

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

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Abstract

Early nutrition is critical for later health and sustainable development. We determined 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 [2007-2011; n=5824], Intervention [2012-2015; n=1110] and Comparison [2012-2014; n=487]) which followed mother-child pairs longitudinally to establish EBF rates from 0-6 months. The Maternal, Infant and Young Child Nutrition (MIYCN) study was a cluster randomized trial; the control arm (MIYCN-Control) received standard care involving community health workers (CHWs) visits for counselling on antenatal and postnatal care. The intervention arm (MIYCN-Intervention) received standard care and regular MIYCN counselling by trained CHWs. Both groups received MIYCN information materials. We tested differences in EBF rates from 0-6 months among four study groups (Pre-intervention, MIYCN-Intervention, MIYCN-Control and Comparison) using a Chi square test and logistic regression. At six months, the prevalence of EBF was 2% in the Pre-intervention group compared to 55% in the MIYCN-Intervention group, 55% in the MIYCN-Control group and 3% in the Comparison group ($p < 0.05$). After adjusting for baseline characteristics, the Odds Ratio for EBF from birth to six months was 66.9 (95% CI 45.4 to 96.4), 84.3 (95% CI 40.7 to 174.6), and 3.9 (95% CI 1.8 to 8.4) for the MIYCN-Intervention, MIYCN-Control and Comparison group, respectively, compared to the Pre-intervention group. There is potential effectiveness of the Kenya national Community Health Strategy in promoting exclusive breastfeeding in urban poor settings where health care access is limited.

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}. Implementing interventions which promote breastfeeding could prevent about 13% of under-five deaths in countries with high mortality rates³. 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 course³⁻⁷. 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 child⁸. 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^{9, 10}. 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 adulthood¹¹.

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 prevalent¹²⁻¹⁵. 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^{12, 13}. However, in low-income countries (LICs), where many deliveries do not occur in health facilities¹⁶, 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 0-6 six months (using 24 hour recall) at only 13% in 2003, improving to 32% in 2008^{17, 18}. The situation is very poor in urban poor settings where barely 2% of children are exclusively breastfed cumulatively from birth to six months¹⁹. To improve the situation in Kenya, the Ministry of Health in Kenya developed an infant and young child nutrition (IYCN) strategy in 2007 (IYCN strategy 2007-2010), aimed at promoting optimal IYCN practices in the country^{8, 20}. The strategy was actualized through revitalization of the BFHI, which has been in existence in Kenya but hardly functional since the 1980s²¹. Anecdotal evidence indicates that only slightly over 10 hospitals in Kenya are certified as baby friendly. Further, realizing the need to extend the counselling and support to the community level, given that many births have been occurring at home^{17, 18}, the Ministry of Health has proposed the adoption of the Baby Friendly Community Initiative (BFCl), 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>). The BFCl therefore complements the BFHI by extending counselling on MIYCN to the community level as proposed in the current (2012-2017) MIYCN strategy. In line with this, the new national 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 Health Strategy, a government initiative that aims at using CHWs to promote health in the community²². 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. The Community Health Strategy was rolled out in Kenya in 2007 although it is not yet fully functional in many parts of the country²³.

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 quality 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 Health Strategy to offer personalized home-based counselling on optimal infant feeding practices²⁴. 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, education and communication (IEC) 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 improving exclusive breastfeeding in the first six months. Preliminary analyses (not shown) have revealed no statistically significant differences in the rate of exclusive breastfeeding from birth to six months between the intervention and the control group, despite the rates increasing from approximately 2% at baseline to over 50% in both groups following the intervention. We argue 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 (Kimani-Murage et al, unpublished). 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.

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. 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 approximately once a year through NUHDSS. 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 indicators²⁵⁻²⁹. 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^{19, 30}. High levels of food insecurity have been documented in these areas, with over 80% of the households either severely, moderately or mildly food insecure, in terms of household's food access, measured using the household food insecurity access score³¹. Undernutrition is high, with stunting at 45% for children aged less than five years³² and is strongly associated with food poverty and other forms of poverty (assets and subjective poverty)³³. Unsurprisingly high under five child mortality has been documented, at 79 deaths per 1000 live births, higher than among other population groups in Kenya including rural settings²⁷. More information regarding the study area and the NUHDSS can be obtained from a previous publication³⁴.

Data

We use data from three studies: a longitudinal observational study conducted between 2007 and 2011, herein referred to as the Pre-intervention study; a cluster-randomized study conducted between 2012 and 2015, herein referred to as the MIYCN Intervention study; and a longitudinal study conducted between 20012 and 2014, herein referred to as the Comparison study.

(i) Pre-intervention study

Details about the pre-intervention study procedures are published elsewhere^{19, 33}. 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, and 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. The mother- child pairs were followed up until the child was five years. Data were collected at recruitment and updated every four months during the follow-up period. Questions on breastfeeding were asked during the first year of life. 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 published²⁴. 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^{35, 36}, conducted between September 2012 and February 2015. For pragmatic purposes, Community Units (CUs), defined by the national Community Health Strategy²² 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.

The inclusion criteria 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. While the reproductive age in most studies is usually defined as 15-49 years, we included girls aged 12-14 years in our criteria as a substantial proportion (close to 10%) of adolescents in the study areas are sexually active before the age of 15 years, and some of them are parents³⁷. Previous research in the study setting has also identified young mothers as a vulnerable group with regards to knowledge on breastfeeding and other infant feeding practices, hence needy of the intervention³⁰. However, in this study the youngest woman recruited was aged 14 years; (b) women with disability that would make delivery of the

intervention difficult e.g. hearing or sight problem, or intellectual impairment; (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 that would significantly affect infant feeding e.g. developmental problems. We did not have such cases in actual sense so no children were excluded based on this criteria. 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). The mothers in the intervention were visited at least once monthly during pregnancy until week 34 after when they were visited every week until giving birth and more often as necessary in the first month after giving birth (for support in initiating breastfeeding and sustaining exclusive breastfeeding). They were then visited once every month until the fifth month when they were visited fortnightly (to prepare them for introduction of complementary feeding) and monthly in the subsequent months for 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, handling and feeding of expressed breast milk and lactation management. It also included age-appropriate complementary feeding. We did not establish or test the HIV status of participants in this study, but the CHWs in the intervention arm were trained on infant feeding in the context of HIV and were expected to incorporate this in the counselling, without establishing HIV status of the mother. Further, the CHWs were advised to counsel mothers to seek further counselling and support at the health facilities in the event they were HIV positive.

CHWs in the Community Units, mainly with at least primary level education and basic CHW training by the government, were trained on counselling mothers on appropriate MIYCN practices. In several of the Units, we (through a different APHRC's project) had to facilitate the government to establish Community Units, recruit and offer basic training to the CHWs as the Community Units were not existent or functional before initiating the intervention. 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 course³⁸. 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, which included ante-natal and post-natal care, family planning, delivery with skilled attendance, immunization and community nutrition. While detailed training on MIYCN including breast positioning and attachment, frequency and duration of breastfeeding, expressing breast milk, storage and handling of expressed breast milk and lactation management, which would help in sustaining exclusive breastfeeding was not given to the CHWs in the control group, training on the message of exclusive breastfeeding for six months and extended breastfeeding for two years has increasingly been integrated in the basic CHW training since the inception of the current (2012-2017) MIYCN strategy. In the control arm, the CHWs were expected to visit the mothers according to usual practice which is defined by need, and usually more frequent around the time of birth.

All recruited pregnant women in both the intervention arm and control arm received IEC 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 the CHWs. 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), which is within the government's limit of 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 follow-up through interviewer administered questionnaires until the child was one year. Data collection was done by a team of 15 experienced field interviewers, who possessed at least secondary school education training, and independent from the CHWs involved in providing MIYCN counselling and support. Details on data collection procedures and other data collected are published²⁴. Data included in the analysis are for children born between December 2012 and July 2014.

(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 on children 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 mothers who were residents in the NUDHSS and their children who were born within the study period. The mother child pair was visited every four months between 2011 and 2014 until the youngest child was eight 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 elsewhere³⁹.

Research Design

The question we ask and answer here is whether regular CHW counselling and provision of MIYCN information materials during the Intervention Study, regardless of which trial arm, is associated with higher levels of exclusive breastfeeding from birth to six months compared to 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. We define four study groups: Pre-intervention group, MIYCN-Intervention group, MIYCN-Control group and Comparison group.

Outcome Measures

We defined exclusive breastfeeding according to the WHO definition i.e. baby receiving mothers milk only and no other liquids or foods except medicines, minerals, and vitamins⁴⁰. Three outcome measures of interest (EBF at 2, 4, and 6) were constructed. 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 (prelacteal feeding refers to feeding on foods other than breast milk in the first days after birth before breast milk flow is established)); (ii) If the child was

given anything other than breast milk in the last three days before each visit; (iib) At what age the child was started on the food/drink; (iii) If the child has ever been given anything other than breast milk; (iiib) At what age the child was started on the food/drink. So to determine whether the child was on EBF we used questions i, ii, and iii. To determine at what age, we used questions i, iib, and iiib. For children in the pre-intervention study and the comparison study, depending on when they were first recruited to the study, the mother had to answer the above questions from recall.

Control Variables

Control variables included maternal demographic and socio-economic status (including age, marital status, education level, ethnicity, religion, parity [number of children ever given birth to; for the Pre-intervention and Comparison studies, this includes the index child; for the intervention study, the index child is not included as the baseline data was collected during pregnancy], and main source of livelihood), and household wealth status, categorized into tertiles. Knowledge of exclusive breastfeeding at baseline, used as a proxy for exposure to BF promotion, was included as a control variable. Other control variables included 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 among the Pre-intervention group, MIYCN Control group, MIYCN-Intervention group, and the Comparison study group using the Chi-square test, adjusted

for clustering at the community unit (village), being the unit of randomization. The proportion of mother-baby pairs practising exclusive breastfeeding (EBF) was compared among 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 for the three outcome variables (EBF at 2, 4 and 6 months) to control for baseline characteristics, adjusting for clustering at the Community Unit (village) using the “survey” command in Stata. We first fitted bivariate regression models of each of the three outcomes of interest and the predictive variable (indicating whether the child belongs to the Pre-intervention, MIYCN-intervention, MIYCN-Control or Comparison group), and also with each of the control variables listed above (mothers age, education, marital status, ethnicity group e.tc.). Using a cut-off of p-value = 0.25 we selected the variables to be included in the final multiple logistic regressions. We did not control for multiple births, nor did we exclude pre-term or low-birth weight children. Children of the same mother in the different studies e.g. pre-intervention and intervention were included in the analysis, and the baseline data collected with respect to each child was used in the analysis.

Results

The study involves 5824 mother-child pairs in the Pre-intervention study; 1110 mother-child pairs in the Intervention Study, 521 in the intervention arm and 581 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 among 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 cumulatively.

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 group and the Comparison 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 group compared to 55% in the MIYCN-Intervention group, 55% in the MIYCN-Control group and 3% in the Comparison 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.

At six months, the unadjusted OR was 64.4 (95% CI 46.7 to 88.7), 66.1 (95% CI 32.3 to 135.4), 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 66.9 (95% CI 45.4 to 96.4), 84.3 (95% CI 40.7 to 174.6), and 3.9 (95% CI 1.8 to 8.4) respectively.

At four months, the unadjusted OR was 15.5 (95% CI 12.2 to 19.7), 16.0 (95% CI 7.9 to 32.4), and 1.3 (95% CI 1.0 to 1.7) 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 4 months was 16.1 (95% CI 11.6 to 22.3), 21.1 (95% CI 11.6 to 38.5), and 3.5 (95% CI 2.5 to 4.8) respectively.

At two months, the unadjusted OR was 13.3 (95% CI 9.4 to 18.7), 17.1 (95% CI 9.1 to 32.2), and 1.1 (95% CI 0.8 to 1.5) 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 two months was 13.7 (95% CI 8.4 to 22.4), 22.6 (95% CI 11.21 to 45.4), and 4.3 (95% CI 3.1 to 5.9) respectively.

>>>Table 3 about here<<<

Discussion

This paper presents results of a quasi-experimental study designed to control for secular trends in exclusive breastfeeding (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. We aimed to determine potential effectiveness of the Kenya national Community Health Strategy to

promote exclusive breastfeeding from birth to 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, or did not exist. 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 rates 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)⁴¹. This may be a result of the changes in policy and practice. The message of exclusive breastfeeding for six months and extended breastfeeding for two years has increasingly been integrated in the basic CHW training since the inception of the current (2012-2017) MIYCN strategy. Additionally, an Act of Parliament (Breast Milk Substitutes - BMS Act 2012 - <http://bit.ly/1FXsEua>) that regulates and controls marketing and distribution of breast milk

substitutes in Kenya in order to protect breastfeeding was enacted in 2012. Another key policy change was 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. The free maternity policy is likely to promote breastfeeding through counselling of mothers delivering at the health facilities by health care workers. However, urban poor settings remain unreached due to poor access to public health care (given limited public health facilities) and other social and economic factors³⁰. For example, the community strategy was hardly functional in the slums where we conducted the study prior to this project, and we had to assist the government to set up community units to enable the intervention study. The enactment of the BMS Act may not have a large impact on the urban poor particularly because there is limited use of commercially produced substitutes such as infant formula due to the prohibitive cost; according to results from qualitative formative research that we carried out before the intervention. The free maternity health policy may not have had a big impact in urban poor settings due to the unavailability of public health facilities in the urban slums (where free maternity services are offered and initiatives such as the BFHI are implemented). Health facilities in urban poor settings are generally (substandard) privately owned⁴². A formative qualitative study done before the intervention indicated that there are complex social-economic factors in urban poor settings that make it difficult for women to adhere to the WHO recommendations for breastfeeding including women having to resume paid work shortly after delivery³⁰. Although there may be ways of ensuring working women breastfeed such as encouraging them to express breast milk to be fed to the baby in their absence, the formative study found that expressing breast milk is a rare practice in these settings due to cultural unacceptability and other factors such as fear of contamination due to lack of appropriate storage facilities such as refrigerators³⁰. Although we incorporated counselling on expressing breast milk in the intervention, few women reported doing it. 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 is more rigorous in establishing exclusivity of breastfeeding than the 24 hour recall method used in the KDHS. Additionally, we report cumulative exclusive breastfeeding from birth to six months, following the children longitudinally, while the KDHS reports exclusive breastfeeding for children aged 0-6 months (cross-sectionally). Therefore our results on EBF for six months may not be directly comparable to those reported in the 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, and supervising them, hence optimising the proposed standard primary health care that is hampered by lack of CHW motivation. This is supported by other evidence in LMICs that indicate that scaling up and sustaining CHW programs in LMICs requires adequate training, motivation and supervision among other things⁴³. Findings from our qualitative midline and endline studies within the MIYCN Intervention study 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, and some women had to make important decision, such as delaying resuming 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 CHWs²³. 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, to complement the BFHI, which promotes optimal MIYCN at the health facility 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 the basic training (as it also includes messages on exclusive breastfeeding) or from other sources e.g. other NGOs. Our anticipation was that the more detailed training on MIYCN including breast positioning and attachment, frequency and duration of breastfeeding, expressing breast milk, storage and handling of expressed breast milk and lactation management which would help in sustaining exclusive breastfeeding would make a difference. The results do not seem to indicate that this extra training made a difference. 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 additional 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 group⁴⁴. 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-intervention⁴⁵. Other studies elsewhere, such as in Ghana and Brazil, have also documented the importance of home-based counselling on the rate of exclusive breastfeeding⁴⁶⁻⁵⁰. For example, in Ghana, 40% prevalence of exclusive breastfeeding was reported among women receiving perinatal and postnatal (in the first six months after birth) counselling compared to control group (20%) not receiving the counselling⁴⁶. In Brazil, Courtinho et al., (2005) found that a huge effect in sustained breastfeeding in the group combined BFHI plus home based visits for up to six months after discharge. The study found that the BFHI achieved a high rate of 70% in exclusive breastfeeding in the hospital compared to 21% before intervention but this was not sustained at home in the group without community-based support. The patterns of EBF in the two groups for 10-180 days differed significantly with a mean aggregate prevalence of 13% in the BFHI alone group compared to 45% in the BHI plus home

visits group⁴⁷. 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 populations¹.

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. We also observe exclusive breastfeeding from birth to six months cumulatively. 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. Social desirability was plausible as the outcome measure of interest was self-reported, and it was hard to control for this bias, given that mothers in both intervention and control arm were visited by CHWs. However, the fact that we asked several questions longitudinally to determine whether the child was exclusively breastfeeding may partly counter this bias. Additionally, the data collection team was different from the CHWs that provided the counselling, which helps to reduce the social desirability 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 of Kenya's 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 to complement promotion of MIYCN through the BFHI at the health facility level. 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 productivity. 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 set by the Kenya Medical Research Institute (KEMRI) Ethical Review Committee on research regarding human subjects and with the Helsinki Declaration. 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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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		p-value ¹
	2007-2011		MIYCN 2012-2015				2012-2014		
			Control		Intervention				
	n	%	n	%	n	%	n	%	
Child's sex									
Male	2948	50.6	302	52.8	262	50.2	267	54.8	0.172
Female	2876	49.4	270	47.2	260	49.8	220	45.2	
Missing	0		9		7		0		
Mother's age (years)									
14-20	1365	25.0	158	27.5	159	30.5	66	16.6	0.000
21-24	1656	30.3	177	30.8	164	31.5	101	25.4	
25-29	1420	26.0	137	23.9	133	25.5	124	31.2	
30-45	1028	18.8	102	17.8	65	12.5	107	26.9	
Missing	355		7		8		89		
Marital status									
Married	901	15.5	70	12.2	75	14.5	60	12.7	0.265
Not Married	4914	84.5	504	87.8	444	85.5	414	87.3	
Missing	9		7		10		13		
Highest level of education completed									
Less than Primary	182	3.4	112	19.7	85	16.8	15	3.9	0.000
Primary School	3875	72.4	327	57.6	284	56.2	242	63.4	
Secondary School	1297	24.2	129	22.7	136	26.9	125	32.7	
Missing	470		13		24		105		
Main source of livelihood									
Business	626	12.2	65	11.5	66	13.1	32	6.6	0.000
Informal	377	7.4	60	10.6	31	6.1	16	3.3	
Formal	64	1.3	24	4.2	55	10.9	4	0.8	
Unemployed	4051	79.2	418	73.7	353	69.9	435	89.3	
Missing	706		14		24		0		
Ethnicity of the mother									
Kikuyu	1401	25.6	119	26.2	132	30.2	85	21.4	0.866
Luhya	962	17.6	92	20.2	73	16.7	74	18.6	
Luo	1046	19.1	66	14.5	81	18.5	64	16.1	
Kamba	1136	20.8	96	21.1	80	18.3	95	23.9	
Other	926	16.9	82	18.0	71	16.2	80	20.1	
Missing	353		126		92		89		
Parity									
No child	1820	31.3	212	36.5	223	42.2	131	26.9	0.000
One	1682	28.9	178	30.6	165	31.2	159	32.6	
Two+	2311	39.8	191	32.9	141	26.7	197	40.5	
Missing	11		0		0		0		
Wealth tertiles									
Lowest	1655	30.6	147	35.8	122	30.0	115	29.0	0.760
Middle	1816	33.6	139	33.8	141	34.7	147	37.1	
Highest	1940	35.9	125	30.4	143	35.2	134	33.8	
Missing	413		170		123		91		
Knowledge on EBF (at baseline)²									
No	1545	26.7	118	21.5	84	17.7	23	12.4	0.006
Yes	4236	73.3	431	78.5	390	82.3	163	87.6	
Missing	43		32		55		301		
Place of delivery									
HF delivery	4557	78.4	534	95.9	481	94.3	455	94.2	0.000
Outside HF delivery	1253	21.6	23	4.1	29	5.7	28	5.8	
Missing	14		24		19		4		
Total	5824	100	581	100	529	100	487	100	

¹P-values are based on Chi-square that accounts for clustering at the Community Unit (Village) level²Knowledge 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				Parallel		
	2007-2011		20012-2015				2012-2014		
			Control		Intervention				
	n	%	n	%	n	%	n	%	p-value ¹
EBF from 0-2 months									
No	4457	77.2	107	20.3	78	16.5	369	75.8	
Yes	1314	22.8	419	79.7	394	83.5	118	24.2	0.000
EBF from 0-4 months									
No	5007	87.2	149	30.6	131	29.9	410	84.2	
Yes	734	12.8	338	69.4	307	70.1	77	15.8	0.000
EBF from 0-6 months									
No	5624	98.2	208	45.4	188	44.8	472	96.9	
Yes	105	1.8	250	54.6	232	55.2	15	3.1	0.000
Total	5824	100	581	100	529	100	487	100	

¹P-values are computed after excluding the missing/don't knows

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 ¹	p-value	95% CI	OR ¹	p-value	95% CI	OR ¹	p-value	95% CI
Group (ref: Pre-intervention 2007-2011)									
Control (2012-2015)	66.94	[0.000]	[45.01,99.54]	16.1	[0.000]	[11.62,22.29]	13.71	[0.000]	[08.41,22.35]
Intervention (2012-2015)	84.26	[0.000]	[40.65,174.63]	21.13	[0.000]	[11.61,38.45]	22.56	[0.000]	[11.21,45.43]
Comparison (2012-2014)	3.91	[0.002]	[01.81,08.42]	3.47	[0.000]	[02.50,04.81]	4.27	[0.000]	[03.07,05.93]
Child sex (ref: Male)									
Female	1.02	[0.907]	[00.76,01.36]	0.95	[0.419]	[00.82,01.09]	0.94	[0.521]	[00.76,01.16]
Mother's age in years (ref:14-20 years)									
21-24	0.77	[0.110]	[00.55,01.07]	0.99	[0.968]	[00.71,01.39]	0.93	[0.600]	[00.69,01.25]
25-29	0.75	[0.078]	[00.54,01.04]	1.1	[0.541]	[00.78,01.55]	1.04	[0.780]	[00.79,01.36]
30-45	0.84	[0.495]	[00.49,01.44]	1.24	[0.178]	[00.89,01.72]	1.1	[0.532]	[00.80,01.51]
Marital status (ref: Not in union)									
Married	1.22	[0.278]	[00.84,01.77]	0.95	[0.619]	[00.78,01.16]	1.12	[0.310]	[00.89,01.42]
Highest level of education completed									
Primary School	1.23	[0.178]	[00.90,01.68]	1.25	[0.244]	[00.84,01.84]	1.66	[0.006]	[01.19,02.32]
Secondary School	1.31	[0.261]	[00.80,02.16]	1.36	[0.097]	[00.94,01.98]	1.89	[0.001]	[01.39,02.56]
Main source of livelihood (ref: Business)									
Informal	1	[0.985]	[00.57,01.77]	0.85	[0.520]	[00.50,01.44]	0.79	[0.261]	[00.52,01.21]
Formal	0.39	[0.020]	[00.18,00.84]	0.46	[0.075]	[00.19,01.09]	1.17	[0.582]	[00.65,02.10]
Unemployed	1.36	[0.071]	[00.97,01.91]	1.52	[0.003]	[01.19,01.94]	1.43	[0.006]	[01.13,01.81]
Ethnicity of the mother (ref: Kikuyu)									
Luhya	0.78	[0.311]	[00.47,01.30]	0.77	[0.011]	[00.63,00.93]	0.74	[0.013]	[00.60,00.93]
Luo	0.66	[0.038]	[00.45,00.97]	0.66	[0.003]	[00.52,00.84]	0.67	[0.000]	[00.57,00.79]
Kamba	0.94	[0.761]	[00.60,01.46]	0.93	[0.452]	[00.75,01.14]	1.07	[0.508]	[00.87,01.30]
Other	0.68	[0.094]	[00.43,01.08]	0.97	[0.795]	[00.76,01.24]	1.02	[0.830]	[00.81,01.29]
Parity (ref: No child)									
One	1.25	[0.289]	[00.81,01.91]	1.4	[0.002]	[01.16,01.69]	1.46	[0.007]	[01.13,01.87]
Two+	1.75	[0.110]	[00.86,03.53]	1.43	[0.015]	[01.09,01.87]	1.53	[0.000]	[01.30,01.80]
Wealth tertile (ref: Lowest)									
Middle	0.76	[0.387]	[00.40,01.46]	0.83	[0.230]	[00.60,01.14]	0.89	[0.179]	[00.74,01.06]
Upper	0.77	[0.349]	[00.43,01.38]	0.71	[0.018]	[00.54,00.93]	0.84	[0.126]	[00.67,01.06]
Knowledge on EBF at baseline (ref: No)									
Yes	1.36	[0.173]	[00.86,02.14]	2.79	[0.000]	[02.02,03.84]	2.38	[0.000]	[01.73,03.27]
Place of delivery (ref: at a health facility)									
Outside HF delivery	0.63	[0.112]	[00.35,01.13]	0.5	[0.000]	[00.37,00.69]	0.52	[0.000]	[00.41,00.65]
	5315			5346			5399		

¹OR adjusted for baseline characteristics and clustering