Synergistic relationship between child morbidity and malnutrition among the urban poor

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1. Background

Malnutrition is one of the most important factors contributing to child mortality and a leading cause of the global burden of disease in developing countries[1,2]. The magnitude of the health loss associated with childhood malnutrition is such that every day, more than 26,000 children under the age of five die mostly from preventable causes[3]. The majority of these deaths occur in developing countries where over half of the deaths are attributed to undernutrition and its complications[4]. Indeed malnutrition is now seen as a neglected epidemic since the scale of the problem has not changed since 1990. In sub-Saharan Africa alone, the prevalence has been reducing but at a very slow pace[5]. Underlying poverty in developing countries is thought to be a major cause of widespread malnutrition among mothers and children, and consequently a major contributor to childhood morbidity and mortality[6.7,8,9]. The focus on child morbidity is important because it is a pre-cursor to under-five mortality and understanding this relationship is important for providing reliable information for policy and program design.

In Kenya, one in every nine children dies before the age of five mainly of acute respiratory tract infections, diarrhea, fever, malnutrition and malaria whose main cause is poverty[10]. The infant mortality rate (IMR) and the child mortality rate (U5MR) as reported in the KDHS, 2003 is 77 and 115 deaths per 1,000[11] live births respectively. This is a matter of great concern since it is an upturn from 1990s. The Kenya Service Provision Assessment (KSPA) report further indicates that 70% of the illnesses that cause death among the under five children in Kenya is as a result of malnutrition whose indicators include stunting, wasting and underweight with 30% of under-five children being chronically malnourished (stunted), 6% acutely malnourished (wasted) and 20% underweight as estimated by the KDHS, 2003. In Kenya, food security has received attention through the poverty reduction strategies although child mortality rates and malnutrition are still high[12]. There are indications therefore that feeding is not just enough, that there has to be access to safe water and proper sanitation as well.

Undernutrition and childhood morbidity have a synergistic relationship but most studies have focused on either malnutrition or morbidity separately, and relatively very few have looked at the relationship between the two[13,14,15,16,17]. The interrelationship of the two is in such a way that on one hand, nutritional deficiencies increase the susceptibility of the child to infectious diseases such as diarrhea, fevers, and malaria, and on the other hand, illness can suppress a child's appetite leading to undernutrition. The consequences of this pattern are poor physical and mental development, and possibly death[18,19]. Child morbidity and malnutrition have similar determinants which include poor maternal health during pregnancy, poorly-resourced health systems, food insecurity, inadequate and inappropriate feeding practices, lack of hygiene, and poor access to safe water. At a distal level, these determinants may be influenced a range of factors such as female literacy, early marriage and childbearing, food taboos, and proximity to essential health and social services[10,11,12] and yet little research has been done indicating the effects of these issues, on child malnutrition and morbidity. Other specific individual child characteristics that are likely

to have an impact on the child's malnutrition and morbidity include age, sex, the size at birth, breastfeeding status, and illness episodes experienced by the child[20]. It is also important when studying undernutrition to take into context a range of factors at macro, household, community, and individual level which according to Griffiths et al.2004, also affect child health for instance, national policies that affect health, agriculture, economics and the environment.

While various studies have been done on child health in developing countries, sub-Saharan Africa included, very few have focused on child health among the urban poor[4,10,21,22]. The focus on child health among the urban poor is important because most urban centers in Africa have had growing population and yet the economies have not been growing at the same pace with the population[23]. Urbanization has therefore outstripped economic growth, making it difficult for most urban populace to afford housing, quality social services or sufficient employment. With this, there has occurred degeneration in basic infrastructure such as piped water, electricity, sewerage, and roads which has prompted people in large African cities to move to unplanned settlements on the urban periphery[24]. Moreover, these populations streaming to the urban peripheries are usually poor and find it difficult to cope[25]. As a result of the poverty in these urban periphery areas, known as 'slums', the health of people living in these areas is poor[26]. For instance, studies have shown that the urban poor tend to have higher morbidity, inadequate access to health services, and higher morbidity compared to their rural counterparts[27,28,29,30,31,32]. To improve child heath at the national level therefore, a close attention needs to be paid to these growing marginalized urban populations.

Kenya's economy like many other African countries has been fluctuating. Its gross domestic product (GDP) for instance attained a growth rate of –0.3% in 2000, down from 1.4% in 1999 which implies that per capita growth continued to fall hence poverty escalated[33]. The total number of poor Kenyans therefore increased over time growing from11.5 million in 1994 to 12.6 million in 1997. According to the 1997 welfare monitoring survey, the poor constitute 52.3% of the Kenya population, and that the situation of urban poverty had deteriorated further with 49.2% of this population being poor[34]. The Kenyan economy however began to recover after 2002, registering 2.8% growth in 2003, 4.3% in 2004, 5.8% in 2005, 6.1% in 2006, and 7.0% in 2007[35] but some families in Kenya still live on less than a dollar a day which was a key issue in the recent elections and the unrest that followed[36] while the Human Development Report ranks Kenya 60th in human development out of 108 countries[37]. The implication of poverty on a population is that there is lower schooling for children who are more likely to be malnourished and there is a less likelihood of the children being immunized hence they face higher chances of dying in infancy and childhood.

Despite the vast amount of research on child health in sub-Saharan Africa as already outlined, very few have focused on the urban poor[38], and more specifically on the relationship between morbidity and mortality among the urban poor children[39]. Furthermore, most studies on child health have been cross-sectional while this study is longitudinal, using the household panel survey approach that enables one to make repeated observations regarding morbidity and mortality of the same children. The longitudinal framework used in this study enables this inter-linkage to be examined over time and across the early child life-course. With this background in mind, this paper aims to examine the synergistic relationship between malnutrition and morbidity among children living in two informal settlements of Nairobi, Kenya. It investigates how

malnutrition affects the occurrence of morbidity episodes, and conversely, how morbidity from common illnesses impacts on child's nutritional status. This study seeks to answer these basic questions: 1. How is malnutrition affected by the occurrence of morbidity episodes among under-five children from poor urban settlements? 2. And how does a child's nutritional status in turn affect incidences of morbidity from common childhood illnesses?

2. Data and Methods

Data

The data used in this paper are from an ongoing Maternal and Child Health Longitudinal study being conducted by the Africa Population and Health Research Center (APHRC) in two slums in Nairobi, Viwandani and Korogocho. The project, funded by Wellcome Trust, started in 2006 and aims to examine the impact of migration, poverty and household composition on morbidity and mortality of under-five children living in informal settlements in Nairobi. The two slum areas like other slums setting in capital city of Kenya, these two slums are characterized by high unemployment, poverty, unsafe water, poor hygiene and poor environmental sanitation which all contribute to child mortality and morbidity. Data in this study are collected through household interviews and measuring of babies' heights and weights. The unit of analysis is children who were born in the two slums from September 2006 and all new births in the surveillance area are systematically included in the study.

Methods of analysis

This study uses both descriptive and multivariate analysis of nutritional status and morbidity variables with focus on the common childhood illnesses such as diarrhea, fever, cough and convulsions. Two models were developed. The first is multiple linear regression analysis of weight-for-age z-scores (a measure of underweight), weight-for-height z-scores (a measure of wasting) and height-for-age z-scores (a measure of stunting) to see how morbidity status in the previous round of data collection is associated with nutritional status. The second analysis is logistic regression of morbidity status (yes/no), where nutritional status in the previous round is an explanatory variable. For both analyses, usual control variables (child's age, sex, maternal age, and socio-economic status) were included. The World Health Organization reference standards were used to calculate the z-scores.

3. Results

The analyses performed in this study were based on 1227 children who had data for first round (also known as the first visit), second round (second visit or first update) and third round (third visit or second update).

Table 1 gives the mean z-scores for weight for age, weight for height and height for age in addition to the proportion of children who are malnourished in the three rounds. For all the three measures of malnutrition, we observe a decrease in the mean Z-scores as the children grow older which indicates that more children get malnourished as they get older (which we see from the percentages of children malnourished per round). Those stunted increase five-fold between rounds 1 and2 and twice between rounds 2 and 3 while the increases for those wasted seems to be very minimal between the three rounds. Regarding morbidity, the table shows about half the

children have experienced an illness with the most common ones being diarrhea, cough and fever.

The Table 2 below gives some characteristics of the samples where about 54% of the children were from the Korogocho slum while 51% of the children in the analysis were male. While about 93% of the mothers interviewed responded to having attended school, only about 23% of them had secondary and higher education. A majority of the children were below six months during the first visit 75%, while about 84% of the children in the third visit were above 1 year.

Table 1: Univariate analysis for key sample characteristics (outcome variables)

Outcome variables		Round1	Round2	Round3
Sample size	N	1227	1227	1227
Malnutrition				
	HAZ (mean)	0.15	-1.09	-1.8
	% Stunted	5.73	23.3	39.74
	WAZ (mean)	0.44	-0.67	-1.16
	% underweight	4.01	15.45	24.3
	WHZ (mean)	0.26	0.11	-0.03
	% wasted	4.25	4.42	5.07
Morbidity status				
	Over all	51.59	45.13	46.44
	Diarrhea	19.79	22.24	25.67
	Fever	22.24	21.34	18.72
	Cough	23.47	23.90	20.52

Table 2 : Univariate analysis for sample characteristics (independent variables)

Control variables		Round 1	Round 2	Round 3
	N	1227	1227	1227
Child's age	< 6 months	75.14	10.69	0
	6 – 12 months	22.27	58.95	16.28
	12 + months	2.59	30.36	83.72
Mother education level	No education			5.64
	Primary			70.33
	Secondary +			23.2
Sex	Male	51.26	51.26	51.26
	Female	48.74	48.74	48.74
Site	Korogocho	54.70	54.70	54.70
	Viwandani	45.30	45.30	45.30

The table 3 below gives the average WHO z-scores for different morbidity status; overall morbidity, diarrhea and cough in the three rounds. The results indicate that younger children who are ill (in the first round) are likely to be malnourished in the second round. This outcome is not seen when comparing the effect of morbidity on malnutrition between the second and third rounds (when the children are older and probably already malnourished).

Table 3 : Relationship between malnutrition and morbidity

		Round 2			Round 3		
		WAZ	WHZ	HAZ	WAZ	WHZ	HAZ
Round 2	Morbidity (Ref: No)				-0.018(0.794)	-0.10(0.195)	0.11(0.108)
	Diarrhea (Ref: No)				0.001(0.985)	-0.003(0.688)	0.05(0.447)
	Cough (Ref: No)				0.02(0.746)	-0.14(0.06)*	0.21(0.003)*
Round 1	Morbidity (Ref: No)	-0.269***	-0.110	-0.28 ***			
	Diarrhea (Ref: No)	-0.21**	-0.06	-0.32***			
	Cough (Ref: No)	-0.15*	-0.025	-0.24**			

Table 4 shows the effect of malnutrition in the previous rounds (one and two) on morbidity in rounds two and three respectively. The results indicate that children who are either underweight or stunted in round one are more likely to be ill in round two. This result is significant for children who are younger.

The bivariate analyses indicate an interrelationship between morbidity especially diarrhea and malnutrition (underweight and stunted).

Table 4 : Relationship between malnutrition and morbidity

		Round 2			Round 3		
		Morbidity	Diarrhea	Cough	Morbidity	Diarrhea	Cough
Round 1	WAZ (underweight)	0.14	0.62**	0.03			
	WHZ (wasted)	-0.02	0.29	-0.01			
	HAZ (stunted)	0.01	0.25	0.03			
Round 2	WAZ (underweight)				-0.04	0.08	0.08
	WHZ (wasted)				0.13	0.37*	-0.04
	HAZ (stunted)				-0.15	-0.19*	-0.14

Table 5 below summarizes the results of multiple linear regression models fitted to assess the effect of morbidity on malnutrition (WAZ and HAZ) while controlling for child's age, sex, mother's education level and study site. Children who had an illness in the previous rounds (one and two) are more likely to be malnourished (WAZ and HAZ) in the next rounds (two and three). This effect is significant (P<0.10) for WAZ in round two.

Table 5 : Coefficients of linear regression models on the effects of morbidity on malnutrition

	WAZ (R2)	WAZ (R3)	HAZ (R2)	HAZ (R3)
intercept	0.30	-1.21***	-0.20	-1.54***
Morbidity (Ref=no)	-0.13*	-0.007	-0.07	0.10
Child's age (Ref: 0-6 months)				
6-12 months	-1.09***	-	-0.96***	-
12+ months	-1.53***	-0.23**	-1.94***	-0.72***
Sex(male)	0.15**	0.19**	0.24***	0.21***
Mother education (Ref=no education)				
Primary	-0.10	-0.21	-0.11	-0.36**
Secondary or higher	0.13	0.01	0.12	-0.20
Site (Ref=Korogocho)	0.01	0.07	-0.002	0.19**

Table 6 indicates the results of multiple logistic regression models fitted to assess the effect of malnutrition (WAZ) on morbidity while controlling for child's age, sex, mother's education level and study site. There was no significant relationship between children who are malnourished in rounds one and two and their morbidity statuses in rounds two and three.

Table 6 : Coefficients of logistic regression models on the effects of malnutrition on morbidity

	Morbidity in R2	Morbidity in R3
Intercept	-0.40	0.22
Underweight (Ref=No)	0.18	0.04
Child's age (Ref= 0 – 6 months)		
6 – 12 months	-0.09	-
12 + months	0.36	-0.10
Sex (male)	0.12	0.06
Mother education (Ref=no education)		
Primary	-0.24	-0.29
Secondary or higher	-0.34	-0.44
Site (Ref=Korogocho)	0.14	0.22*

4. Discussion

From the descriptive statistics and the bivariate analyses, an interrelationship between morbidity especially diarrhea and malnutrition (underweight and stunted) can be observed. Similar observations are made after controlling for age and sex of the child, mother's education level and the study site, although the results are not statistically significant. The results also indicate that malnutrition in one round is affected by morbidity in the previous round, especially underweight and stunting. The lack of significance could be due to the high rate of loss of follow-up of the mothers/children under study.

5. Conclusion

There are various prevention and treatment strategies to prevent about 60% of all deaths in children which include vaccinations, oral rehydration therapy, effective anti-biotics and prompt treatment of such illnesses as malaria[40]. These interventions however have to be applied in an integrated approach[41] in order to optimize the children's health statuses. Since the World Health Organization indicates undernutrition as the main underlying factor for up to half of all deaths of children under-five years of age, there is therefore the need to reduce poverty and hunger. To reduce malnutrition, improving food security is important. Improving maternal health is also vital for the health of a child and its survival since children who are orphaned have a very high

chance of dying before reaching the age of two compared to those who have a mother[42]. All these strategies if implemented will in turn improve maternal and child nutrition therefore meeting MDGs 1, 4 and 5.

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