Potential effectiveness of Community Health Strategy to promote exclusive breastfeeding in urban poor settings: A quasi-experimental study in Nairobi, Kenya

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Abstract

Early nutrition is critical for later health and sustainable development. We determine potential effectiveness of the Kenyan Community Health Strategy in promoting exclusive breastfeeding (EBF) in urban poor settings in Nairobi, Kenya. We used a quasi-experimental study design, based on three studies (Pre-intervention [2007 to 2011; n=5824], Intervention [2012 to 2015; n=1110] and Comparison [2012 to 2014; n=487]). The three studies followed mother-child pairs longitudinally to establish EBF for six months. The intervention study (MIYCN study) was a cluster-randomised trial, involving regular home-based counselling visits of mothers in the intervention arm by Community Health Workers (CHWs) on maternal, infant and young child nutrition (MIYCN), while the control arm received optimized standard care involving regular CHW visits. The pre-intervention and comparison group received usual care. We tested differences in EBF for six months post-partum using Chi square test and logistic regression. At six months, the prevalence of EBF was 2% in the Pre-intervention group compared to 56% in the MIYCN study intervention group, 54% in the MIYCN study control group and 3% in the Comparison group ($p<0.05$). After adjusting for baseline characteristics, the Odds ratio for EBF at 6 months was 66.2 (95% CI 45.4 to 96.4), 86.0 (95% CI 41.3 to 179.3), and 3.9 (95% CI 1.8 to 8.4) for the MIYCN Intervention group, MIYCN Control group and Comparison group, respectively, compared to the Pre-intervention group. There is potential effectiveness of the Kenyan national Community Health strategy in promoting exclusive breastfeeding in urban poor settings, with limited health care access.

Trial Registration: The MIYCN intervention study is registered, # ISRCTN83692672

Key Words: Exclusive Breastfeeding, Community Health Strategy, Community Health Workers, Kenya, sub-Saharan Africa, urban slums.

Background

Promotion of breastfeeding is considered one of the high impact nutrition interventions[1, 2]. It is estimated that implementing interventions which promote breastfeeding could prevent about 13% of under-five deaths in countries with high mortality rates[3]. Breastfeeding confers both short-term and long-term benefits to the child. It reduces infections and mortality among infants, improves mental and motor development, and protects against obesity and metabolic diseases later in the life course[3-7]. The WHO recommends exclusive breastfeeding in the first six months of life followed by extended breastfeeding for two years or beyond for optimal growth, development and survival of the child. Non-exclusive breastfeeding in the first six months has been associated with higher morbidity and mortality compared to exclusive breastfeeding, and likewise, no breastfeeding at all has been associated with higher risk of morbidity and mortality in children 6-23 months compared to breastfeeding. Recent evidence by Victora et al. (2015) based on a prospective, population-based birth cohort study launched in 1982 in Pelotas, Brazil further indicates that the duration of total breastfeeding improves intelligence quotient, educational attainment and income in adulthood[8].

Strategies for the promotion of breastfeeding have been defined and implemented in various settings, including the Baby Friendly Hospital Initiative (BFHI), a global strategy which promotes breastfeeding in maternity wards around the time of delivery. The effectiveness of the BFHI in promoting optimal breastfeeding practices has been established, particularly in more developed countries where health care is accessible, hence health facility deliveries prevalent[9-12]. For example, the PROBIT (Promotion of Breastfeeding Intervention Trial) study in the republic of Belarus found that the BFHI was effective in improving both duration and exclusivity of breastfeeding[9, 10]. However, in low-income countries, where many deliveries do not occur in health facilities[13], the effectiveness of the BFHI may be limited.

In Kenya, the situation of infant and young child feeding practices has been poor, with the prevalence of exclusive breastfeeding for children aged less than six months at only 13% in 2003, improving to 32% in 2008[14, 15]. The situation is very poor in urban poor settings where barely 2% of children are exclusively breastfed[16]. To improve the situation, the Kenyan Ministry of Health developed an infant and young child nutrition (IYCN) strategy in 2007 (IYCN strategy 2007-2010), aimed at promoting optimal IYCN practices in the country[17, 18]. The strategy was actualized through revitalization of the BFHI, with breastfeeding counselling provided during the perinatal period in the hospital. Further, realizing the need to extend the counselling and support to the community level, given that most births have been occurring at home[14, 15], the Ministry of Health has proposed the adoption of the Baby Friendly Community Initiative (BFCI), a global initiative which extends the principles of BFHI to the community level, as outlined in the 2012-2017 Nutrition Action Plan (http://bit.ly/1G8RVz8). In line with this, the new national maternal, infant and young child nutrition (MIYCN) strategy (2012-2017) recognises the important role of community health workers (CHWs), currently referred to as community health volunteers (CHVs) in Kenya, in promotion of optimal MIYCN practices. It is expected that the CHWs would promote MIYCN through the Community Strategy, a government strategy that aims at using CHWs to promote health in the community[19]. However, achievement of this aspect of the MIYCN strategy is hampered by the fact that optimal implementation of the proposed national Community Health Strategy in Kenya is barred by limited funding[20].

To inform potential effectiveness of using CHWs to promote exclusive breastfeeding and other optimal infant and young child feeding practices in urban poor settings in Kenya where access to health care is limited, we designed a cluster randomized controlled trial (CRT) in urban poor settings in Nairobi, Kenya. We used CHWs within the Community Strategy to offer personalized home-based counselling on optimal infant feeding practices[21]. CHWs in the intervention arm were trained to offer counselling on MIYCN while those in the control arm were trained to offer

standard care including counselling on antenatal and postnatal care. In both arms, CHWs were given financial incentives and were supervised routinely. Additionally, women received information materials on MIYCN, distributed by the CHWs in both groups. The primary aim of the CRT was to determine the effectiveness of the intervention on exclusive breastfeeding in the first six months. Our analysis of the intervention is showing no statistically significant difference in the rates of exclusive breastfeeding for six months between the intervention and control group (Kimani-Murage et al, unpublished), despite the rates increasing from approximately 2% at baseline to over 50% following the intervention in both groups. We argued that, it was likely that the intervention was actually effective in increasing the rate of exclusive breastfeeding, but we were unable to show this difference due to potential secular trends and/or contamination of the control group by inadvertent breast-feeding information, among other possibilities. In this paper we use other contextual data to determine whether the intervention did potentially work to improve exclusive breastfeeding rates, over and above secular trends. In other words, we aim to determine potential effectiveness of the national Community Health Strategy involving home-based counselling visits by CHWs on exclusive breastfeeding. We hypothesize that exclusive breastfeeding for six months increased significantly in households receiving regular CHW counselling visits in our study regardless of study arm, i.e. either intervention and control arms, but little change occurred in households which were not in our study as these households were unlikely to receive regular CHW visits due to the financial constraints placed on the government programme barring optimal implementation of the Community Health Strategy.

Methods

Study Setting

The study was carried out in two slums of Nairobi, Kenya (Korogocho and Viwandani) where the African Population and Health Research Center (APHRC) runs the Nairobi Urban Health and Demographic Surveillance System (NUHDSS), covering close to 70,000 residents, under the INDEPTH network (International Network for the Demographic Evaluation of Populations and Their Health). The NUHDSS involves a systematic quarterly recording of vital demographic events including births, deaths and migrations occurring among residents of all households in the NUHDSS area since 2003. Other data including household assets, morbidity, and education are also collected and updated regularly. More information regarding the study area and the NUHDSS can be obtained from a previous publication[22]. The two slums are located about 7Km from each other. They are densely populated with 63,318 and 52,583 inhabitants per square km, respectively, and are characterized by poor housing, lack of basic infrastructure, violence, insecurity, high unemployment rates and poverty, and poor health indicators[23-27]. Poor breastfeeding and other infant feeding practices have been documented in the study setting, and these have been attributed to poor knowledge, lack of professional health support to mothers, food insecurity, and women's occupation that are incompatible with exclusive breastfeeding[16, 28]. High levels of food insecurity at over 80% have also been documented[29]. Malnutrition is high[30,31], and is strongly associated with food and other forms of poverty[32]. Unsurprisingly, high child mortality has been documented, higher than among other population groups in Kenya including rural settings[25].

Data

We use data from three studies: a longitudinal observational study conducted between 2007 and 2011, here referred to as the Pre-intervention study; a cluster-randomized study conducted

between 2012 and 2015, here referred to as the MIYCN Intervention study; and a longitudinal study conducted between 20012 and 2014, here referred to as the Comparison study.

(i) Pre-intervention study

Details about the pre-intervention study procedures are published elsewhere[16, 32]. We use data from the maternal and child health (MCH) component of a broader longitudinal study entitled Urbanization, Poverty and Health Dynamics (UPHD) in sub-Saharan Africa, funded by the Wellcome Trust, nested within the NUHDSS. The UPHD study addressed key health consequences of rapid urbanization and growing urban poverty at different stages of the life course namely childhood, adolescence, adulthood, and old age. The UPHD study was conducted between 2007 and 2010, but the MCH component was extended beyond 2010 through another project referred to us INDEPTH Vaccination Study (IVP), funded by the Danish Development Agency (DANIDA) through the INDEPTH network.

Data included in the analysis were collected between February 2007 and December 2011. All women who were resident in the NUHDSS sites who gave birth from September 2006 to December 2011 and their children were enrolled in the study. Efforts were made to recruit the mother-child pairs as early as possible after birth. Data were collected at recruitment and updated after four months. During each visit field interviewers administered questionnaires to collect data on breastfeeding and other feeding practices, vaccination, health care seeking and health status. Anthropometric measurements were also carried out.

(ii) Intervention Study

The study protocol is already published[21]. Here we only detail methods relevant to the research question for this paper.

The study, funded by the Wellcome Trust, was a randomized controlled trial using cluster randomization[33, 34], conducted between September 2012 and February 2015. For pragmatic purposes, Community Units (CUs), defined by the national Community health Strategy[19] were used as clusters. CUs are geographically defined units with an approximate population of 5,000 people. Within each CU, a CHW provides primary health care services to people. Where the CUs did not exist, APHRC facilitated set-up of the CUs by the government. Cluster randomization was preferred over individual-level randomization to minimize contamination, given the nature of the intervention as described below and for pragmatic purposes in case of future scale-up of the intervention within the Kenyan health system.

Study participants included all pregnant women aged between 12-49 years old, who were resident within the defined study area and their respective babies (when born). The exclusion criteria included: (a) women of reproductive age who gave birth before receiving the intervention; (b) women with disability that would make delivery of the intervention difficult e.g. hearing or sight problem, or mental handicap; (c) women who lost the pregnancy and/or had still-birth; (d) women who were lost to follow-up during pregnancy; and (e) mother-baby pairs if baby was born with disability. Recruitment of the participants was done from September 2012 to February 2014. An eventual sample size of 1110 mother child pairs was included.

The experimental intervention involved regular visits by CHWs for personalized home-based nutritional counselling of women from the time of recruitment (during pregnancy, continued until the baby attained one year). Counselling encompassed maternal nutrition, immediate initiation of breastfeeding after birth, breast positioning and attachment, exclusive breastfeeding, frequency and duration of breastfeeding, expressing breast milk, storage and handling of expressed breast milk and lactation management. It also included age-appropriate complementary feeding. CHWs in the Community Units, already given the basic training for a CHW by the government, were trained on counselling mothers on appropriate MIYCN practices.

Training of CHWs was done using the Community Infant and Young Child Feeding (IYCF) Counselling Package developed by UNICEF in partnership with other organizations, which has been adopted by the Kenya Ministry of Health (http://uni.cf/1QavG2g), based on the WHO infant and young child feeding (IYCF) integrated course[35]. The package is designed to equip community workers or primary health care staff to be able to support mothers, fathers and other caregivers to optimally feed their infants and young children. The CHWs were equipped with IYCF counselling cards; brightly coloured illustrations that depict key infant and young child feeding concepts and behaviours for the CHWs to share with mothers, fathers and other caregivers. These materials can be obtained in the project's webpage (http://bit.ly/1LBfr7M). CHWs in the control arm were not trained on MIYCN but were trained (through the regular government facilitated training) on standard care, including ante-natal and post-natal care, family planning, delivery with skilled attendance, immunization and community nutrition. All recruited pregnant women in both the intervention arm and control arm received information materials regarding MIYCN through the CHWs, as part of (optimized) standard care. Additionally, both the intervention and control groups were provided with standard care counselling by CHWs including on antenatal and postnatal care, family planning, appropriate tests during pregnancy, health facility delivery, general nutrition, hygiene, and immunization. A total of 30 CHWs across the intervention and control arms were involved during the study. The CHWs were given a monthly incentive of KES 3,500 (approx. USD 35). The government proposes a minimum monthly incentive of KES 2000 (USD 20). Routine supervision was provided to the CHWs by an intervention monitor and the project team.

Data on infant feeding knowledge, perceptions and practices, anthropometric measurements and morbidity were collected every two months during the follow-up through interviewer administered questionnaire. Details on data collection procedures and other data collected are published [21]. Data included in the analysis are for children born between December 2012 and

July 2014. The CONSORT diagram is provided in a forthcoming paper with more details in the intervention study (Kimani-Murage, et al. unpublished).

(iii) Comparison Study

Data for the comparison study comes from the IVP project which succeeded the Wellcome Trust UPHD-MCH project from 2011 to December 2014. Data included in the comparison study are for children born between September 2012 and February 2014. Apart from continuation of the MCH longitudinal study, the study aimed to monitor and assess the intended and un-intended effects of vaccinations in the study area to ensure evidence-based policies for vaccine and preventive drug delivery in low-income countries, in order to reduce child morbidity and mortality. The study recruited mother-child pairs of children born, if the mother was a resident of the NUHDSS and the pair was followed up every four months. As in the pre-intervention study, efforts were made to recruit the mother-child pairs as early as possible after birth. Information on breastfeeding and other feeding practices, vaccination, health care seeking, health status and anthropometric measurements were also collected.

Both pre-intervention and the comparison studies were run by the same team using similar procedures and questionnaires so that the data quality was similar across all the rounds of data collection. Additional details about the comparison study procedures are published elsewhere[36].

Research Design

The question we ask and answer here is whether regular CHW counselling during the Intervention Study, regardless of which trial arm, is associated with higher levels of exclusive breastfeeding for six months compared to exclusive breastfeeding levels in the Comparison study. Since the Intervention Study and Comparison Study were performed in the same years, a contrast of these two offers some control for secular trends over time in dissemination and

health literacy about the importance of exclusive breastfeeding. We therefore use the three studies (Pre-intervention, Intervention and Comparison) to construct a quasi-experimental study.

Outcome Measure

The variable on exclusive breastfeeding was constructed using a series of questions asked longitudinally during the three studies. These included: (i) If the child was given anything other than breast milk in the first three days of life (i.e. prelacteal feeds; (ii) If the child was given anything other than breast milk in the last three days before each visit; (iib) If yes to ii, at what age was the child started on the food/drink; (iii) If the child has ever been given anything other than breast milk; (iiib) If yes to iii, at what age was the child started on the food/drink. This is illustrated in Fig 1.

>>>Fig. 1 about here <<<

Control Variables

Control variables included maternal demographic and socio-economic status (including age, marital status, education level, ethnicity, religion, parity and main source of livelihood), and wealth status, categorized into tertiles. Other control variables included knowledge on proper timing of introduction of foods, constructed based on knowledge that foods should be introduced at six months, used as proxy for knowledge on exclusive breastfeeding; and place of delivery, categorized into two, either at a health facility or otherwise (including home or TBA facility). Table 1.

Data on socio-economic status were either collected at baseline in the respective studies described above or extracted from the NUHDSS database and linked to the study participants through their household identifier, while data for the other control variables was collected at baseline from the respective studies described above.

Statistical analysis

We examined baseline differences between the Pre-intervention study group, Intervention study intervention and control groups, and the Comparison study group using the Chi-square test, adjusted for clustering. The proportion of mother-baby pairs practising exclusive breastfeeding (EBF) was compared between the four groups at two months, four months and six months. The Chi-square test was used to check for significant differences in the proportions, adjusting for clustering within a community. We then used logistic regression to control for baseline characteristics, adjusting for clustering. Statistical significance was assessed with p=0.05.

Results

The study involves 5824 mother-child pairs in the pre-intervention study; 1110 mother-child pairs in the Intervention Study, 522 in the intervention arm and 588 in the control arm; and 487 mother child pairs in the comparison study. Children in the pre-intervention study were born between September 2006 and December 2011; and the Intervention and parallel studies between September 2012 and July 2014.

Baseline Characteristics

The baseline distribution of participants by demographic and socioeconomic variables between the four groups is presented in Table 1. The distributions showed significant difference in basic socio-demographic factors between the four groups for some variables including maternal age, maternal education level, main source of income, socio-economic status, knowledge on duration of EBF at baseline and place of delivery ($p<0.05$), respectively.

<<<Table 1 about here>>>

Exclusive Breastfeeding

Table 2 shows the proportions of children that were exclusively breastfed for two, four and six months, measured longitudinally.

There was higher prevalence of reported exclusive breastfeeding at all the study points (2, 4 and 6 months) among children in the MIYCN-Intervention and MIYCN-Control groups compared to the Pre-intervention study group and the Comparison study group. The prevalence of EBF was also slightly higher in the Comparison group compared to the Pre-intervention group at all the study points. At six months, the prevalence of exclusive breastfeeding was 2% in the Pre-intervention study group compared to 56% in the MIYCN-Intervention group, 54% in the MIYCN-Control group and 3% in the Comparison study group.

>>>Table 2 about here<<<

Regression analysis for exclusive breastfeeding

The odds ratio of exclusive breastfeeding was higher in all the groups (MIYCN-Intervention, MIYCN-Control and the Comparison group compared to the Pre-intervention group) at two, four and six months. The unadjusted OR at six months was 63.7 (95% CI 46.4 to 96.4), 68.9 (95% CI 34.0 to 139.7), and 1.7 (95% CI 0.9 to 3.2) for the MIYCN-Control, MIYCN-Intervention and Comparison group, respectively, compared to the Pre-intervention group. After adjusting for baseline characteristics, the OR for EBF at 6 months was 66.2 (95% CI 45.4 to 96.4), 86.0 (95% CI 41.3 to 179.3), and 3.9 (95% CI 1.8 to 8.4) respectively.

>>>Table 3 about here<<<

Discussion

This paper presents results of a quasi-experimental study designed to control for secular trends in EBF, and constructed using data from a pre-intervention study done in 2007-11, an intervention study in 2012-14 and a comparison study in 2012-15. The aim of this study is to determine potential effectiveness of the Kenyan national Community Health Strategy to promote exclusive breastfeeding for six months in urban poor settings in Nairobi, Kenya, through home-based visits by CHWs. We found that the intervention, involving CHW visits about infant health with general and specific counselling about EBF had a high impact on EBF for the first six months. The effect was seen among mothers in both the control and intervention arms of the Intervention study, but not in the group in the Comparison study, done at the same time, where CHWs were not financially motivated to visit mothers. This may indicate that the difference observed in exclusive breastfeeding was due to incentivising and routinely supervising the CHWs, hence motivating them to regularly visit and counsel the mothers. In effect this may mean that optimising standard care, through incentivising and supervising CHWs within the government Community Health Strategy to conduct home-based counselling of mothers would be effective in promoting exclusive breastfeeding, particularly in underserved areas such as urban poor settings.

The study shows that there was remarkable improvement in exclusive breastfeeding for children in both the intervention arm and the control arm of the MIYCN intervention study, from 2% at pre-intervention to over 50% in both arms following the intervention. However, this study shows a small (though significant) difference between the Pre-intervention group and the Comparison group from 2% at pre-intervention to 3% during the intervention period. The situation of

exclusive breastfeeding in Kenya has improved at the national level, from 32% in 2008 to 61% in 2014, according to the latest Kenya Demographic and Health Survey (KDHS)[37]. This may be a result of the changes in policy and practice, including the introduction of the free maternity policy (http://bit.ly/1QsLuZ2) since June 2013 with the placement of the new government, under which maternity care is now provided for free in public health facilities nationally. This study shows a small improvement in EBF among the participants receiving only standard care (Comparison group). This may indicate that the initiatives such as the free maternity care may not have had a big impact in urban slum settings, for possible reasons including unavailability of public health facilities where the government's BFHI is implemented and other factors such as social economic circumstances. Further, a qualitative study done before the intervention indicated that there are complex social-economic factors in urban poor settings that deter people from adhering to the WHO recommendations for breastfeeding including women having to resume paid work shortly after delivery[28]. Qualitative data (unpublished) collected during and at the end of the MIYCN intervention study indicate that some mothers in the intervention had to make some important changes including post-poning resuming paid work to ensure optimal breastfeeding practices in line with the CHW counselling. Another potential reason for low prevalence of EBF in the Comparison group compared to the prevalence at the country level may also be attributable to the fact that the method in our study (Fig 1) is more rigorous in establishing exclusivity of breastfeeding than the method used in the KDHS, which uses 24 hour recall. Additionally, we report exclusive breastfeeding from birth to six months, following the children longitudinally, while KDHS reports exclusive breastfeeding for children aged 0-6 months (cross-sectionally), and therefore our results on EBF for six months may not be directly comparable to those reported in KDHS.

The large difference between the MIYCN intervention groups and the comparison group may be attributed to regular CHWs' visits for counselling and support and distribution of information materials to the mothers in both intervention and control areas, motivated by incentivising CHWs to visit mothers in the study setting, hence optimising the proposed standard primary health care that is hampered by lack of CHW motivation. Unpublished qualitative midline and endline studies indicate that women in both control and intervention groups were very impressed with the CHW visits, including frequency of visits. They indicated that CHWs gave them useful advice, which they often followed or which informed important decisions such as regarding resuming paid work. Women not in the intervention study were unlikely to receive CHW visits and information materials at the community level as a key challenge in the actualization of the Community Health Strategy in Kenya is lack of incentives for CHWs[20]. So our study indicates that over and above improvement due to possible secular trends (from 2% at baseline to 3%), there was potentially a large improvement in exclusive breastfeeding rates in both the control and intervention arm of the study that is beyond what the comparative data in these communities would predict. The monthly financial incentive given to the CHWs in our in our study was within the range proposed in the government Community Health Strategy, and was agreed upon in consultation with the government officials.

The findings of this study give an indication of potential effectiveness of the government's Community Health Strategy in promoting optimal breastfeeding practices, and in particular exclusive breastfeeding in the urban poor settings. This is particularly important given the change in the government's MIYCN strategy to adopt the BFCI which proposes use of CHWs to promote optimal MIYCN practices at the community level. The study findings may indicate that optimized standard care involving home-based visits by incentivised CHWs with basic training, supervision and provision of MIYCN information materials could be adequate to change

breastfeeding practices This is because there was little difference in the EBF changes over 6 months between the two arms of the MIYCN intervention. While we did not train CHWs in the control arm on MIYCN, an endline evaluation of knowledge levels on MIYCN among CHWs (unpublished) indicated high and similar levels of knowledge across the two groups. It is possible that the CHWs in the control group may have obtained this knowledge on MIYCN from other sources. Further, we also anticipate that there could have been contamination due to the information materials that we provided to the CHWs in both arms, which may have enhanced knowledge of CHWs in both intervention and control groups. Contamination between the two groups could also have happened through possible interaction of the CHWs across the arms and possible sharing of the counselling materials that we provided to the intervention group, given that it was not possible to blind the CHWs regarding the purpose of the intervention. This is particularly possible because, in trying to be pragmatic, we used existing CHWs within the government's Community Health Strategy, who live in the same community in close proximity with each other, and who, being within the same government program may have met regularly. Further investigation through analysis of qualitative data collected at midline and endline from CHWs and mothers in both arms of the Intervention study is likely to offer some information on the pathways through which the intervention worked in both arms.

The level of increase in exclusive breastfeeding documented in this study was also documented in a study in Bangladesh, where home-based breastfeeding counselling using peer counsellors was highly effective in improving breastfeeding practices, with more than 10-fold increase in exclusive breastfeeding rate for six months in the intervention group compared to the control group[38]. Similarly, the study agrees with findings of a pre-post study without control conducted in an agrarian rural setting in Kenya by Wangalwa et al. (2012), which found effectiveness of the Community Strategy (using CHWs for home-based care) in improving maternal and child health

outcomes, including exclusive breastfeeding for the first six months from 20% at baseline to 52% post-intervention[39]. The effectiveness of community based interventions using CHWs to promote health including optimal breastfeeding practices has been documented in other settings[40-42]. Bhutta et al. (2013) identified community based interventions using CHWs as an important delivery model for nutrition education and promotion, particularly among difficult to reach populations[1].

The importance of nutrition in the first 1000 days of life (during pregnancy and within the first two years of life) in terms child's early and later life cannot be overemphasized. Breastfeeding is particularly important; it confers both short-term and long-term benefits to the child. It reduces infections and mortality among infants, improves mental and motor development, and protects against obesity and metabolic diseases later in the life course[3-8]. Exclusive breastfeeding is particularly important as implementing interventions which promote exclusive breastfeeding for the first six months could prevent about 13% of under-five deaths in countries with high mortality rates[3, 4]. On the other hand, non-exclusive breastfeeding in the first six months has been associated with higher morbidity and mortality compared to exclusive breastfeeding, and likewise, no breastfeeding at all has been associated with higher risk of morbidity and mortality in children 6-23 months compared to breastfeeding. Recent evidence by Victora et al. (2015) further indicates that the duration of total breastfeeding in childhood improves intelligence quotient, educational attainment and income in adulthood [8]. This re-emphasizes the importance of finding strategies to promote breastfeeding particularly exclusive breastfeeding, and particularly among hard to reach populations.

Strengths of this study include being able to constitute a quasi-experimental study using longitudinal studies (pre and post-intervention) which used similar data collection

tools/questions regarding exclusive breastfeeding, to determine effectiveness of an intervention. Limitations in this study may include potential bias in reporting of the primary outcome (exclusive breastfeeding), often associated with self-reported outcomes, particularly due to social desirability. However, the fact that we asked several questions longitudinally to determine whether the child was exclusively breastfeeding may partly counter this bias. Another limitation may be in the differences in the design of the three studies to constitute the quasi-experimental study. Though similar questions were asked to the mothers to establish exclusive breastfeeding, the intervention groups were recruited during pregnancy and followed up more regularly, while mothers in the Pre-intervention and the Comparison study groups were recruited after birth and had fewer follow-up visits, meaning there would be longer recall periods to remember when exclusive breastfeeding ceased.

In summary, the results indicate potential effectiveness of the government Community Health Strategy, through CHWs to improve exclusive breastfeeding in urban poor settings. The results of this study will inform policy and practice particularly regarding implementation of the proposed national BFCI program, which proposes to promote MIYCN through the Community Health Strategy. While this study offers a great contribution to implementation science, more investigation into pathways through which the intervention worked is worthwhile in order to inform the implementation of the BFCI program in Kenya and beyond more appropriately. Increase in exclusive breastfeeding for infants living in urban poor settings may improve their health, growth and cognitive development, and their future health and economic productive. This in effect would not only benefit the child but the whole community through intergenerational transfer of the benefits. This community approach is applicable in other similar African settings.

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Conflict of Interest

The authors have no conflict of interest to declare.

Ethical Standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the Kenya Medical Research Institute (KEMRI) Ethical Review Committee on research regarding human subjects and with the Helsinki Declaration, and has been approved by the KEMRI Ethical Review Committee. The investigators upheld the fundamental principles regarding research on human subjects: respect for persons, beneficence and justice. For all data collection activities, written informed consent was obtained from the eligible participants following full disclosure regarding the study before data collection was done.

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Figure 1: Determination of exclusive breastfeeding, MIYCN-Quasi-Experimental Study, Nairobi Slums, 2015. [1]Prelacteal feeding refers to feeding on foods other than breast milk in the first days after birth before breast milk flow is established.

Table 1: Baseline distribution of the study participants by demographic and socioeconomic variables by study group, MIYCN-Quasi-Experimental Study, Nairobi Slums, 2015

	Pre-intervention		**Intervention**				**Comparison**		
	2007-2011		**MIYCN 2012-2015**				**2012-2014**		
	Total		Control		Intervention		Total		
	n	%	n	%	n	%	n	%	p-value
Child's Sex									
Male	2948	50.6	307	52.9	257	50	267	54.8	
Female	2876	49.4	273	47.1	257	50	220	45.2	0.201
Mother's age									
14-20	1365	25	160	27.5	157	30.6	66	16.6	
21-24	1656	30.3	180	30.9	161	31.4	101	25.4	
25-29	1420	26	138	23.7	132	25.7	124	31.2	
30-45	1028	18.8	104	17.9	63	12.3	107	26.9	0.000
Marital status									
Married	901	15.5	70	12	75	14.6	60	12.7	
Not Married	4914	84.5	511	88	437	85.4	414	87.3	0.241
Highest level of education completed									
Less than Primary	182	3.4	114	19.9	83	16.6	15	3.9	
Primary School	3875	72.4	330	57.5	281	56.3	242	63.4	
Secondary School	1297	24.2	130	22.6	135	27.1	125	32.7	0.000
Main source of livelihood									
Business	626	12.2	67	11.7	64	12.9	32	6.6	
Informal	377	7.4	59	10.3	32	6.4	16	3.3	
Formal	64	1.3	24	4.2	55	11	4	0.8	
Unemployed	4051	79.2	424	73.9	347	69.7	435	89.3	0.000
Ethnicity of the mother									
Kikuyu	1401	25.6	119	25.9	132	30.5	85	21.4	
Luhya	962	17.6	91	19.8	74	17.1	74	18.6	
Luo	1046	19.1	68	14.8	79	18.2	64	16.1	
Kamba	1136	20.8	98	21.4	78	18	95	23.9	
Other	926	16.9	83	18.1	70	16.2	80	20.1	0.870
Total number of children ever given birth									
Null	1820	31.3	212	36.1	223	42.7	131	26.9	
One	1682	28.9	184	31.3	159	30.5	159	32.6	
Two+	2311	39.8	192	32.7	140	26.8	197	40.5	0.000
3 quantiles of wealthscore									
Lower	1655	30.6	147	35.5	122	30.3	115	29	
Middle	1816	33.6	139	33.6	141	35	147	37.1	
Upper	1940	35.9	128	30.9	140	34.7	134	33.8	0.775
Knowledge on EBF (at baseline)									
No	1545	26.7	120	21.6	82	17.6	23	12.4	
Yes	4236	73.3	436	78.4	385	82.4	163	87.6	0.008
Place of delivery									
HF delivery	4557	78.4	537	95.4	476	94.8	455	94.2	
Outside HF delivery	1253	21.6	26	4.6	26	5.2	28	5.8	0.000
Total	**5824**	**100**	**588**	**100**	**522**	**100**	**487**	**100**	

*P-values are based on Chi-square that accounts for clustering

**Knowledge that foods other than breast milk should be initiated at six months

Table 2: Practice of Exclusive Breastfeeding by Study Group, MIYCN-Quasi-Experimental Study, Nairobi Slums, 2015

	Pre-intervention		**Intervention**				**Comparison**		
	2006-2011		**2012-2015**				**2012-2014**		
	P		Control		Intervention		Total		
	n	%	n	%	n	%	n	%	p-value[1]
EBF for the first 2 months									
No	4457	77.2	108	20.3	75	16.1	369	75.8	
Yes	1314	22.8	424	79.7	391	83.9	118	24.2	0.000
EBF for the first 4 months									
No	5007	87.2	150	30.5	127	29.3	410	84.2	
Yes	734	12.8	342	69.5	306	70.7	77	15.8	0.000
EBF for the first 6 months									
No	5624	98.2	211	45.7	182	43.8	472	96.9	
Yes	105	1.8	251	54.3	234	56.3	15	3.1	0.000
Total	**5824**	**100**	**588**	**100**	**522**	**100**	**487**	**100**	

Note: [1]P-values are computed after excluding the missing/don't knows, and after adjusting for clustering

Table 3: Logistic regression for exclusive breastfeeding for six months by study group, controlling for baseline characteristics, MIYCN-Quasi-Experimental Study, Nairobi Slums, 2015

	6 months			4 months			2 months		
	OR	p-value	95% CI	OR	p-value	95% CI	OR	p-value	95% CI
Group [ref: Pre-Intervention (2007-2011)]									
MIYCN-Control (2012-2015)	66.2	[0.000]	[45.4,96.4]	16.2	[0.000]	[11.7,22.3]	13.8	[0.000]	[8.6,22.2]
MIYCN- Intervention (2012-2015)	86.0	[0.000]	[41.3,179.3]	21.0	[0.000]	[11.6,38.1]	22.3	[0.000]	[11.0,45.3]
Comparison (2012-2014)	3.9	[0.002]	[1.8,8.4]	3.5	[0.000]	[2.5,4.8]	4.3	[0.000]	[3.1,5.9]
Child Sex [ref: Male]									
Female	1.0	[0.938]	[0.8,1.4]	1.0	[0.422]	[0.8,1.1]	0.9	[0.522]	[0.8,1.2]
Mother's age [ref: 14-20 years)									
21-24	0.8	[0.103]	[0.6,1.1]	1.0	[0.963]	[0.7,1.4]	0.9	[0.591]	[0.7,1.3]
25-29	0.7	[0.071]	[0.5,1.0]	1.1	[0.534]	[0.8,1.6]	1.0	[0.778]	[0.8,1.4]
30-45	0.8	[0.485]	[0.5,1.4]	1.2	[0.172]	[0.9,1.7]	1.1	[0.527]	[0.8,1.5]
Marital status [ref: Not in Union]									
In union	1.2	[0.293]	[0.8,1.8]	1.0	[0.641]	[0.8,1.2]	1.1	[0.324]	[0.9,1.4]
Highest education level [ref: < primary]									
Primary School	1.2	[0.235]	[0.9,1.7]	1.3	[0.221]	[0.9,1.8]	1.7	[0.005]	[1.2,2.3]
Secondary School	1.3	[0.310]	[0.8,2.1]	1.4	[0.093]	[0.9,2.0]	1.9	[0.000]	[1.4,2.6]
Main livelihood source [ref: Business]									
Informal	1.0	[0.983]	[0.6,1.8]	0.9	[0.519]	[0.5,1.4]	0.8	[0.258]	[0.5,1.2]
Formal	0.4	[0.017]	[0.2,0.8]	0.5	[0.076]	[0.2,1.1]	1.2	[0.574]	[0.7,2.1]
Unemployed	1.4	[0.062]	[1.0,1.9]	1.5	[0.003]	[1.2,2.0]	1.4	[0.006]	[1.1,1.8]
Ethnicity of the mother [ref: Kikuyu]									
Luhya	0.8	[0.346]	[0.5,1.3]	0.8	[0.011]	[0.6,0.9]	0.7	[0.014]	[0.6,0.9]
Luo	0.7	[0.040]	[0.4,1.0]	0.7	[0.003]	[0.5,0.8]	0.7	[0.000]	[0.6,0.8]
Kamba	0.9	[0.763]	[0.6,1.4]	0.9	[0.461]	[0.8,1.2]	1.1	[0.518]	[0.9,1.3]
Other	0.7	[0.091]	[0.4,1.1]	1.0	[0.802]	[0.8,1.2]	1.0	[0.831]	[0.8,1.3]
Parity [ref: None]									
One	1.3	[0.299]	[0.8,1.9]	1.4	[0.002]	[1.2,1.7]	1.5	[0.006]	[1.1,1.9]
Two+	1.8	[0.101]	[0.9,3.6]	1.4	[0.015]	[1.1,1.9]	1.5	[0.000]	[1.3,1.8]
Wealth tertile [ref: Lowest]									
Middle	0.8	[0.386]	[0.4,1.5]	0.8	[0.230]	[0.6,1.1]	0.9	[0.178]	[0.7,1.1]
Highest	0.8	[0.357]	[0.4,1.4]	0.7	[0.018]	[0.5,0.9]	0.8	[0.126]	[0.7,1.1]
Knowledge on EBF (baseline) [ref: No]									
Yes	1.4	[0.164]	[0.9,2.1]	2.8	[0.000]	[2.0,3.9]	2.4	[0.000]	[1.7,3.3]
Place of delivery [ref: Health Facility]									
Outside HF delivery	0.6	[0.088]	[0.4,1.1]	0.5	[0.000]	[0.4,0.7]	0.5	[0.000]	[0.4,0.7]
		5314			**5345**			**5398**	

[1]OR adjusted for baseline characteristics and clustering