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Implementing Enhanced Early Childhood Development Package, Leveraging m-Health and Using a Task-Shifting Approach in Kenya

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Abstract

The WHO/UNICEF have recently disseminated the Care for Child Development curriculum for training community health workers (CHWs) to provide counseling on early childhood development to parents during routine home visits in low resource countries. We propose to integrate it with a 'human-computer hybrid' platform that functions as a 2-way SMS communication tool to engage parents on ECD issues and empower CHWs to provide psychosocial support on a more frequent basis. We will identify high risk, vulnerable families to augment in-person and mobile interface to further address mental health, community health promotion model and early childhood development. We will also identify three areas of growing concern which include engagement with male caregiver/s, high risk parents/mothers and deepening psychosocial support over mobile interface. Finally, we will address how our hybrid model integrates several ECD and MCMH approaches in offering a unique community health promotion framework, health workforce and parental empowerment.
Relevance to innovation. The proposed model of ECD delivery leverages on existing mobile technology to enhance efficiency and supervision of the delivery of ECD packages developed by WHO. It is a process innovation for public use that is aimed at improving neurodevelopmental outcomes for children and can be used in any low income setting with access to mobile technology and trained health personnel.

Keywords. Care for Child Development, Community Health Workers, Early Childhood Development, Mobile technology, World Health Organization

Introduction

Maternal and child mental health still remains an area requiring tremendous innovative services delivery worldwide and more so in Kenya. The WHO and UNICEF have recently disseminated a manualized curriculum (Care for Child Development) for training community health workers (CHWs) to provide counseling on early childhood development to parents during routine home visits in low resource countries. The curriculum piloted in other countries has been shown to improve child developmental outcomes. In Kenya though, CHWs are a fragile work force and therefore innovative, low cost strategies are needed to support this global initiative. Even in optimized, well-funded circumstances, CHWs are hard-pressed to provide a complex array of health services to all vulnerable families in their catchment.

One innovative approach is to integrate the CCD curriculum with a 'human-computer hybrid' platform that functions as a 2-way SMS communication tool. In this paper, firstly, we will lay out our conceptual model. Our model proposes to disseminate critical information to CHWs on ECD and simultaneously disseminate a mobile portal to engage parents on ECD issues and empower CHWs to provide psychosocial support on a more frequent basis. Our proposed model is innovative as it would use an existing WHO developed ECD manual to be modified for local use. The platform would automatically deliver timely, personalized weekly messages, and enable user-friendly 2-way counseling dialogue between community health workers and caregivers. Messages would target infant development, maternal- and paternal-infant interactions and parenting practices, and infant feeding and growth outcomes. The platform would allow frequent counseling at flexible times and without need for transit. Secondly, in addition to laying out a roadmap of our model, we also identify three areas of opportunities for innovation which include engagement with male caregiver/s, Identification of high risk parents/mothers, and deepening psychosocial support and over mobile interface as areas needing further work. Thirdly, we will embed these concerns in ECD and MCH care delivery related implementation gaps and finally we will address how our hybrid model integrates several ECD and MCMH approaches in offering a unique community health promotion framework, health workforce and parental empowerment along interface with innovative mobile early childhood development delivery service.

Background

An estimated two hundred million children in low and middle income countries (LMICs) live in poverty, and may fail to reach their full developmental potential due to a number of environmental, maternal and infant factors that often occur in combination (Walker et al 2011; Jensen et al 2015) (Fig.1). In 2010, the global cost of early growth faltering in developing countries was estimated at $176.8 billion in future earnings ($34.2 billion in sub-Saharan Africa). In the same year in sub-Saharan Africa, 43.8% of children aged 3-4 had either low cognitive or low socio-emotional skills or both (Mccoy, DC Plos Medicine 2016), and cofactors for lower scores included poverty, stunting, and poor stimulation. Caregivers can play an important role in mitigating the negative effects of these stressors on child development outcomes in early childhood, through quality caregiving. Caregiver

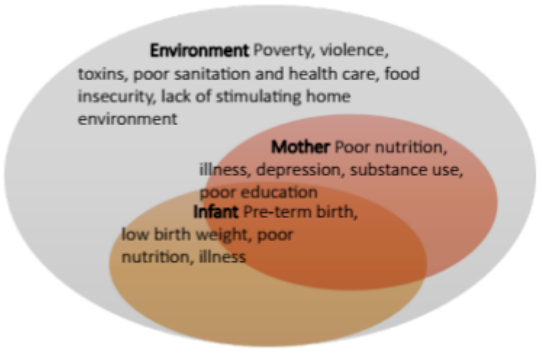

Figure 1. Environmental, maternal and infant factors that compromise infant development often overlap

behaviors associated with responsiveness, nurturing, and stimulation are protective and promote infant development in spite of environmental and biological risk factors (Walker et al, 2011; Yousafzai et al 2014). These interventions are a practical target for intervention at scale. In studies of under-nourished children who were followed for 2 decades in the Caribbean, providing mothers with simple counseling on parenting skills translated to higher earnings later in life, suggesting simple early childhood interventions can limit the economic cost of early malnutrition (Gertler P Heckman J et al. Science 2014).

MCH and ECD context in Kenya

Health systems in Kenya are overburdened and under-resourced, limiting implementation of individualized developmental interventions for children. Despite the strong evidence base for developmental interventions, their utilization in LMIC settings such as Kenya has been limited by a lack of staff and resources to deliver individualized therapies, and home visits. It is important to develop low-cost sustainable approaches that are appropriate for use in severely resource-constrained settings without compromising quality.

A significant proportion of the population of Kenya lives in informal urban settlements. These settings are very highly congested with temporary homes and no social amenities including sanitation, clean water, lighting and security. HIV infection rates are relatively high and access to healthcare and proper nutrition is poor. Unemployment rates are constantly high and when employed the majority are casual workers in the informal sector or low-wage earners in industry. Household resources are often minimal, affording only basic survival. Infrastructure, resources and knowledge to support early childhood development are poor. Most adults lack maternity or paternity leave, minimizing contact between infants and parents, particularly fathers. Options for childcare outside of the home may consist of a one-room shack with mattresses, where a single individual may care for 20-30 children of various ages. Other childcare options may include grandparents, who are often illiterate, elderly or disabled.

However, these communities do have access to mobile phones. Recent initiatives have

improved ante- and postnatal clinic attendance. These two positive factors provide an opportunity for simple, SMS-based interventions that are aligned with existing health facility services to benefit this vulnerable population lacking in time, resources and paternal involvement in child upbringing.

Low resource approaches to ECD in other settings

In Uganda, 12 volunteer, peer-educator group sessions improved child cognition and language and maternal depressive symptoms (Singhla et al 2015). Other low-cost approaches involve community health care workers (CHWs). The WHO and UNICEF have disseminated the Care for Child Development (WHO, 2012), a manualized curriculum which can be used to train low-skill health workers to counsel caregivers and promote responsiveness, sensitivity, and age-appropriate communication and play during routine home visits. In a community-based cluster randomized trial in Pakistan, the CCD intervention improved infant cognition, language and motor development following 24 monthly home visits (Yousafazai AK, Rasheed MA et al Lancet 2014). In another recently conducted Caribbean study, CHWs delivered 5 20-minute group-based parenting sessions 3-monthly clinic visits which improved child cognition at 18 months (Chang et al 2015).

Few data for cost and child development interventions in LMICs

A 2014 systematic review identified seven studies aimed at estimating cost-effectiveness of early childhood development interventions (Battura et al 2015) each of which involved parenting interventions focused on conduct disorders, and either home visits or practice-based delivery models. Two cost- and cost-effectiveness studies from LMICs (Pakistan and Nicaragua) have been published recently, both involving CHW-based approaches in which health, nutritional, and child development counseling was delivered during individual home visits (Gowani et al 2014; Lopez et al 2014). These studies are promising, because they demonstrate relatively low annual costs per child ($37-48) within the context of incremental gains in child development measures at scale. Other low-cost approaches have usually involved community health care workers (CHWs), and exploration of a collaborative care cascade and integrating nutrition and maternal health in their intervention (Murray et al 2016; Zafar et al 2016; Murray-Kolb et al, 2014). Although CHWs are likely a valuable resource for advancing maternal child health initiatives in resource poor-settings (WHO, 2007), their coverage of households within a community may vary (Aridi et al 2014), and it is plausible that adding high quality child development support to existing services may compromise other initiatives. As national health systems and supporting non-government programs strive to incorporate parenting interventions into their activities in sub-Saharan Africa, acceptability, feasibility, and cost studies are needed within this context to inform design of affordable models for delivery. We hypothesize that combined mHealth-based and human delivery models are a plausible approach to lowering costs while enabling scaling-up reaching higher coverage.

The increased uptake of mobile network coverage, the rapid expansion in mobile phone penetration along with affordable costs of phone services and a large scale mobile banking that is most benefitting the poorest of the poor in Kenya has offered a tremendous

opportunity to overcome infrastructure, human resources, specialized information and communication barriers of health systems in Africa (Malar et al 2014; Murray-Kolb et al 2014).

Method

Computer-human hybrid SMS delivery models could allow remote ECD delivery

Human-computer hybrid communication platforms combine strengths of computer- and human-delivery models (Perrier et al, 2015). In a prototype human-computer hybrid (Mobile WACh) system recently developed and implemented in Kenya, pregnant women received standardized messages encouraging antenatal care, birth planning, facility delivery, and family planning (Perrier et al 2015). The system allowed combined standardized tracks of automated messages for efficiency, but also provided a platform for two-way dialogue with a nurse that was user-friendly for both facilitator and recipient. Efficiency was enhanced by developing standardized responses that were incorporated into 'manual' in the moment dialogue. The platform allowed ready access to key clinical demographic and clinical information and prior conversations for each participant. Messages included a question tied to the content of the message:

> **Sample Mobile WACh message**: '[Name], this is [Name] Are you having trouble breastfeeding? Giving the baby other fluids can cause illness and weakness. Please continue to only give breast milk to your baby for at least six months. How long do you plan to breastfeed?'

Two-way dialogue allowed opportunity for social support, counseling, and problem-solving that was tailored for a specific recipient. Recipients of the platform had higher uptake of family planning and breastfeeding (Unger JA et al, 2015). We propose that parenting counseling messages, such as those provided as part of the WHO CCD curriculum could be successfully integrated into a computer-human hybrid platform. This approach may offer a low cost mechanism to provide high frequency of counseling interactions, and increase population reach by eliminating need for travel.

Using the computer-human hybrid system, community health workers who receive standard CCD training could deliver the intervention remotely, rather than via a home visit, as in current CCD delivery in Kenya. The automated system would enable timely, personalized weekly messages, but would still allow user-friendly 2-way counseling dialogue between community health workers and caregivers. Messages will be crafted to provide age-appropriate, timely infant feeding, health, and child-development counseling. Child-development counseling messages will integrate emotional support and praise, maternal behaviors to support development, infant developmental areas, and support for infant feeding (Figure 2). The platform could allow frequent counseling at flexible times and without need for transit. In addition, the human-computer hybrid mechanism offers unique training benefits not afforded by standard in-person counseling, because interactions between facilitators and supervisors can be monitored and reviewed remotely and in real-time. Use of pre-scripted response messages may also provide ongoing

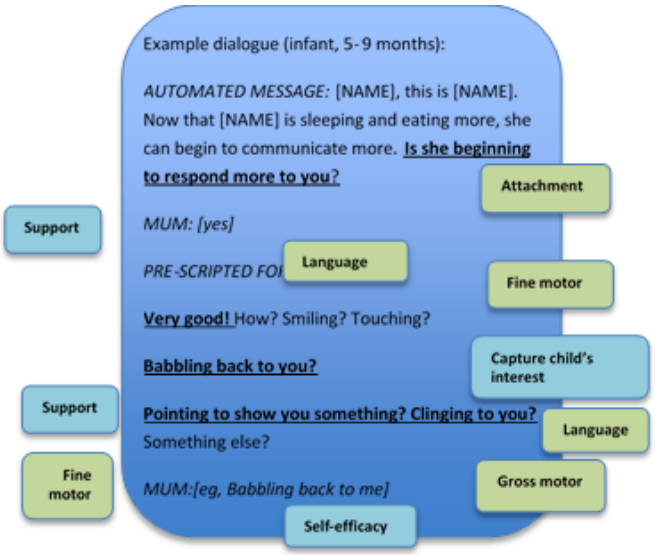

Figure 2. Sample Computer-human hybrid dialogue supporting ECD.

reinforcement of ECD concepts. These features could be particularly appealing with regard to implementation in the context of Kenyan community health workers, who have little opportunity for in-person supervision and skills-building.

Opportunities for innovation in ECD and MCH context

Paternal involvement

Fathers and male partners are an important, under-targeted support for mothers within households, facilities, and communities. There is limited data regarding specific paternal involvement domains that are modifiable in this community. In an evaluation of the World Bank-assisted project on Nutrition and Early Child Development in Uganda, caregivers were more likely to report attitudes in favor of father involvement than in the control; however, father attitudes did not change (Britto et al. 2009). In Malawi, mass media campaigns resulted in father higher participation in antenatal care visits, delivery, and postnatal care visits (Zamawe et al 2015). SMS-based interventions warrant consideration in efforts to improve paternal involvement in child-rearing in the Kenyan context.

Supporting self-efficacy in parenting

Caregiver behaviors are influenced at least in part by their self-efficacy (the belief that they are effective at parenting) (Klein, 2004 #426). Based on the Social Cognitive (Bandura, 1998#492) we hypothesize that the two-way SMS counseling will strengthen maternal caring capabilities of agency and self-efficacy in addition to knowledge, and social support [Yousafzai AK,Lancet 2014, Matare, 2015#491;Klein, 2004#426;Engle, 1999#493]. These capabilities will in turn promote behaviors to supporting early child

development. It is important to recognize that SMS counseling may not be sufficient for supporting parenting behavior change. SMS relies on maternal interest and engagement, does not afford opportunity for direct observation of mother-infant interactions, modeling of desired behavior, or practice and role-play with in the moment feedback (Fig. 2). On the other hand, a human-computer hybrid platform could provide perception of individualized, interpersonal interaction, particularly if standard messages incorporate timeliness (appropriate to the age of the child), personalization (use of the caregiver's and infant's name), actionable messaging, and open-ended questions crafted to engage dialogue. Thus, two-way SMS may provide social support, and potentially could be leveraged to instill self-efficacy.

Reaching high-risk caregivers

A number of systematic reviews of parenting interventions focused on LMICs have been conducted (Engle et al 2014; Aboud et al 2015, Engle et al 2007; Nores et al 2010], and have identified relatively few RCTs of child development interventions originating in sub-Saharan Africa. Pre-term birth (Blencow et al 2013; Gladstone et al 2015), and stunting (Ricci et al 2006), are highest, or among the highest in Africa, and the need for high quality, intensive interventions for child development may be greatest in this region. With one exception (Singhla et al 2015), studies of early childhood development interventions in Africa have involved intensive programs involving frequent and numerous home visits, skilled-staff or both (Klien et al 2004; Boivin et al 2013; Potterson et al 2010; Boivin et al 2013; Cooper et al 2009). In other regions of the world, parenting interventions that focused on certain subsets of high risk infants, such as low-birth weight infants (Nahar et al 2012; Hamadani et al 2006) undernourished infants (Nahar et al 2009; 2012; Hamadani et al 2006; Powell et al, 2004; Gardner et al 2005) have involved daily, weekly or fortnightly individual clinic sessions or home visits. As approaches to streamline early childhood delivery models take shape in sub-Saharan Africa, it will be important to compare the benefits of these approaches for high versus low risk infants and determine best practices for reaching high-risk dyads.

Hybrid implementation effectiveness design: extending m-health innovation to grassroots

Several components of our design are novel in that there is hybridization at the level of technology-human interface, at the level of training CHWs, MCH and ECD personnel that incorporates parenting, mental health and child development and addresses knowledge, resource and service implementation gaps by developing a portal that is potentially highly sustainable given the large scale use of mobile technology in low resource households. Our intervention would offer knowledge exchange (imparting of knowledge between different producers to different consumers of the knowledge), and knowledge transfer (getting knowledge out from producers to the potential users) from the CCD guidelines to CHWs who would be mastering a new portal of exchange and reaching out to the families and individual caregivers via SMS. In this process our efforts are geared towards capacity building at several tiers: a) enabling Kenyan researchers to review, critique and evolve

critical mental health overlaps between ECD and MCH programming and include male caregivers through our adjoining qualitative work, b) we visualize the Mobile WaCH technology as a skills and knowledge transfer for the overburdened, under-resourced CHWs and other health workers who can use the portal to connect in timely and efficacious manner with needy families through rigorous training and evaluation and the novelty also lies in c) engaging families in a technology that they trust and are efficient in using. We conjecture that we would be able to strengthen the capacity of the caregivers to engage with child development and parenting issues via this medium that protects their time, privacy and offers exclusivity of interaction, In this hybrid type 2 design, we are strengthening clinical effectiveness of this mobile ECD technology while immersing ourselves in addressing implementation barriers of face-to-face reaching out to families, paucity of CHWs and their poor training credentials etc.

In our mobile ECD implementation framework, new knowledge is being generated and tested at the same time (Curran et al 2013). We are testing the ability of the providers (primary health system, CHWs, select MCH and ECD workers) in immersing in the mobile portal engaging the key consumers-caregivers in vulnerable family and community contexts. Some of the caregivers features such as male involvement in parenting, high poverty and food insecurity, poor maternal health etc are also features which we are assessing in terms of how the mobile interface bolsters these social determinants of health. These features we know moderate the future of how well these technologies can address public health burden. At the system level, we establish a researcher-primary care partnership in the service of low cost, high impact mobile ECD interface that would significantly impact families. We have taken all contextual factors (as proposed by models such as Consolidated Framework for Implementation Research (CFIR) and Promoting Action on Research Implementation in Health Services (PARIHS) (Naik et al 2015) and we feel the mixed methods arm of our study would provide some pointers to how community based participatory research model of mobile enhanced ECD delivery would evolve for resource constrained Kenyan families. The local practical experiences and constraints of the families, caregivers, and health workers would provide us with meaningful data to iterate the computer-human interface and despite the complexity that appears to be evident in such designs we are embracing a systematic study of barriers and facilitators to uptake of this innovative practice at multiple tiers.

Our strength also lies in research partnerships that are highly complementary, egalitarian and multidisciplinary. With partners from pediatrics, global health systems research, HIV research and mental health, we have been iterating with grassroots researchers based in ECD context, high vulnerable families from informal settlements, HIV care clinics to address how caregivers fare, fear and what challenges they encounter in providing care for their children. mental health professional from diverse backgrounds have been deliberating on the content of the SMS messages discussing how to adapt the CCD core messages into a comprehensive culturally relevant and easily accessible form for caregivers. Over the years our group has felt very strongly about empowerment of CHWs and other allied health workers in Kenyan and other SSA context. We feel our hybrid model engages with them in evidence based training. One of our key concerns is to deepen the psychosocial support that is offered via this computer-human interface providing simple but stepped care design type messages or direct interface as need arises

or caregiver requires. Being in a consecrated dialogue with psychotherapists and mental health specialists based in Kenya and US, we have been deliberating on recently launched low intensity manualized treatments offered by WHO (WHO 2015) as a way of borrowing models and therapeutic stances to bring to the mobile portal. We are very conscious of the fact that mhealth faces a deep criticism from those who argue how it removes the relational component of human exchange. We have been very focused on a hybrid computer-human exchange where a direct health worker-caregiver contact could be made when there is a felt need but more importantly the SMS are embedded in the everyday concerns of the caregivers (Vassilev et al 2015) and are offered in a supervised, well thought out CCD augmented with parenting and problem solving strategies promoted by some of WHO initiatives (WHO, 2015; WHO mhGAP, 2016. These planned inquiries would provide critical insight into behavioral change models that speak to families in resource constrained contexts as we introduce positive motivational messages, support, information about caregiving and problem solving strategies. As we progress with in this inquiry our concern is to take Ministries of Health and Education in Kenya more actively on board to understand if our implementation framework, community partnership and empowerment strategy and behavior change via mobile ECD dissemination matches their vision and evolve forays to develop cross-cutting understandings.

Discussion

A computer-human SMS platform is a compelling delivery mechanism that could plausibly address scientific, social and affordability issues noted in other ECD delivery mechanisms in a coordinated manner. Automated messaging allows for comprehensive, time- and age-appropriate content whilst the SMS dialogue allows frequent counseling and social support at flexible times, and during critical windows and for high-risk individuals. SMS-based counseling reduces costs and time-burdens, by eliminating the need for transit to individual homes. Documented content of the counseling dialogue offers a unique opportunity for supervision and monitoring and evaluation, and can be used to refine future approaches. This platform could have multiple beneficiaries including: providing counseling and social support to individual mothers and their male partners or secondary caregivers to improve infant feeding and neurodevelopment. It may also empower community health workers by providing them with better access to technology, reducing their travel times, and providing mechanisms for ongoing training in real time. The shared sense of responsibility and network of people involved in this project bring diversity, complexity but also problem solving and continued focus towards uplifting overburdened families and health workers through this innovative portal. In summary, we have invested in our partnerships, common resources, and needs of caregivers, families and health workers by assisting in the reverse the trend of developmental disadvantage in early childhood Kenya.

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