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*Full Length Research Paper*

# Impact of community health educators on the nutrition of children in Gaza province, Mozambique

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**Twenty six percent of children with protein-energy malnutrition live in Africa. This study determines whether Care Groups (CG) in collaboration with Community-based Health Educators (CHE) help reduce malnutrition in children between 0 and 23 months of age. A total of 299 caregivers at baseline (2004) and 380 at follow-up (2007) were interviewed using a structured questionnaire. Caregivers were between 12 and 49 years (mean 26.9 years standard error (SE)=0.33, 95% confidence interval (CI):26.3 to 27.6). Data was analysed with STATA version 10. A two-sample t-test was used to compare the findings while logistic regression analysis was used to test the association between outcome variables and predictor variables. Underweight children decreased from 16.3% at baseline to 7.6% at follow-up, fluid intake during diarrhoea episodes increased from 4.6 to 16.1%, exclusive breastfeeding increased from 91.9 to 95.2%, children attended by skilled health personnel at birth increased from 45.2 to 72.8%. Dehydrated children were 1.61 times more likely to be taken to hospital. Children weighed in the previous three months were 1.3 times more likely to have received food with marula nuts added to it. The world relief project appears to have improved caregivers' knowledge and behaviour regarding child nutrition in Gaza province of Mozambique.**

**Key words:** Community health workers, care group (CG), baseline, follow-up, malnutrition, underweight, dehydration, Mozambique.

## INTRODUCTION

Malnutrition is associated with 60% of all deaths among children under five years old in low-income developing countries (UNICEF, 2007). More than one-quarter of malnourished children live in Africa. Malnutrition impedes development of an adequate immune system and thus predisposes children to illness from opportunistic diseases like malaria, diarrhea, and pneumonia (WHO, 2005). Moreover, general malnutrition and specific micro-nutrient deficiencies hinder children's development, learning capacity, child morbidity and complications during and after birth among women. When diet is exclusively driven from a single source like corn or rice all the time, we dispose ourselves to malnutrition. This may either be caused by a lack of education about proper nutrition, or from only having access to a single food source (Dennill et al., 1999). Malnutrition can be derived from health issues such as gastroenteritis or chronic illness like the HIV/AIDS pandemic. Diarrhea is another infection that can cause malnutrition in instances like decreased intake of food, decreased nutrient absorption, increased metabolic

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requirements, and direct nutrient loss. Furthermore, parasite infections can also lead to malnutrition (Baro and Deubel, 2006).

Child malnutrition has many roots, including inadequate food supply, limited family purchasing power, poor environmental health conditions, and inadequate parental knowledge about nutrition and health. Inadequate breastfeeding leads to malnutrition in infants and children and is associated with the deaths of an estimated one million children annually (Afreen et al., 2000). Illegal advertising of breast milk substitutes continues three decades after its 1981 prohibition under the WHO International Code of Marketing Breast Milk Substitutes and this continuously contributes to malnutrition (WHO, 1981).

Low birth weight is 10 to 13% (< 2.5 kg) in the six Southern African countries including Mozambique and usually children grow well for the first few months. At the age of three, the prevalence of underweight is around 30% (at < -2 standard deviation (SD), weight-for-age); stunting (< -2 SD height-for-age) is around 50% and wasting (< -2 SD weight-for-height) is 5 to 10%. Mozambique showed worsening of wasting from 2000 to 2002, while underweight showed no consistent pattern during this time period (UNICEF, 2003). In Mozambique, high levels of wasting were at 14% in December, 2002. A major deterioration in wasting was seen in Gaza province (3.5% to 14%) before this study was conducted.

Child malnutrition continues to be a vexing public health problem in developing countries, and fighting malnutrition through education and behavior change is a cornerstone of anti-poverty efforts in these areas worldwide (ACC/SCN, 1988).

Mozambique ranks among the highest countries in the world with infant, early childhood, and maternal mortality (DHS, 2003), with only 30% of the population having access to health services. Nationally, 44% of deaths among children <5 years old are nutrition related. Despite increasing levels of economic growth, malnutrition worsened substantially in Mozambique between 1997 and 2006, and the proportion of children <5 years old suffering from malnutrition increased from 36 to 46% over the decade. Gaza province, in Southern Mozambique, has a population of 1.2 million, high rates of poverty, and especially, high malnutrition and child and maternal mortality. Poor nutrition and hygiene practices have been linked with continuous malnutrition among children between 0 and 23 months of age. In 2003, 30% of children <2 years old in Gaza province were malnourished, almost 16% were underweight, and almost 10% were assessed to be wasted.

Maternal nutritional practices in Gaza province were poor due to lack of knowledge among caregivers (World Relief Mozambique, 2005). Exclusive breastfeeding was a neglected practice due to taboos that involved weaning a child when a mother becomes pregnant. The expected increase in feeding frequency and giving foods with micronutrients to children were overlooked by caregivers because children did not receive three nutrient balanced meals per day. In addition, most women living in Gaza province were unaware of the importance of immunization for their children and themselves when they were pregnant.

To address the persistent problem of malnutrition among young children in Gaza province, the World Relief's Vhuronga Expanded Impact Child Survival Program (VEICSP) intervened in December, 2004 and focused on both child and maternal nutrition. The programme's goal was to scale up the Care Group Model (CG) for child survival with the following objectives: (1) strengthen the capacity of the health system to improve quality and coverage of Integrated Management of Child Illnesses (IMCI) through training and supervision and by establishing effective health information systems; (2) develop sustainable community based mechanisms to improve prevention and care seeking practices for IMCI; and (3) improve child feeding practices to reduce malnutrition.

The overall objective of this study was to determine whether the community health system that is supported by Community-based Health Educators (CHEs) can reduce malnutrition in Mozambique. This study looked for ways to foster a sustainable community based nutrition mechanism that is supported by a CG Model.

## METHODOLOGY

The current study is a secondary analysis of data collected as part of the World Relief's Vhuronga Expanded Impact Child Survival Program (VEICSP). This study examined only data on the effects of the CG Model and CHEs using "before and after" intervention data collected in the cross-sectional survey conducted in 2004 and 2007.

### Participant selection

The target population was caregivers of children of 0 to 23 months of age residing in Gaza province during September, 2004 and September, 2007. Researchers selected the two cross-sectional samples separately using Lot's Quality Assurance (LQAS) methodology (Valadez and Devkota, 2002). Given the target population of 247,146 in Gaza province and the presence of 20 supervision areas (intervention areas), calculations specified a total sample of 299 at baseline and 380 at follow-up to be representative of Gaza province. This translated into 19 households to be selected from each supervision area (SA). Researchers selected households by visiting the centre of each supervision area, gathering mothers in a circle, spinning a bottle, and selecting the caregiver to whom the bottle pointed if she had a child of 0 to 23 months old. This procedure was conducted until a total of 19 caregivers were interviewed in that SA. Researchers then moved to the next supervision area and repeated the steps mentioned earlier. Only one caregiver and one youngest child per household were selected. For caregivers who had twins, only one child was chosen by randomly picking one piece of paper with numbers 1 or 2 written on either of them.

**CG intervention**

The CG intervention strengthens the health infrastructure through training CHEs to improve nutrition of children and manage child illnesses. VEICSP implemented the project in Gaza province by first collecting baseline data in 2004. The project aimed to reduce child morbidity and mortality in the province where malaria, pneumonia, malnutrition and diarrhoea were dominant. The intervention addressed appropriate dietary management and counselling for the sick child according to the Integrated Management of Childhood Illness (IMCI) guidelines which include: continuing to breastfeed during illness; feeding the child with more food during illness and for two weeks following illness; feeding the child with fluids during illness; and prompt referral if the child exhibits danger symptom of vomiting and inability to drink or eat. The project encouraged regular attendance of the caretakers and children for weighing, educating and counselling pregnant women to consume more food during pregnancy and take iron supplements Underwood,1983; Mandomando et al.,2007).

The CG training program included community interventions with a focus on: diarrhoea prevention, nutrition, immunization, hygiene and sanitation and pneumonia prevention (Laughlin, 2008; Partners in Health, 2007). Training sessions for each intervention area lasted 2 weeks. For diarrhea prevention (Sebodo et al.,1977), the curriculum covered causes of diarrhea and its possible prevention measures. Good nutrition practices and prevention of malnutrition were covered in nutrition lessons. Growth monitoring (GM) including the importance of immunization for children between 0 and 23 months of age were a teach and practise activity among caregivers. Hygiene in homes, use of clean water and prevention of pneumonia in children were among the most important topics included in the curriculm. The training procedure involved a group of 10 to 15 caregivers with children between 0 and 23 months of age. In return, the trained caregivers would each train ten more mothers in the same topics thereby increasing coverage. All lessons were taught by community health workers using flip-charts with bold pictures and inscriptions that described each picture. Pictures were widely used because they helped in transferring messages to the rural, illiterate populace and the method proved to be useful and friendly. The 10 to 15 caregivers regularly meet together with project staff for training, supervision and support.

**Measures and data collection protocol**

***Survey***

A survey was conducted in December, 2004 to obtain baseline demographic information and information on community taboos and beliefs about child nutrition and caregiver care-seeking practices for their sick children. The survey was readministered in 2007 to obtain information on the progress of the intervention. The survey questionnaire consisted of 49 questions and caregivers of children under two years of age were interviewed in the local language (Changaana). Response categories were binary (that is, yes or no) and ordinal (e.g., amount of food taken during pregnancy=less than usual, usual, more than usual).

***Clinical measures***

Child malnutrition status was assessed by CHEs in households in the intervention area. Malnutrition was determined using a measure of child underweight status. The cut-off point of underweight was based on the WHO maxim equation of weight for age measurement index which shows mild [-2SD>WAZ≥1 SD] to moderate [-3SD>WAZ≥2 SD] level of malnutrition (WHO: Child Health at a glance; March 2002).

**Data analysis**

Two-pronged analyses were conducted using STATA version 10 statistical package. Two-sample t-test was conducted on baseline and follow-up data basing on answers given to questions in the questionnaire to determine changes in mothers' knowledge and practice in nutrition, illness management, and GM, and in care-seeking behaviours over the intervention period. This was followed by a multivariate logistic regression to determine predictors of practice and behaviour change caused by the CG Model through the use of CHEs involving caregivers who have children between 0 and 23 months of age with an aim to reduce malnutrition.

For the two-sample tests of proportions, the following dependent variables were studied: dehydration danger sign, underweight, weight in the last three months, dehydration and mother's education that intended to change mothers' behaviour after training them. Independent variables in the study included: highest level of education attained by the mother; breastfeeding at post-partum; liquid or food given to the child in the last 24 h; introduction of complementary foods; knowledge about signs of illness; liquids or foods given during a diarrhoea episode; diarrhoea treatment at home using porridge prepared from fermented maize flour; complete child immunisation; tetanus injection to pregnant women; and birth assisted by a skilled health personnel.

An analysis was performed in order to obtain the crude un-adjusted odds ratios and their 95% confidence intervals. The odds ratios were used to assess the association between the dependent variables and independent variable. Backwards stepwise regression was performed starting with a full model, including interaction terms. Variables that were the least significant were removed one after the other. Each variable removal was followed by a likelihood ratio test (lrtest). The lrtest evaluated whether removal of a variable improved the model or not, the aim being to end up with the simplest possible model which best predicts the outcome. The same modelling process was followed in building all the logistic regression models in this study. Post-regression analysis was used to evaluate the models.

Tests of goodness of fit (GOF) were performed using the Pearson's GOF, the Hosmer and Lemeshow's GOF and the analysis of area under the receiver operating characteristic (ROC) curve.

## RESULTS

### Characteristics of caregivers and households of children of 0 to 23 months of age

The demographic characteristics of caregivers at baseline and follow-up are shown in Table 1. The caregivers were all female and mostly between 12 and 49 years of age with mean age of 26.9 years (SE=0.33, 95% CI:26.3 to 27.6) both at baseline and follow-up. Care-givers of age 12 to 17 years comprised 5% of the sample at baseline and 3.4% at follow-up. Caregivers 18 to 35 years old comprised 84% of the sample at baseline and 86% at follow-up. Fewer women at follow-up (38%) compared with baseline (68%) reported that they had completed primary education and could read and write. The percentage of caregivers who reported they had

**Table 1.** Socio-demographic characteristics of caregivers and households of children of age 0 to 23 months for baseline and follow-up surveys.

| Characteristic | Baseline (n=299) | Percent | Follow-up (n=380) | Percent |
|---|---|---|---|---|
| **Age of mother (years)** | | | | |
| 12-17 | 15 | 5 | 13 | 3.4 |
| 18-35 | 252 | 84 | 326 | 86 |
| 36-49 | 32 | 11 | 40 | 11 |
| 50+ | 0 | 0 | 1 | 0.3 |
| **Children under 5 living in the household** | | | | |
| HH = 1 child | 125 | 42 | 119 | 31.3 |
| HH = 2 children | 106 | 35 | 174 | 46 |
| HH = 3 children | 36 | 12 | 47 | 12.4 |
| HH ≥ 4children | 32 | 11 | 40 | 11 |
| **Mother's biological children** | | | | |
| Mother = 1 | 183 | 61 | 217 | 57 |
| Mother = 2 | 113 | 38 | 158 | 42 |
| Mother = 3 | 3 | 1 | 4 | 1.1 |
| Mother ≥ 4 | 0 | 0 | 1 | 0.3 |
| **Mother's level of education** | | | | |
| Primary, but cannot read | 38 | 23 | 50 | 13.2 |
| Primary, can read | 114 | 68 | 145 | 38.2 |
| Secondary and higher | 15 | 9 | 34 | 8.9 |

completed secondary education was the same (about 9%) at baseline and follow-up.

### Baseline and follow-up indicators for children between 0 and 23 months of age

Table 2 shows results of the comparison between baseline and follow-up data. The percentage of underweight children decreased from 16.3 to 7.6% at follow-up while fluid intake during diarrhoea episodes increased from 4.6 to 16.1% at follow-up. Exclusively breastfed children were 91.9% at baseline and 95.2% at follow-up. Children who were attended to by skilled health personnel increased from 45.2 to 72.8% at follow-up. DPT3 coverage was 48.8% at baseline and 62.8% at follow-up while proper administration of oral rehydration salts (ORS) during a diarrhoea episode increased from 29% at baseline to 67.11% at follow-up. Nutrition counselling increased from 2.3 to 80.6% at follow-up.

### Factors associated with underweight and immunisation among children of 0 to 23 months of age

The model revealed that newly born underweight children delivered in a health facility were 4.4 times more likely to receive Bacille Calmette Guerin (BCG) vaccine than those who were not delivered in a health facility. Children who were underweight in the follow-up study were 77% less likely to receive Polio 0 than those who were not underweight. The Diphtheria Tetanus and Pertussis (DPT)1 odds ratio showed that children in the study who were underweight were 97% less likely to receive the vaccine than those who were not underweight. The DPT2 vaccine odds ratio reveals that those children who were underweight in the study were 22.4 times more likely to receive DPT2 vaccine than those who were not underweight after controlling for other variables in the model. The DPT3 odds ratio showed that children in the study who were underweight were three times more likely to receive DPT3 vaccine than those who were not underweight after controlling for other variables in the model. The measles odds ratio showed that children who were underweight in the study were 60% less likely to receive measles vaccine than those who were not underweight. Furthermore, children who were underweight were 1.84 times more likely to receive Vitamin A capsules, 1.80 times more likely to have had complete immunisation, and 1.42 times more likely to receive Polio 3 vaccine than those who were not underweight, after controlling for other variables in the model. The tetanus

**Table 2.** Baseline and follow-up indicators for children of age between 0 and 23 months .

| Indicator | Baseline (%) | Follow-up (%) | Difference (%) | CI- 95% of difference | p-value |
|---|---|---|---|---|---|
| **Immunisation** | | | | | |
| DPT1 Coverage (%) | 78.2 | 81.5 | 3.3 | (-2.0, 10.0) | 0.12 |
| DPT3 Coverage (%) | 48.8 | 62.8 | 14 | (8.0, 24.0) | 0.00 |
| Percent of children aged 12-23 months who received a measles vaccine | 27.42 | 41.32 | 13.90 | (7.0, 22.0) | 0.00 |
| **Nutrition** | | | | | |
| Percent of currently breastfed children | 91.9 | 95.2 | 3.3 | (-0.00, 6.00) | 0.06 |
| Percent of children who received complementary feeding | 16.2 | 15.3 | -0.9 | (-10.0, 4.0) | 0.44 |
| Percent of children weighed regularly in growth monitoring (GM) | 76.9 | 87.4 | 10.5 | (5.0, 17.0) | 0.00 |
| Percent of children of age 0-23 months who are underweight (-2SD from the median weight-for-age) | 16.1 | 7.6 | -8.7 | (-14.0, -3.0) | 0.00 |
| Percent of caregivers of malnourished children who received nutrition counselling | 2.34 | 80.6 | 78.26 | (56.0, 93.0) | 0.00 |
| **Diarrhoea** | | | | | |
| Percent of sick children of age 0-23 months who received increased fluids during illness | 4.6 | 16.1 | 11.5 | (9.0, 18.0) | 0.00 |
| Percent of children with diarrhoea treated with ORS | 29 | 67.11 | 38.1 | (30.0, 45.0) | 0.00 |
| **Maternal care** | | | | | |
| Percent of children of age 0-23 months whose births were attended by skilled health personnel | 45.2 | 72.8 | 27.6 | (25.0, 36.0) | 0.00 |

injection odds ratio showed that caregivers with underweight children in the study were 23% less likely to receive the injection than those who did not have underweight children.

### Factors associated with GM by caregivers among children between 0 and 23 months of age

A logistic regression analysis for factors associated with GM among children between 0 and 23 months of age was performed. The study revealed that at baseline, 16.11% of the children were –2SD from the median weight-for-age, indicating underweight while follow-up results showed that 7.65% 7.65% of children were underweight. The outcome variable “weighed in the last three months” (Table 3) was analyzed to see if children were weighed regularly to guard against underweight. The outcome variable was analysed against two explanatory variables which were GM counselling and the use by caregivers of marula nuts in children’s food. “The GM counselling” variable looked at nutrition counselling by CHEs to caregivers. “GM using marula nuts” looked at how the caregivers were involved in using marula nuts in the daily improved feeding practices using locally available food stuffs. The logistic regression model showed the effect of GM counselling and the use of marula nuts in feeding children. The odds ratio for GM counselling is 2 and it indicates that children who were weighed in the previous three months were twice as likely to have caregivers who received GM counselling than those who had not been weighed in the previous three months. The marula nuts odds ratio shows that children who had been weighed in the previous three months were 1.3 times more likely to have received food with marula nuts added to it than those who had not been weighed in the previous three months.

### Factors associated with underweight of children and maternal care for caregivers

In this study, pregnant caregivers were asked about

**Table 3.** Logistic regression analysis for growth monitoring, underweight of children and maternal care for caregivers, exclusive breastfeeding and caregiver's education and hand-washing among children of age 0 to 23 months.

| Weight in last 3 months | OR | P-value | 95% CI | |
|---|---|---|---|---|
| | | | Lower limit | Upper limit |
| **Growth monitoring (n=31)** | | | | |
| Growth monitoring counselling | 2 | 0.64 | 0.10 | 39.07 |
| Growth monitoring marula | 1.3 | 0.85 | 0.07 | 23.43 |
| **Maternal Care (n=374)** | | | | |
| Delivery by skilled personnel | 0.79 | 0.60 | 0.33 | 1.88 |
| Delivery by TBA | 0.67 | 0.65 | 0.11 | 3.89 |
| Eat food less than usual amount | 1.25 | 0.71 | 0.37 | 4.20 |
| **Exclusive breastfeeding (n=379)** | | | | |
| Current breastfeeding | 3.76 | 0.29 | 0.32 | 44.25 |
| Breastfeeding only | 0.23 | 0.16 | 0.03 | 1.82 |
| Complementary feeding | 2.09 | 0.07 | 0.92 | 4.76 |
| Solid food | 2.19 | 0.12 | 0.79 | 6.05 |
| Complementary food-age | 1.02 | 0.90 | 0.70 | 1.47 |
| **Hand-wash before food (n=380)** | | | | |
| Preparation | 0.91 | 0.69 | 0.57 | 1.44 |
| Hand-wash before feed child | 1.06 | 0.80 | 0.64 | 1.75 |
| Hand-wash after child defecates | 0.97 | 0.89 | 0.61 | 1.53 |
| Hand-wash after caregiver defecates | 1.67 | 0.05 | 0.99 | 2.82 |

about the amount of food they eat. The outcome variable "underweight" (Table 3) and three explanatory variables were included in the final model. Explanatory variables included the delivery of caregivers' babies with the help of skilled health personnel, delivery with the help of traditional birth attendants (TBAs), and eating food that is less than usual by pregnant caregivers. The initial model was compared with the final model and the Prob>Chi$^2$ was equal to 0.7551. The p-value is greater than the significance level (>0.05). At baseline, 58.19% of caregivers mentioned that they ate less food than usual and at follow-up 21.32% reported that they ate less food than usual when they were pregnant. Nutrition counselling was 2.34% at baseline and 80.65% at follow-up, with p-value of 0.00. Caregivers delivered by the help of a doctor were 1.34% at baseline and 1.32% at follow-up. The odds ratio for delivery by skilled personnel indicates that children who were underweight were 21% less likely to have been delivered by skilled health personnel than those children who were not underweight, after controlling for other variables in this model. The odds ratio for deliveries attended by TBAs show that, children who were underweight were 33% less likely to have been delivered by TBAs at birth than those who were not underweight, after controlling for other variables in the model. Children who were born underweight were 1.25 times more likely to have been born of caregivers who ate less food during pregnancy than the usual amount than those children who were not underweight, after controlling for other variables in the model.

### Factors associated with underweight and exclusive breastfeeding among children between 0 to 23 months of age

Exclusive breastfeeding was based on the question that sought to find out if caregivers gave breast milk only to their children in the 24 h preceding the survey. Caregivers who gave water and breast milk to their children 24 h preceding the baseline study were 73.58% and follow-up study showed 24.21%. Baseline results show that 88.63% of caregivers exclusively breastfed their children and at follow-up, 95.00% of caregivers exclusively breastfed their children. A percentage of 28.43% of caregivers breastfed their babies within the first hour after giving birth at baseline and at follow-up, 45.82% of caregivers reported that they gave breast milk to their babies within the first hour after giving birth. Table 3 shows that children who were underweight were 77% less likely to

receive breast milk only than those who were not underweight, 2.09 times more likely to receive complementary foods than those who were not underweight, 2.19 times more likely to receive solid foods than those who were not underweight and 1.02 times more likely to receive complementary foods at the recommended age than those not underweight after controlling for other variables in the model, respectively.

### Factors associated with caregiver's education and hand-washing

Caregivers who washed their hands before food preparation were 29.10% at baseline and 67.63% at follow-up. Those who washed their hands before feeding the child were 9.03% at baseline and 23.42% at follow-up with p-value of 0.00, which is statistically significant. Caregivers who washed their hands after the child defecated were 6.35% at baseline and 33.68% at follow-up. At baseline, caregivers who washed hands after they had defecated and before handling their children were 41.81 and 78.42% at follow-up. Hand washing with soap was 13.38% at baseline and 100% at follow-up with p-value of 0.00, and this is associated with adoption of the practice. A logistic regression analysis for the factors associated with caregiver's education and hand-washing was run (Table 3). The outcome variable in this model was "the mother's education". An analysis was performed between the outcome variable and four explanatory variables. When the logistic regression test (lrtest) was performed, the result was: Prob>Chi$^2$=0.9115, after removing the variable "hand-washing never" from the model. We failed to reject the null hypothesis that the two models are the same. Therefore, the removal of the variable from the model or keeping it in the model does not make much difference. However, the variable was removed from the model. The odds ratios give the following understanding of the study that: caregivers who were educated were 9% less likely to wash hands before preparing food; 1.06 times more likely to wash hands before feeding the child; 3% less likely to wash hands after the child defecates; and 1.67 times more likely to wash hands after they themselves defecate than those who were not educated.

### Demographic characteristics of target age group (0 to 23 months old)

The age range of the target group was 0 to 23 months for both males and females and the mean age was 9.9 months (SE=0.34, 95% CI:9.3 to 10.6 with n=299 at baseline and n=380 at follow-up). The mean age was alike in both male and female children. The highest percentages for children at baseline were 36.79% for the 12 to 23 months and 36.45% for the 0 to 5 months age groups. The 6 to 11 months age group was 26.76% at baseline and was the lowest percentage.

At follow-up, 36.58% of the children made up the 12 to 23 months age group while 32.63% made up the 6 to 11 months age group. The 0 to 5 months age group at follow-up was 30.79%, which was the lowest category.

## DISCUSSION

Prior studies found that erroneous sources of diet may be caused by a lack of education about proper nutrition, or from only having access to a single food source (Baro and Deubel, 2006). This study further proved that knowledge, practice and behaviour change due to CHEs' efforts using care groups of mothers with children between 0 and 23 months of age is associated with a tremendous reduction of malnutrition. The literature supports the fact that proper nutrition during pregnancy has also proved essential for the healthy growth and development of the fetus (Nancy et al., 2002). Health sciences also confirm how nutrition during lactation improves the quality and quantity of breast milk, which is the best food for the child in the first six months of that child's life (Sternin et al., 1998). This study found out that as children grow, their nutritional need exceeds that of the nutritional content of the mother's breast milk. This additional need can be addressed by providing appropriate supplemen-tary food. In contrast, inadequate food during pregnancy and lactation by the mother and poor child feeding practices lead to poor physical growth, poor mental de-velopment and susceptibility to infection, which ultimately results in high morbidity and mortality, as observed among children in the developing world (Mulholland, 2005; Fenn et al.,2005). It is estimated that more than 60% of deaths among under 5 (U5) children in developing countries are associated with malnutrition (WHO, 2002; Berg, 1987; PAJPH, 2005)).

### Breastfeeding, nutrition and factors associated with underweight

Inadequate breastfeeding leads to malnutrition in infants and children and is associated with the deaths of an estimated one million children annually (WHO, 1981). This study proved the fact that breastfeeding is acceptable by most caregivers and in some cases is fully practised for a period of six months after giving birth. Exclusively breastfed children feed on only the mother's breast milk and if and when given water in addition to breast milk, then those children are no longer exclusively breastfed. Exclusive breastfeeding (EBF) is recommended for the first four to six months of life of a born child. This helps to prevent diarrhoea by minimising

the infant's exposure to diarrhoeal pathogens, which are common in other foods and in water (Kenneth and Brow, 2005). In this study, the percentage of children (0 to 6 months of age) exclusively breastfed in 24 h diet recall increased by 6% between baseline and follow-up. The percentage of increase was associated with increased efforts by CHEs who operated in the project area, although the baseline figure is relatively high.

Adoption of EBF through information from friends in neighbouring project areas may have inflated the baseline figure. The rest of the children were given plain water (73.58% at baseline and 24.21% at follow-up). This is associated with the reduction of mothers who gave water instead of EBF, causing a rise in EBF in the project area. The study reveals a further increase in complementary feeding in children of 6 to 24 months of age when solid food is introduced in addition to breast milk. The percentage of children (6 to 24 months) who received complementary feeding in a 24 h diet recall was 69.90% at baseline and 66.84% at follow-up. The 2.06% reduction in percentage must have been caused by those mothers who adjusted from earlier introduction (3 to 4 months) of complementary foods to the exact recommended age (after 6 months). This may have given a shift in increase in caregivers who abided to the recommended period of introducing complementary foods. However, the observed universal breastfeeding practice should be encouraged, despite the fact that the high rate of poverty in Gaza province could affect the mother's own nutrition. The absence of other safe options to meet the nutritional needs of children makes breastfeeding mandatory to the survival of the child. More effort is needed to promote EBF during the first six months of the child's life.

## Immunisation

### *Factors associated with immunization of children of 0 to 23 months of age*

In Mozambique, children in poor households are half as likely to be fully vaccinated as children in best-off households (Instituto Nacional De Estatisticas, 2008).

Preventive health care practices are essential to the growth of children. The target population for infant immunization from both poor households and best-off households in this study was those children between 12 and 23 months of age. This study revealed overwhelming improvements in the follow-up coverage of DPT3 vaccination (14% increase from baseline), Polio 3 vaccination (12% increase from baseline), measles vaccination (14% increase from baseline), tetanus vaccination (19% increase from baseline) and reception of tetanus injection more than twice by caregivers (30% increase from baseline). Among the 368 children, 367 (99.7%) had immunization cards and 33.95% had complete immunization by one year of age. The p-values for all variables are statistically significant except for DPT1 (p-value 0.12>0.05). The statistical significance of the p-values of all, but one variable leads one to tentatively conclude that caregivers had changed their behavior in favor of child immunization.

Furthermore, 62.9% of the children who had reached their fifth month had immunization for DPT3 compared to 48.8% who received the injection at baseline. Immunization was accessible, with children receiving Polio 3 (51.8%) at baseline and 63.4% at follow-up, DPT 1 (78.3% at baseline and 81.6%) at follow-up. There was a continuous rise in coverage in immunization practices except for DPT1 (3% increase from baseline) where the increase in percentage was very low compared to other immunizations given. CHEs seemed to neglect DPT1 in their messages to the caregivers and attention is needed so that caregivers are encouraged to take children for DPT1 vaccination. Generally, the study shows that there was an increase in immunization coverage and that caregivers adopted the practice. It seems that caregivers know the benefits of getting their children immunized. The increased immunization trend also gives the impression that there was a good motivation amongst the caregivers and, on the other hand, stock-outs in hospitals and clinics seemed to be rare or non-existing. However, continuous motivation of caregivers to get their children completely immunized is needed. In general, there is a large proportion of participating children in preventive health care services, as demonstrated by the high immunization coverage.

## Factors associated with GM in children of 0 to 23 months of age

GM without teaching and involving caregivers does not improve nutrition. Many programmes spend time weighing and using health charts because this is often easier than careful explanation to caregivers about how they can better feed their children (Lankester, 2000). This study agrees with Lankester (2000) since the results after involving CHEs and caregivers were progressive. The objectives of regular GM and community-based nutrition programmes, among others in this study were to monitor closely the nutritional status of children using GM cards, and to train mothers of malnourished children in proven child feeding, child caring and preventive health care practices through practical demonstration.

The percentage of underweight children identified through GM in this study was16% at baseline and this was reduced by 8.46%. There was an increase by 3.68% of caregivers who used marula nuts in improved feeding practices. The percentage increase in the use of marula nuts is insignificant, especially if we consider that

access to the nuts has no cost attached to it.

The use of locally available food stuffs in the preparation of improved porridge increased by a small proportion (3.6%). It is difficult to identify from the results children who underwent GM using age for weight measurement index if they had a mild [-2SD>WAZ<-1 SD] or a moderate [-3SD>WAZ <-2 SD] level of malnutrition. However, the results were clear enough to show that underweight reduced from 16.11% at baseline to 7.65% at follow-up.

## Maternal care

### *Factors associated with underweight of children and maternal care*

A malnourished pregnant woman is at high risk of giving birth to a low birth weight (LBW) baby who will be prone to growth failure during infancy and early childhood, and can be at increased risk of morbidity and early death.

This study found out that women who eat less food than usual are more likely to give birth to a child who is underweight than those who eat the same food as usual or more food than usual. This finding indicates that more food and well balanced diet will result in healthy babies at birth. Scientists are aware that malnutrition is a pathological condition brought about by the inadequacy of one or more of the essential nutrients that the body cannot make but that are necessary for survival, for growth and reproduction, for the capacity to work, learn and function in society (Berg, 1987). This study agrees with the view expressed by Berg (1987) since even eating more food than usual but lacking essential nutrients for the child's growth will not yield the expected result of a healthy child. It is encouraging to notice that nutritional counselling increased from 2.34% at baseline to 80.65% during the follow-up survey. The increase of use and adaptation of feeding practices at follow-up shows that, caregivers improved in their nutrition management when they were pregnant.

## LIMITATIONS OF THE STUDY

This study used secondary data. Errors and biases which may have occurred during primary data collection will, in some way, appear in this study. There are no sections in the secondary datasets where grandparents who look after children without parents are mentioned and in reality such situations exist in the communities. However, since the questionnaire clearly investigated caregivers with biological children, this bias may have little potential to cause negative effect on the results. Furthermore, the study does not reflect the inclusion of qualitative data that may have brought about rich information about the caregivers with children in the target age group although the findings are credible.

## Conclusion

The CG and CHEs appear to have improved caregivers' knowledge and behaviour regarding child nutrition. Involvement of CHEs has left community mothers with knowledge and sustainable practice in the nutrition of infants in Gaza province of Mozambique. Although there are some areas that need to be improved by the CG Model working with CHEs, complex problems that contribute to the incessant malnutrition of children in Gaza province, Mozambique, are being minimized. According to this study, good feeding practices in children, hygiene and sanitation practices, home management of child illnesses (especially diarrhoea), and the use of scales to track underweight in children at home level have proved useful to reduce malnutrition in children between 0 and 23 months of age in Gaza province of Mozambique.

The percentage increases in the follow-up survey figures in comparison to the baseline survey figures relative to all the world relief project indicators manifest the progress. World relief's CG Model could be regarded as a leader model for use in comprehensive primary health care implementation by using CHEs working with children under the age of two years. Women of reproductive age and children under the age of 24 months could benefit the fruits of replication and expansion of community health education in the entire Mozambique.

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