centers &amp; social services programs</td>
<td>Family development volunteers (local women with child-rearing experience) work with 5 families each, providing information about child health and development. Teachers use play activities and developmentally appropriate toys for younger children, and teach older children to determine vaccination status and developmental progress of younger siblings and neighbors. Settings of delivery vary (home visitations, schools, marketplace). Frequency of interaction unknown</td>
<td>Phai Sali district in Nakjon Sawan province, Thailand &lt;br&gt; n = 245 children, aged 6 months to 6 years old</td>
<td>Controlled trial with 3 program villages matched with 3 control villages &lt;br&gt; Follow-up period of 2 years</td>
<td>Nutrition (weight and height for age) &lt;br&gt; Intelligence/Developmental Status (IQ) &lt;br&gt; Quality of home environment (HOME assessment scale)</td>
<td>Statistical analyses were not reported, but it was observed that the program did not have a major impact on nutritional status. The intervention group showed improvements in IQ score and the quality of home environments. Improvements in nutritional status, developmental performance, intelligence quotient scored, utilization of health care resources and parental attitude and involvement</td>
<td>The IFBECD model is a collaborative project between UNICEF, Save the Children USA, Christian Children’s Foundation, Royal Thai Government, and villagers themselves. A Community Development Department helped facilitate cooperation between village leaders and local women. Consistent coordination among multisectoral governmental organizations and local administrative bodies must be maintained to ensure sustainability and efficiency. Detached role of mass media and policy-making bodies was important to overall success of program No statistical analysis of the program outcomes has been performed yet</td>
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<td>PROGRAM</td>
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<td>POPULATION AND DESIGN</td>
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<td>Bogota Study of Malnutrition, Diarrheal Disease, and Child Development (Super, Herrera &amp; Mora, 1990)</td>
<td>Two interventions consisting of food supplementation of entire family, and home visits to promote early cognitive development and environmental stimulation</td>
<td>Nutrition program: familiar food supplementation, distributed weekly at special centers, nutritionists educated mothers about hygienic preparation of foods and dry milk</td>
<td>Poor neighborhoods in southern Bogota, Colombia n = 522 children aged 0–3 at risk of malnutrition, and their families</td>
<td>Anthropometry (height, weight, head circumference, triceps skinfold) Dietary intake Family life and household facilities (maternal interviews) Family functioning</td>
<td>After 3 years, children with supplementation had significant increases in height (p &lt; 0.001) and weight (p = 0.001). At 6 years, the supplement and home visit groups had significant increases in height (p = 0.002 and p= 0.022 respectively). Logistic regression analyses showed that subjects in the nutrition+ECD program had highly significant scores with respect to weight-for-age and height-for-age outcomes at three years and six years of age. Home visiting increased protein intake (p = 0.02) compared to controls, and paternal involvement with the child (p= 0.01 at 24 and p = 0.03 at 36 months).</td>
<td>Supplementation had a persistent effect 2 years after termination of intervention. Home visits led to a 3 year reduction in growth retardation, and these effects increased after time, leading to a hypothesis that the causal mechanisms were created and instituted by the intervention. This &quot;sleeper effect&quot; of home visitation may also highlight the important role of the family, through parental understanding of or attention to development. Incentives: All families received free medical and pediatric care for the duration of the study.</td>
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**COLOMBIA**
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<tr>
<th>INDONESIA</th>
<th>STRATEGIES AND OUTCOMES</th>
<th>REFLECTION ON PROGRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not identified (Pollitt, Watkins &amp; Husaini, 1997)</td>
<td>Evaluation of the long-term effect of a 3 month dietary supplementation program based in daycare centers</td>
<td>The study concludes that age of supplementation determines the developmental effect of supplementation, and suggests that the critical period for neural development (for working memory) is before 18 months of age.</td>
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<td>Subjects at daycare centre for children of tea plantation employees who participated in a 3 month program testing dietary supplements when they were 6–60 months old. Randomized cluster design, comparison between supplement group (n = 125) and control group (n = 106), followed up after 8 years</td>
<td>The original study found no significant differences between the treatment and control group. The follow-up study also found that no cognitive or emotional outcomes were different between groups, except for working memory. Children who received supplementation showed significant and borderline significant improvements in the Sternberg working memory (p &lt; 0.002 to p &lt; 0.068, depending on the presence of a probe).</td>
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<td>Pengalengan, Indonesia n = 231 school aged children who participated in a 3 month program testing dietary supplements when they were 6-60 months old</td>
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<td>Anthropometry (height, weight, head circumference, skinfold thickness) Hematology (Iron status kit) Cognition (simple and choice reaction time, Sternberg working memory scanner, probe recall) Emotionality (tachistoscopic threshold test) Peabody Picture Vocabulary Test Arithmetic test</td>
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<td>Results and discussion and limitations</td>
<td></td>
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<tr>
<td>Logistics and Design</td>
<td>Assessed (tools used)</td>
<td></td>
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</tbody>
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