

# Pregnant Women's and Community Health Workers' Perceptions of Root Causes of Malnutrition Among Infants and Young Children in the Slums of Dhaka, Bangladesh

Sophie M. Goudet, PhD, Sabina Faiz, PhD, Barry A. Bogin, PhD, and Paula L. Griffiths, PhD

Research in Bangladesh shows that malnutrition among infants and young children is most severe in urban slums. We examined the root causes of malnutrition as perceived by pregnant women and community health workers. We conducted 10 focus group discussions in the slums of Dhaka in 2008 and 2009. Participants accurately perceived inappropriate care, inappropriate environment, inappropriate food, and flooding to be major causes. Recurrent flooding has not traditionally been identified by experts as a cause of malnutrition. We recommend further research to address the nutritional risks flooding creates for vulnerable slum populations. (*Am J Public Health*. 2011;101:1225–1233. doi:10.2105/AJPH.2010.300090)

Urbanization is one of the most important demographic trends of the past century. The latest United Nations (UN) estimates are that by 2030, 55% of the population in Asia will live in cities.<sup>1</sup> Dhaka, the capital of Bangladesh, is among the fastest-growing megacities in the world.<sup>1</sup> Every year, an estimated 300 000 to 400 000 new migrants, mostly of low socioeconomic status, arrive in the city, increasing the demand for dwellings and infrastructure.<sup>2</sup> In 2000, approximately 28% of Dhaka's residents were classified as poor and 12% as extremely poor.<sup>3</sup> Poor households tend to have more people, particularly children, than do nonpoor households, and their members are younger and less educated and have lower school attendance.<sup>3</sup> Approximately 5000 slums are scattered throughout Dhaka, with an estimated 10 million inhabitants.<sup>4</sup> The operational definition of slum, according to the UN Human Settlements Programme, is an area that combines (to varying extents) inadequate access to safe water, sanitation, and other infrastructure; poor structural quality of housing; overcrowding; and insecure residential status.<sup>1</sup>

Bangladesh does not have a comprehensive policy for improving living conditions of slum dwellers.<sup>3</sup> Slum settlements are often demolished, and slum dwellers are forced to leave their homes. Although nongovernmental organizations

are attempting to ensure better access to water and health, the situation in the slums remains difficult.<sup>5</sup> Only 9% of households in the poorest quintile have a sewage line, and 27% obtain water through piped supplies. Most slum households have a shared toilet more than 100 meters from the housing area.<sup>3</sup>

Public health problems arising from these poor living conditions are especially serious for infants and young children, who have acquired little specific immunity to infectious agents. Morbidity rates are high among children younger than 5 years living in Dhaka slums: prevalence of diarrhea is 25% and of respiratory illness, 40%.<sup>6</sup> Low birth weight affects 46% of infants and young children (70% of these were small for gestational age and 17% premature)<sup>7</sup>; these children have an increased risk of remaining lighter and smaller than their peers throughout life.<sup>8</sup>

Few nutritional studies have been conducted in Bangladesh's slums, where crime, insecurity, and scarcity of basic services make research difficult.<sup>5</sup> However, the limited existing data reveal a high prevalence of malnutrition; infants' and young children's nutritional status is worse in slum than in rural poor or urban nonslum populations.<sup>6,9–11</sup> In Mohammedpur, an old slum settlement in Dhaka, the prevalence of malnutrition among infants and young children is

higher than in the rest of the country: 68% of slum children and 49% of children nationwide are stunted (>2 SD below the median reference body length/height for age),<sup>12</sup> 31% of slum children and 17% of children nationwide meet the criterion for wasting (>2 SD below the median reference body weight for height), and 73.2% of slum children and 56% of children nationwide are underweight (>2 SD below the median reference for body weight).<sup>6</sup>

The combination of poor nutritional health, exposure to morbidity, and a difficult living environment results in high mortality rates for infants and young children. In the Dhaka slums of Agargaon, Kamalapur, and Mohammedpur, reported death rates per 1000 children (0–107 months) were 20.5 for boys and 27.0 for girls, according to a cross-sectional survey of 1500 households.<sup>13</sup> In a sample of 100 households, the mortality rate for infants younger than 1 year was 50%.<sup>4</sup>

Malnutrition is not reported as a cause of death in Bangladesh.<sup>13</sup> Sometimes diarrhea, respiratory disease, trauma, or stillbirth is cited as a cause of mortality, but in most cases the cause is unknown. Despite high reported mortality rates, 76% household heads in 1 survey rated their children's health as good to very good and only 19% called it poor.<sup>4</sup> These findings suggest a lack of perception of malnutrition and poor health in children. Perhaps parents' expectations are shaped by the illness and malnourishment of the majority of children in their neighborhoods. Alternatively, because the study took place in the dry season, the children may have been in relatively better health than they were in the rainy season, and their parents therefore perceived them to be healthy.

Malnutrition has long-term negative effects on the physical growth and cognitive development of children; ultimately, severe malnutrition can kill. We explored the perceptions of



Pregnant women building a causal tree with photographs. Photograph by Sophie Goudet.

slum dwellers regarding the root causes of malnutrition so as to aid in the design of interventions to promote better health among their children. Rather than soliciting simple statements about children's health status, we used participant-driven classification systems to identify pregnant women's and community health workers' perceptions of the root causes of malnutrition in Dhaka slums.

## METHODS

We conducted focus group discussions in 4 Dhaka slums, from November 2008 to May 2009. Slums are well-known to be violent and stressful places with rampant crime and drug activity.<sup>5</sup> Fieldwork was extremely challenging, and we had to constantly negotiate access to our target communities through gatekeepers and local drug dealers.

All of the participants were living in the slums (12% in Begunbari, 36% in Kunibara, 18% in Mohammedpur, and 35% in Kamrangir char [a land area surrounded by water]). The participants ( $n=104$ ) were pregnant women ( $n=20$ ; average age=23 years; average number of children=1), experienced community health workers ( $n=72$ ; average

age=29 years; average number of children=2), and newly trained community health workers ( $n=12$ ; average age=29 years; average number of children=2).

The Bangladesh Rural Advancement Committee (BRAC) trained women to be volunteer community health workers as part of the Manoshi program, funded by the Bill and Melinda Gates Foundation and aimed at reducing maternal and child mortality in Bangladesh slums by scaling up proven interventions. Experienced community health workers had at least 1 year of experience in addition to their BRAC training.

We chose pregnant women and community health workers as participants to compare views between groups who are exposed to the issue of malnutrition. We held the focus group discussions in BRAC birth centers, which were well known to most pregnant women and community health workers and were a familiar and safe location for these women. We convened 10 focus groups, with an average of 10 participants: 3 groups of new community health workers, 5 groups of experienced community health workers, and 2 groups of pregnant women. We held enough sessions to reach a saturation of concepts from each group of

participants, that is we stopped when new information was no longer being generated.

## Causal Model

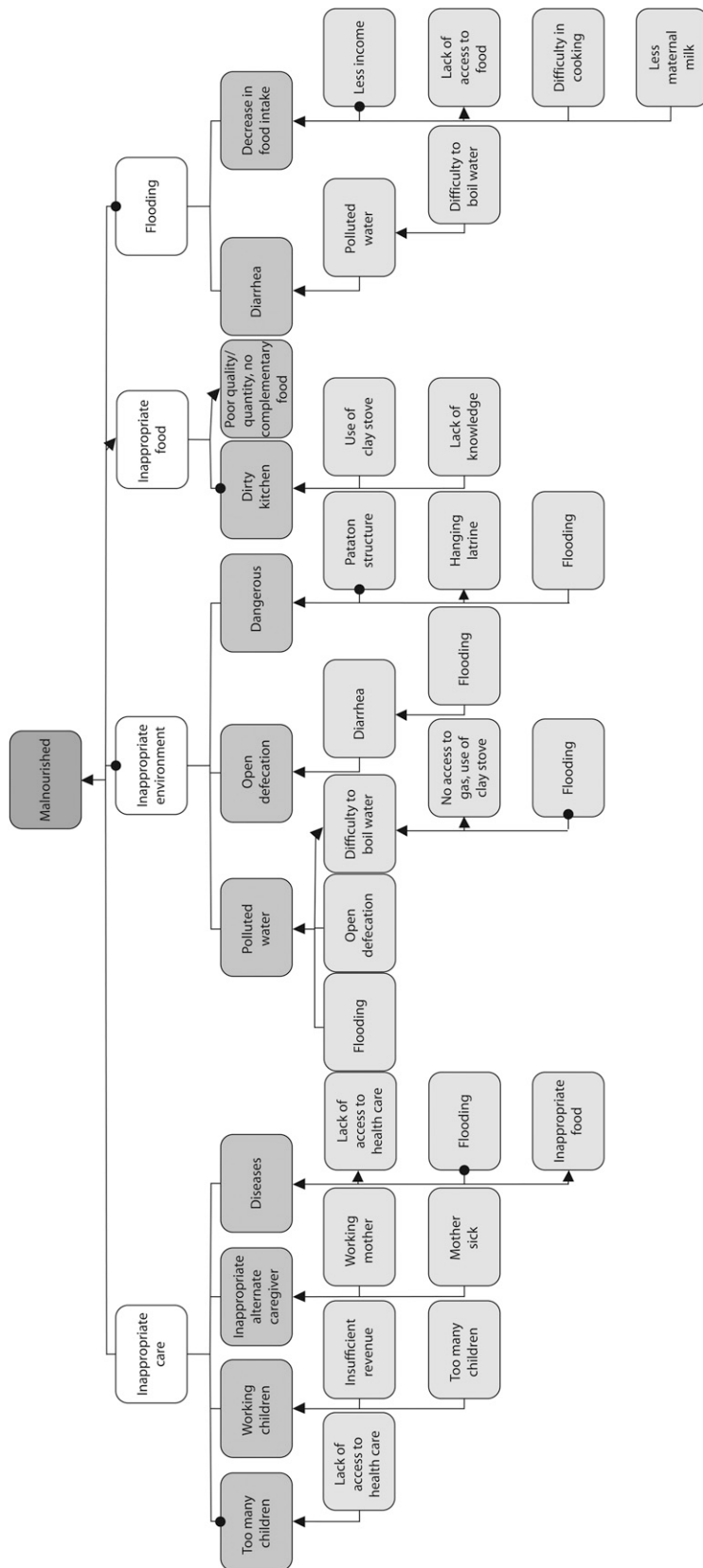
Causal models are constructed to help understand the perception of the underlying contributory factors of a phenomenon.<sup>14</sup> Causal models have been used in qualitative nutrition research.<sup>14-19</sup> For our study, the participants collaborated to explore their perception of malnutrition and to identify the determinants of malnutrition in infants and young children. Because our time was limited, we used a short version of the causal model technique. We limited the participants to a maximum of 9 determinants; an open construction with an unlimited number of determinants is used in the full model.

Our technique combined building a causal model with pile sorting of photographs. The causal model-building technique was previously used to understand the root causes of malnutrition.<sup>14</sup> Ours was the first study, however, to combine this type of model with photographs and pile sorting. We chose this method to facilitate the construction of the causal model by providing familiar verbal representations of the participants' understanding of the causes of malnutrition, accompanied by photographs of places and activities that were familiar to the participants.

## Pile Sorting

We selected 72 photographs to show participants, 80% taken by S.M.G. during previous research and 20% found on the Internet and used with the photograph subjects' permission. The Internet photographs were taken in Bangladesh or India (those from India depicted no cultural differences that would have made them unfamiliar to our participants). The photographs were representative of food, environment, socioeconomic status, caring practices, health, nutrition, education, water, sanitation, and hygiene. For example, a photograph showing girls studying represented education.

Participants were first asked to group photographs with the same characteristics into different piles, so that they would familiarize themselves with the photographs and so that researchers could explore participants' perceptions of the representations in the pictures





inappropriate care, inappropriate environment, inappropriate food, and flooding. Community health workers and pregnant women perceived these roots to be related to malnutrition. Each dominant root cause had a causal link with minor root causes. The closer to the top of the tree the determinant was, the more dominant it was.

### Inappropriate Care

The major determinants identified in the theme of inappropriate care were too many children in a family, working children, inappropriate caregiver, and diseases (Figure 1). Working children were required to earn money for the household. Participants defined an inappropriate caregiver as a child younger than 12 years, an old grandmother, a working mother, or a sick mother.

*Too many children.* Pregnant women and community health workers believed that children become malnourished because they have too many brothers and sisters. Most of the participants believed that having 2 children, 1 boy and 1 girl was “good.” In fact, this family size has been promoted by the Bangladeshi government as “the happy family” as part of its advocacy for family planning and gender balance. Participants in all groups referred to families with many children as “not happy family.” They suggested that parents could not provide proper care for so many children and let them grow without attention, guidance, and rules. They also believed that parents of large families were unable to provide adequate physical comfort: “They all sleep together on the floor” or “They sleep in a dirty place.” Lack of a bed and sleeping on the floor symbolized the poorest of the poor in the slums.

Pregnant women believed large families resulted from a lack of access to health care and family planning. By contrast, community health workers reported that family planning was available for women who desired it through various organizations, but that some women were unwilling to use contraception because they didn’t like its effect on their body or because they wanted a son (even if they already had daughters). Respect for married women in Bangladesh derives from their ability to conceive and reproduce. Marriage and children ensure economic and social security.<sup>28,29</sup> Sons are often preferred because a daughter

incurs a dowry obligation: her parents must pay her husband’s family before and often after her marriage.<sup>30–32</sup> Sons are also expected to contribute income to the household and therefore to support aging parents.<sup>28,33</sup>

*Working children.* Most of the participants perceived that a child who worked became malnourished because there was no money for school. Education was valued mainly by community health workers, who were generally literate themselves, as the key to obtaining a good job and getting out of poverty. School-aged children ( $\geq 5$  years) were pushed in poor families to bring income to the households. As the participants said: “The poor children can’t go to the school,” and “They collect paper to make money.” These children became malnourished, said participants, because their jobs were physically demanding: collecting paper, begging, or selling items to drivers on the road. They stayed outside the whole day in the heat and sun and frequently had to skip meals or eat only roti (flat bread).

Participants in all groups reported that mothers could not afford the small monthly school fees (~US\$1) and school uniforms. In Bangladeshi families with many children, it is common for only 1 to go to school while the others work. Participants reported that mothers often lasted only a few years in demanding garment factory jobs; when they quit to stay at home, their older children were often forced to begin contributing to household income.

*Inappropriate caregivers.* Many pregnant women believed that neglect by sick or working mothers led to malnourishment in children. As one woman put it, “She [the mother] works and has to leave them alone all day long.” Mothers were reported to suspend their infants in a hammock made of a scarf while working outside. Participants described some working mothers locking their children in their room while they were out or leaving the youngest children in the care of the eldest sibling. Alternative caregivers such as young children or elderly grandmothers were common in the slums. These caregivers were typically inappropriate because they lacked the skills, knowledge, or physical capacity to properly care for infants and young children.

Participants in all groups stressed that mothers in the slums often suffered from various diseases, such as anemia, headache,

stomachache, and respiratory infections. They felt weak and exhausted and therefore lacked the physical energy and motivation to provide adequate care to their children, which led to poor health and malnutrition. In households headed by women, usually because of divorce, the task of bringing in income while providing adequate care of children was especially difficult. Although the children’s father, who frequently was remarried and might have more children with his second wife, might contribute a small part of the household income, the major burden of income generation and household tasks was carried by these single mothers. Bangladeshi men tend to play a limited role in caring for the children because caring tasks tend to be gender specific and remain women’s duties. However, participants reported that women frequently received support from neighbors and help with child care when needed.

*Diseases.* Participants in all groups reported that children were malnourished because they suffered from various diseases, such as diarrhea, scabies, pneumonia, asthma, and anemia, and from debilitating conditions such as iodine deficiency, worms, and physical malformations or handicaps. Diarrhea and scabies were the most frequently mentioned diseases.

Disability (which participants referred to as polio, although the disease was eradicated in Bangladesh in 1990) was associated with a lack of access to health care. Children who defecated on the bamboo *pataton* (an elevated path outside the latrines) were assumed to be suffering from diarrhea, which indicated malnourishment. Participants in all groups explained that a child who suffered from diarrhea quickly lost weight and became weak because he could not eat properly, and the food eaten would “go through its body too quickly.” An alternative explanation offered was that children might acquire diarrhea from poor hygiene practices, indicated by defecating outside the latrines.

Participants also identified flooding, which pollutes bathing and drinking water, as a cause of diarrhea. Scabies and pneumonia were especially common in the slums during the rainy season. As a pregnant woman describing scabies said, “This is during flooding. . . . The child is malnourished, he has scabies . . . and cannot have proper bath.”

Respondents in all groups also attributed malnutrition to worms. Pregnant women explained that a child might eat too many *misti* (sweets), eat with dirty hands, or walk barefoot: “His stomach becomes big and he suffers from stomach ache,” “He needs to go often to toilets,” and “If it’s not treated, he will become skinny.”

### Inappropriate Environment

Slum environments were “not peaceful” and were difficult to live in, participants reported, which contributed to increased risk of poor nutrition outcomes among infants and young children. The major roots related to inappropriate environment were polluted water, open defecation, and a dirty, dangerous, and open (homeless) environment (Figure 1).

**Polluted water.** Polluted waters—stagnant water, floodwater, uncovered water, or wastewater—are everywhere in the slums. Most slums in Dhaka are built on top of polluted waters because these are the only areas not deemed suitable for more expensive construction. Participants cited polluted water in its various forms as highly associated with malnutrition. They reported that water supplies in the slums were inadequate in both quantity and quality.

Pregnant women said that children became malnourished by drinking water that had not been boiled or had been left uncovered, which caused sickness. Pregnant women mentioned that their regular water supply from hand pumps could become polluted during the rainy season because floodwater could get into the water pipeline through the pipe joints. They reported that this water tasted and smelled bad and deduced that if this water was not boiled, children who drank it would become sick and malnourished. Women reported they had limited use of a gas stove for cooking (a maximum of 30 minutes per day on 2 burners) because many households shared a communal kitchen. They also said that the mothers who used *matir chula* (clay stoves) could not boil water because it required too much time and firewood.

Pregnant women also perceived floodwater to be dirty, because latrines frequently overflowed, and black water mixed with floodwater, rubbish, dead cockroaches, snakes, and rats. This water flowed through the alleyways of the slums. One pregnant woman said, “During flooding, the child is not given proper bath. . . .

He drinks polluted water. . . . At this time, it’s impossible to boil water!” Pregnant women reported that during the rainy season, slum dwellers were not able to boil water because gas connections were cut.

**Open defecation.** Open defecation exacerbates the problems caused by floods because dirty water stagnates or flows through homes and leads to diarrhea. One pregnant woman said, “The child defecates on a bamboo path above dirty water. . . . This is floodwater. . . . He has diarrhea.” Another pregnant woman explained, “When the dirty water goes into the belly then he gets diarrhea.” According to all of the participants, open defecation into floodwater was frequent because either the latrines were made inaccessible by flooding or they overflowed. Children were often forced to walk through or swim in heavily flooded areas to access supplies, and they might drink some of the dirty water.

**Open, dirty, and risky conditions.** Pregnant women perceived the environment in their slum settlements to be dirty because “there is lots of garbage underneath houses.” Slum dwellers threw their garbage underneath their doorstep or on top of a garbage pile at the entrance of the slums, because they lacked other options. Children played in and with the garbage, thereby exposing themselves to disease. According to pregnant women, *patatons* in slums were dangerous and risky because they were built on stilts and could be uneven, broken, and unstable. Participants believed that this unsafe environment contributed to malnutrition in infants and young children because they lacked suitable places to play.

Respondents also attributed malnutrition to living in the open. Participants held cultural beliefs about airborne disease transmission and thus considered it harmful for infants to live outdoors. Pregnant women stressed that mothers should not have to work and should keep their babies at home “under a roof” to protect them against diseases.

### Inappropriate Food

Participants identified dirty kitchens and poor quality or quantity of food as the major components of the inappropriate food theme (Figure 1).

**Dirty kitchen.** Community health workers explained that the pictured child was malnourished

because “his mother cooks in a very dirty place,” and “She does not have sufficient knowledge. She is careless and doesn’t arrange well the cooking environment.” The health workers stressed the mother’s lack of knowledge. They stated that cooking equipment should be kept neatly on a shelf and drinking water should be stored in a *kulchi* (clay or metal container) with a cover. They explained that a good communal kitchen was a clean kitchen with tall gas stoves, because food cooked on gas stoves placed low to the ground was vulnerable to contamination and to flooding during the rainy season.

**Matir chula** were considered to be the worst means of cooking and were associated with malnutrition because they were frequently used in households without access to gas. In the slums, the lowest rent was charged for rooms without a gas connection. The poorest slum dwellers cooked with *matir chula*; it was extremely time consuming, so mothers cooked only once a day. It was also costly to purchase combustible material, so typically mothers looked for wood in the streets. Because of these conditions, participants suggested that mothers could not cook special meals for their children. The community health workers stressed that mothers should prepare and feed their infants and young children special meals to meet their nutritional needs, but the lack of facilities for doing this was a barrier to meeting this goal. During flooding, *matir chula* are used by more households because gas lines are cut.

**Poor quality and quantity of food.** Pregnant mothers said, “The family eats not covered food,” and “That’s why the child is in bad health.” According to the participants, open food might spoil quickly and be contaminated by flies. Community health workers said, “The child doesn’t get sufficient food because his parents cannot afford it,” and “The mother does not breastfeed her child and cannot prepare nutritious food like *khichuri* [a rice, vegetable, and lentil dish].”

The community health workers recognized the importance of exclusive breastfeeding for infants younger than 6 months but also reported that working mothers might be forced to stop breastfeeding during the day and that providing liquids early in infancy was a strong cultural practice. *Suji*, a mixture of rice or wheat flour, sugar, and water or milk, was

commonly given to infants and young children as a replacement for or supplement to breast-milk. Health workers described bottle feeding as a determinant of malnutrition, because mothers who could not afford proper formula milk might substitute *suji*, which was often prepared in a highly dilute solution and served in unclean bottles. They perceived this to be a root cause of malnutrition because *suji* did not provide adequate nutrition, was introduced at too early an age, and exposed the infant to disease. By contrast, the pregnant women said that bottle feeding should substitute when a mother lacked sufficient milk.

Regarding older children, community health workers explained, “The child is weak because he does not eat vegetables.” The Ministry of Health and various organizations, including BRAC, that work in the slums have promoted *khichuri* as a supplement food for children older than 1 year. *Khichuri* is nutritious, cheap, and easy to prepare. However, the community health workers said that even they were rarely able to prepare *khichuri* for their own children, because of the constraints of communal kitchens.

### Flooding

During the rainy season, children became “bony” and lost weight because food intake decreased and diarrhea episodes increased (Figure 1). These conditions affected everyone in the slums: “In this unhealthy environment, a healthy man becomes unhealthy,” said a pregnant woman.

**Decreased food intake.** Pregnant women explained, “In the month of June, July, and August it starts with storm and rain,” “Then we cannot work,” “We have less money to buy food,” “We eat less and breastfeeding mothers have less milk,” and “Life is then so painful!” Most of the fathers were rickshaw pullers and could not work during the rainy season because the roads were inundated. Women could not go to work at the garment factories because they feared traveling through the water and because exposing their ankles when lifting their clothing above the water and wearing soaked and clinging clothing in public violated their tenets of modesty. The lowered income and food shortages caused most participants to decrease their food intake by 50%. Mothers tended to skip meals in favor of feeding men and children. Consequently, some mothers had

to stop breastfeeding during the rainy season because of their own poor nutritional health.

**Diarrhea.** Pregnant women reported that children also became malnourished because they suffered from diarrhea caused by dirty water. In their words, “Latrines go under water,” “Stools float on the water,” and “Children have then scabies and diarrhea.” Community health workers stressed the lack of knowledge of slum residents, with one stating “They bathe their children with dirty water,” “They don’t understand,” and “This is the floodwater. They are passing urine and stool in this water and they bathe again.” It was so difficult to reach the street that few went there to get their drinking water in a kulchi from the tube well (a hand-pumped apparatus that supplies groundwater).

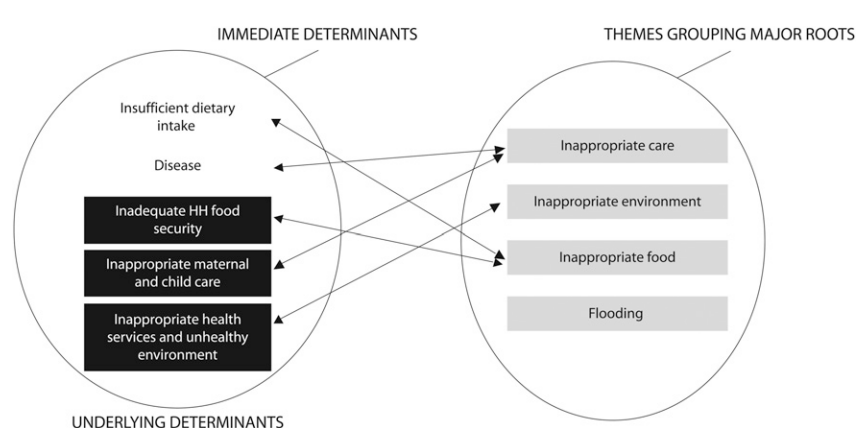
### DISCUSSION

We combined causal modeling and pile sorting of photographs to reach a better understanding than either technique alone would provide of the perceptions of root causes of malnutrition held by mothers and community health workers living in the slums of Dhaka, Bangladesh.

We compared the conceptual framework developed by the participants in our focus group discussions to the UNICEF framework, developed in 1990 as part of the UNICEF nutrition strategy.<sup>34</sup> The UNICEF framework

incorporates the multisectoral causes of malnutrition, such as food, health, and caring practices (child care), further classifying them as immediate (individual level), underlying (household or family level), and basic (societal level). With 1 exception, all of the determinants of malnutrition identified in our focus group discussions corresponded well with UNICEF determinants (Figure 2). Flooding, not included in the UNICEF framework, was classified as a disaster factor rather than an environmental factor because it was not a consistent presence in the environment; it appeared to be newly perceived as a root cause of malnutrition by our participants.

This comparison shows that pregnant women and community health workers living in the slums have an excellent perception, in good alignment with the views of international experts, of the root causes of malnutrition in infants and young children. The majority of the participants were experienced community health workers, which explains their good understanding of the UNICEF determinants of malnutrition. However, even newly trained community health workers and pregnant women with no training evinced a similar level of understanding. Newly trained and experienced community workers strongly associated malnutrition with inappropriate food; pregnant mothers attributed it more to inappropriate environment and flooding (Table 1). This difference was likely attributable to the health



Note. HH = household.

**FIGURE 2—Comparison of conceptual frameworks constructed by UNICEF and by focus groups of pregnant women and community health workers in Dhaka, Bangladesh, 2008–2009.**

**TABLE 1—Comparison of Causal Models of Roots of Malnutrition Built by Pregnant Women and Community Health Workers: Dhaka, Bangladesh, 2008–2009**

| Root Causes of Malnutrition       | Perceptions of Effect on Malnutrition                                                                                                          |                                                                                                            |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
|                                   | Community Health Workers                                                                                                                       | Pregnant Women                                                                                             |
| Inappropriate care                |                                                                                                                                                |                                                                                                            |
| Too many children                 | Major root cause linked to the effect of contraception on women's body and gender preference                                                   | Major root cause linked to lack of access to health care and family planning                               |
| Working children                  | Major root cause linked to lack of education, probably because respondents were literate                                                       | Major root cause linked to need for additional household income                                            |
| Working mother                    | Not a major root cause, probably because respondents worked                                                                                    | Major root cause linked to children being left alone while mothers worked                                  |
| Diarrhea                          | Major root cause linked to lack of knowledge of hygiene                                                                                        | Major root cause linked to lack of access to safe water for drinking and bathing and to cooking facilities |
| Inappropriate environment         | Not a major root cause, probably because respondents lived in more expensive rooms that were less exposed to flooding and better constructed   | Major root cause                                                                                           |
| Inappropriate food                |                                                                                                                                                |                                                                                                            |
| Dirty kitchen                     | Major root cause linked to lack of knowledge about cleanliness and cooking techniques                                                          | Not a major root cause                                                                                     |
| Poor quantity and quality of food | Major root cause linked to lack of knowledge and poor breastfeeding and complementary feeding practices                                        | Major root cause linked to poor hygiene                                                                    |
| Bottle feeding                    | Minor root cause because <i>sujji</i> <sup>a</sup> does not provide adequate nutrition, is introduced too early, and exposes infant to disease | Not a root cause because sometimes necessitated by insufficient breastmilk supply                          |
| Flooding                          | Not a major root cause, probably because respondents were less affected by flooding because of better housing                                  | Major root cause                                                                                           |

<sup>a</sup>A mixture of rice or wheat flour, sugar, and water or milk, which is diluted for infant bottles.

worker training, which emphasized traditional causes of malnutrition. The pregnant women's perception of malnutrition was not influenced by training but probably arose from their experiences with the slum environment and flooding. In addition, the community health workers were literate, and their job status placed them in the highest economic group among the poor. Some had a family link with the landlord of the slum where they lived, and they likely lived in better rooms or in areas less exposed to flooding and not constructed on top of a *pataton*.

Community health workers identified inadequate breastfeeding and supplementary feeding practices as root causes of malnutrition arising from insufficient knowledge. In particular, the difference in perception associated with bottle feeding illustrates the dilemma faced by mothers in the slums. Community health workers were educated about the risks of improperly prepared food and dirty bottles. Pregnant mothers, by contrast, were more aware of insufficient breastmilk caused by their own poor health and nutrition, especially

during floods, and were afraid their perceived lack of breastmilk would expose their children to malnutrition. They therefore believed bottles should supplement breastfeeding. Unfortunately, most mothers could not afford recommended amounts of infant formula and would dilute the formula, exposing their children to a greater health risk from inadequate nutrition. Research from Baqui et al. confirms these findings and highlights the risk of early supplementation with powdered milk.<sup>35</sup>

We previously showed the importance of understanding mothers' limitations and constraints regarding breastfeeding, such as insufficient milk supply and employment.<sup>36</sup> Similarly, Zeitlyn and Rowshan found that mothers and health professionals in the Dhaka slums regarded insufficient breastmilk with ambivalence.<sup>37</sup> Mothers blamed their poor nutrition, and health professionals blamed the mothers' inadequate breastfeeding and caring practices.

Interventions to promote breastfeeding often fail to take into account the knowledge and beliefs on which women rely. For example, in Bolivia, anthropological research on

breastfeeding revealed that health interventions that promoted the biomedical and economic benefits of breastfeeding failed to take into account the ways culture shaped this practice.<sup>38</sup> Mothers experienced strong peer pressure to view their milk as insufficient and unhealthy and ceased to breastfeed their children.

Other differences we detected in perception likely arose from differences in social status (e.g., a family link with the landlord), education (literate versus illiterate), and occupational status (working versus nonworking) between the community health workers and the pregnant women. Lefèvre and Beghin<sup>19</sup> also observed differences in perception between causal models built by health professionals and by mothers: health professionals named microbiological factors, caretaker behavior, and external factors as roots of malnutrition; mothers emphasized children's behavior. These differences in perceptions should be taken into account in designing interventions in the slums, because they influence the way nutrition interventions will be received by their intended beneficiaries. Interventions informed by their intended



participants' knowledge and perceptions are more likely to succeed.

Flooding is a newly perceived determinant of malnutrition that warrants further study. Slum dwellers in Dhaka are highly vulnerable to flooding because slums are often constructed on precarious sites such as embankments and garbage dumps.<sup>3</sup> These households, socially vulnerable because of their extreme poverty, are also more likely to have no choice but to live where they are exposed to flooding and its attendant health risks.<sup>39,40</sup> The cheaply built bamboo basements of slum housing often sit below water levels typically reached by rainy season floods.<sup>41</sup>

The effect of flooding on health is difficult to evaluate.<sup>42–46</sup> A study performed during the floods of 1998 revealed that women and children were the most vulnerable groups and that increased food prices resulted in decreased food intakes and changes in women's diet.<sup>47</sup> Qualitative findings suggest that feeding practices for infants and young children deteriorate during flooding in Dhaka slums.<sup>36</sup> These practices are poor in normal, nonflood periods and become much worse during flooding. Mothers see the negative health effects of flooding when their children lose weight and become ill, but they are unable to prevent them. They attempt to preserve their children's health through coping strategies that have other negative consequences.<sup>36</sup> For example, mothers tend to decrease their own food intake to favor their children, thereby exposing themselves to undernutrition. This leads to an inability to exclusively breastfeed their infants, who are then put at risk for undernutrition. Decreases in breastmilk have been reported as a frequent problem faced by mothers during flooding. If food is available, they also face difficulties in cooking, and the household may only eat dry food such as *muri* (puffed rice) or *chira* (flattened rice).

Unfortunately, no quantitative data have been reported on the contribution of flooding to malnutrition among slum dwellers. In rural and other flood-affected areas, infants' and young children's nutritional health has been shown to be negatively affected by flooding.<sup>48–54</sup> Further research should be conducted to identify nutrition interventions that can ameliorate the long-term effects of exposure to flooding on infants and young children. It is unlikely that slums will in the foreseeable future cease to be built on

marginal, flood-prone lands whose very undesirability makes residents feel less vulnerable to eviction, so in the short term interventions should be developed to help households develop coping strategies to avoid some of the worst nutritional consequences of flooding.

### Limitations

Despite the novelty of the causal model approach, the conceptual frameworks built during focus group discussions were linear, linking an effect to a cause. Frequently, participants struggled to identify cause and effect. For example, some had difficulty differentiating cause and effect between malnutrition and diarrhea; indeed, the causal link between them is bidirectional. During the focus group discussions, participants were nonetheless forced to choose a direction, because the model was causal and linear.

This limitation reflects the many vicious circles existing in which malnutrition may be not only the effect but also the cause. Malnutrition should also be studied through a systems approach that recognizes that causes and effects are often dynamically interdependent. We suggest a causal loop modeling approach for future research.<sup>55</sup> Such an approach would accommodate negative and positive links between variables and allow for nonlinear dynamics in the model.

### Policy Recommendations

In the Dhaka region, urban growth, compounded by climate variability as well as other drivers of change, could increase the intensity of flooding and the vulnerability of slum populations. Flooding is clearly a major determinant of malnutrition in the slums, and emergency nutritional interventions are needed during the rainy season. This recommendation is also supported by our previous findings about coping strategies used by mothers in the slums.<sup>36</sup> Security of the environment, caring practices, and food are determinants of health, and long-term efforts to prevent malnutrition should address all of these factors.

These research findings highlight the need to update the UNICEF conceptual framework.<sup>34</sup> An important first step would be to include natural disasters such as floods in the framework, because this model is used by policymakers to plan interventions. Incorporating floods and other natural disasters (e.g., earthquakes and tsunamis)

in the framework could help to drive a policy agenda for initiating interventions to help those most vulnerable to malnutrition in many settings.

### Conclusions

We found that pregnant women and community health workers in the Dhaka slums had an accurate perception of the root causes of malnutrition. Inadequate knowledge therefore does not appear to be a root cause of malnutrition. The fact that flooding is newly identified as a root cause of malnutrition stresses the need for further research on this recurrent phenomenon. A holistic approach to disaster preparedness should aim to reduce social vulnerability by first addressing poverty. Slum dwellers need improved access to clean water and sanitation.

Our study also showed that the UNICEF conceptual framework should be updated to include natural disasters as a determinant of malnutrition. Interventions should be developed to help communities overcome the negative consequences of natural disasters such as floods, especially among infants and young children, who are the most vulnerable to malnutrition. ■

### About the Authors

*Sophie M. Goudet, Barry A. Bogin, and Paula L. Griffiths are with the Centre for Global Health and Human Development, School of Sports, Exercise and Health Sciences, Loughborough University, Loughborough, UK. Sabina Faiz is with the James P Grant School of Public Health, Bangladesh Rural Advancement Committee, Dhaka, Bangladesh.*

*Correspondence should be sent to Sophie Goudet, PhD researcher, Centre for Global Health & Human Development, SSEHS, Loughborough University, LE11 3TU United Kingdom (e-mail: s.goudet@lboro.ac.uk). Reprints can be ordered at <http://www.ajph.org> by clicking the "Reprints/Eprints" link.*

*This article was accepted November 27, 2010.*

### Contributors

S.M. Goudet originated the study, collected the qualitative data in the Dhaka slums, conducted the analyses, and led the writing of the article. S. Faiz provided insight information and advice on collection of qualitative data in Dhaka slums. B.A. Bogin and P.L. Griffiths assisted with the study and analyses and provided guidance. All authors helped to conceptualize ideas and review drafts of the article.

### Acknowledgments

Research in Dhaka, Bangladesh, was supported by Action Contre la Faim.

We thank the Bangladesh Rural Advancement Committee (BRAC) staff working in the slums for their constant support. We are also grateful to the mothers, their children, and the BRAC community health workers



living in the slums for their time, understanding, and willingness to share their knowledge. We gratefully acknowledge the comments and suggestions provided by James Robertson on an earlier draft of the article.

### Human Participant Protection

The Loughborough University ethical committee approved the study.

### References

1. *Improving the Lives of 100 Million Slum Dwellers*. London, UK: Earthscan and UN Habitat; 2003.
2. *Bangladesh Demographic and Health Survey 2004*. Calverton, MD: National Institute of Population Research and Training; 2005.
3. Baker JL. *Dhaka: Improving Living Conditions for the Urban Poor*. Washington, DC: World Bank; 2007. Bangladesh Development Series 17.
4. Podymow T, Turnbull J, Islam M, Ahmed M. Health and social conditions in the Dhaka slums. International Society for Urban Health. 2002. Available at: <http://www.isuh.org/download/dhaka.pdf>. Accessed June 25, 2008.
5. Rashid SF. Strategies to reduce exclusion among populations living in urban slum settlements in Bangladesh. *J Health Popul Nutr*. 2009;27(4):574–586.
6. Pryer J. *Poverty and Vulnerability in Dhaka Slums: The Urban Livelihood Study*. Hampshire, UK: Ashgate Publishing; 2003.
7. Arifeen SE, Black RE, Caulfield LE, et al. Infant growth patterns in the slums of Dhaka in relation to birth weight, intrauterine growth retardation, and prematurity. *Am J Clin Nutr*. 2000;72(4):1010–1017.
8. Bogin B. *Patterns of Human Growth*. 2nd ed. Cambridge, UK: Cambridge University Press; 1999.
9. Izutsu T, Tsutsumi A, Islam AM, Kato S, Wakai S, Kurita H. Mental health, quality of life, and nutritional status of adolescents in Dhaka, Bangladesh: Comparison between an urban slum and a non-slum area. *Soc Sci Med*. 2006;63(6):1477–1488.
10. Hassan N, Ahmad K. The nutrition profile of the slum dwellers: a comparison with the rural poor. *Ecol Food Nutr*. 1991;26(3):203–214.
11. Kiess L. Comparison of nutritional status among pre-school children living in rural, slum and urban Dhaka [abstract]. Seventh Annual Scientific Conference; February 14–15, 1998; Dhaka, Bangladesh.
12. National Institute of Population Research and Training. *Bangladesh Demographic and Health Survey 1996–1997*. Dhaka: Government of Bangladesh, Ministry of health and Family Welfare; 1997.
13. Hussain A, Ali K, Kvale G. Determinants of mortality among children in the urban slums of Dhaka city, Bangladesh. *Trop Med Int Health*. 1999;4(11):758.
14. Lefèvre P, Suremain CE, Rubin de Celis E, Sejas E. Combining causal model and focus group discussions experiences learned from a socio-anthropological research on the differing perceptions of caretakers and health professionals on children's health (Bolivia/Peru). *Qual Rep*. 2004;9(1):1–17.
15. Beghin I, De Muynck A, Van der Stuyft P, Mentens H. Can the causal model approach contribute to the study of the epidemiology and the control of sleeping sickness? *Ann Soc Belg Med Trop*. 1989;69(Suppl 1):37–47.
16. Beghin I, Cap M, Dujardin B. *A Guide to Nutritional Assessment*. Washington DC: World Health Organization; 1988.
17. Beghin I. *Le Modèle Causal Dans la Surveillance Nutritionnelle* [The causal model of nutrition surveillance]. Tunis, Tunisia: Options Méditerranéennes; 2002: 29–38.
18. Tonglet R, Mudosa M, Badashonderana M, Beghin I, Hennart P. The causal model approach to nutritional problems: an effective tool for research and action at the local level. *Bull World Health Organ*. 1992;70(6):715–723.
19. Lefèvre P, Beghin I. *Guide to Comprehensive Evaluation of the Nutritional Aspects of Projects and Programmes*. Anvers: Institut de Médecine Tropicale; 1991; Health and Community Working Paper 27.
20. Cogill B. *Anthropometric Indicators Measurement Guide*. Rev ed. Washington, DC: Food and Nutrition Technical Assistance Project, Academy for Educational Development; 2003.
21. Albarello L. *Pratiques et Methodes de Recherche en Sciences Sociales* [Practices and methods of research in social sciences]. Paris, France: Armand Colin; 1995.
22. Copans J, de Singly F. *Introduction à l'Ethnologie et à l'Anthropologie* [Introduction to ethnology and anthropology]. Paris, France: Nathan; 1996.
23. Denzin NK, Lincoln YS. *Collecting and Interpreting Qualitative Materials*. London, UK: Sage Publications; 2003.
24. Denzin NK, Lincoln YS. *Handbook of Qualitative Research*. London, UK: Sage Publications; 1994.
25. Peltó PJ, Peltó GH. *Anthropological Research: The Structure of Inquiry*. Cambridge, UK: University Press; 1996.
26. Sanjek R. *Fieldnotes: The Makings of Anthropology*. New York, NY: Cornell University Press; 1990.
27. Muhr T. *User's Manual for ATLAS.ti 5.0*. Berlin, Germany: ATLAS.ti Scientific Software Development GmbH; 2004.
28. Rashid SF. *Marriage Practices in an Urban Slum: Vulnerability, Challenges to Traditional Arrangements and Resistance by Adolescent Women in Dhaka, Bangladesh*. Singapore: Asia Research Institute; 2006. ARI Working Paper 72. Available at: <http://www.ari.nus.edu.sg/pub/wps.htm>. Accessed April 10, 2011.
29. Rashid SF. Kal distri, stolen babies and 'blocked uterus': poverty and infertility anxieties among married adolescent women living in a slum in Dhaka, Bangladesh. *Anthropol Med*. 2007;14(2):153–166.
30. Amin R, Mariam A. Son preference in Bangladesh: an emerging barrier to fertility regulation. *J Biosoc Sci*. 2008;19(2):221–228.
31. Chowdhury MK, Bairagi R. Son preference and fertility in Bangladesh. *Popul Dev Rev*. 1990;16(4):749–757.
32. Edlund L. Son preference, sex ratios, and marriage patterns. *J Polit Econ*. 1999;107(6):1275–1304.
33. Kabir ZN, Szebehely M, Tishelman C. Support in old age in the changing society of Bangladesh. *Ageing Soc*. 2002;22(5):615–636.
34. *The State of the World's Children 1998*. New York, NY: Oxford University Press and United Nations Children's Fund; 1997.
35. Baqui AH, Paljor N, Nahar Q, Silimperi D. *Infant and Child Feeding Practices in Dhaka Urban Slums: International Centre for Diarrhoeal Disease Research*. Dhaka, Bangladesh: International Centre for Diarrhoeal Disease Research; 1993.
36. Goudet SM, Griffiths PL, Bogin BA, Selim N. Impact of flooding on feeding practices of infant and young children in Dhaka, Bangladesh slums: what are the coping strategies? *Matern Child Nutr*. 2010; doi: 10.1111/j.1740-8709.2010.00250.x. Epub ahead of print.
37. Zeitlyn S, Rowshan R. Privileged knowledge and mothers' "perceptions": the case of breast-feeding and insufficient milk in Bangladesh. *Med Anthropol Q*. 1997; 11(1):56–68.
38. Tapias M. 'Always ready and always clean?': competing discourses of breast-feeding, infant illness and the politics of mother-blame in Bolivia. *Body Soc*. 2006;12(2):83–108.
39. Hardoy JE, Mitlin D, Satterthwaite D. *The Environmental Problems of Third World Cities*. London, UK: James & James/Earthscan; 1992.
40. Adger WN. Social vulnerability to climate change and extremes in coastal Vietnam. *World Dev*. 1999; 27(2):249–269.
41. Wood G, Salway S. Introduction: securing livelihoods in Dhaka slums. *J Int Dev*. 2000;12(5):669–688.
42. Kolsky P, Shaw R. Surface water drainage—how evaluation can improve performance. *Waterlines*. 1998; 17(1):15–18.
43. Ahern M, Kovats RS, Wilkinson P, Few R, Matthies F. Global health impacts of floods: epidemiologic evidence. *Epidemiol Rev*. 2005;27(1):36–46.
44. McCluskey J. Water supply, health and vulnerability in floods. *Waterlines*. 2001;19(3):14–17.
45. Kondo H, Seo N, Yasuda T, et al. Post-flood— infectious diseases in Mozambique. *Prehosp Disaster Med*. 2002;17(3):126–133.
46. Akter N. *BRAC's Experience on Flood Disaster Management*. Dhaka, Bangladesh: Environmental Research Unit, Research and Evaluation Division, Bangladesh Rural Advancement Committee; 2004.
47. Rashid SF. The urban poor in Dhaka City: their struggles and coping strategies during the floods of 1998. *Disasters*. 2000;24(3):240–253.
48. Chowdhury MK, Gupta VM, Bairagi R, Bhattacharya BN. Does malnutrition predispose to diarrhoea during childhood? Evidence from a longitudinal study in Matlab, Bangladesh. *Eur J Clin Nutr*. 1990;44(7):515–525.
49. Woodruff BA, Toole MJ, Rodrigue DC, et al. Disease surveillance and control after a flood: Khartoum, Sudan, 1988. *Disasters*. 1990;14(2):151–163.
50. Centers for Disease Control and Prevention. Health assessment of the population affected by flood conditions—Khartoum, Sudan. *MMWR Morb Mortal Wkly Rep*. 1989;37(51):785–788.
51. Chowdhury MR. An assessment of flood forecasting in Bangladesh: the experience of the 1998 flood. *Nat Hazards*. 2000;22(2):139–163.
52. del Ninno C, Lundberg M. Treading water. The long-term impact of the 1998 flood on nutrition in Bangladesh. *Econ Hum Biol*. 2005;3(1):67–96.
53. Bloem MW, Moench-Pfanner R, Panagides D, eds. *Health & Nutritional Surveillance for Development*. Singapore: Helen Keller International, Asia Pacific Regional Office; 2003.
54. Goudet S, Griffiths P, Bogin B. Mother's BMI as a determinant of infant and young children's nutritional status in the post-emergency phase of a flood. *Disasters*. In press.
55. Richardson GP. Problems in causal loop diagrams revisited. *Syst Dyn Rev*. 1997;13(3):247–252.

Copyright of American Journal of Public Health is the property of American Public Health Association and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.