*Children, Youth and Environments 18(1), 2008*

# The Implications of Climate Change for Children in Lower-Income Countries

**Sheridan Bartlett**
*Children's Environments Research Group*
*The Graduate Center, City University of New York*

Citation: Bartlett, Sheridan (2008). "The Implications of Climate Change for Children in Lower-Income Countries." *Children, Youth and Environments* 18(1): 71-98. Retrieved [date] from http://www.colorado.edu/journals/cye.

---

## Abstract

*This article provides a brief overview of the implications for children of climate change—both of extreme weather events and more gradual changes, along with the adaptations likely to be made at various levels. Because data on the impacts of climate change tend not to be disaggregated by sub-population or by age, there is insufficient knowledge to present a comprehensive picture of the impacts for this age group. Instead, this paper extrapolates from existing knowledge in a number of related areas to present a picture of the probable implications for children's health, safety, and long-term well being, especially in lower-income countries and communities that are at highest risk from climate change. The article stresses not only children's vulnerability, but also their resilience and their capacity as active agents to play a role in addressing the challenges they confront related to climate change.*

**Keywords:** children, climate change, impacts, resilience, vulnerability

## Introduction[1]

There is growing discussion of the implications of climate change for children. Save the Children UK (2007) has just released a report on the topic, estimating that over the next decade, 175 million children annually will be affected by disasters triggered by climate change—both extreme weather events and more "slow-moving disasters" like desertification and rising sea levels. UNEP, UNICEF, and WHO (2002), in a joint report on children in the new millennium, point to climate change as a significant component of the challenges facing this generation of children. A UNICEF report (2007a) points to the damaging impact climate change is likely to have on the achievement of the Millennium Development Goals; and an editorial in the *Journal of Tropical Pediatrics* has recently proposed that climate change is emerging as the single greatest threat to the world's children, given its critical contribution to all the other serious threats—hunger, disease, war, poverty, and displacement (Waterston 2006).

The discussion of the implications of climate change for children, however, tends for the most part to be limited to research, publications, and venues focused specifically on children. Systematic attention to children does not feature much in the broader discourse on climate change and the adaptations needed to respond to it. The most recent report from Working Group II of the Intergovernmental Panel on Climate Change (IPCC) provides a good indication of the imbalance with regard to children: while the chapter on health gives good attention to the disproportionate vulnerabilities of young children (Confalonieri et al. 2007), the chapter on adaptation practices makes only two references to children (and old people), both embedded in a box on the vulnerability of women (Adger et al. 2007). In some broader discussions, there is not even this level of attention: a 2003 report on urban indicators of climate change, for instance, makes only two references to children, both related to their susceptibility to asthma (Epstein et al. 2003). In fact, most of the numerous public health problems discussed in this report have disproportionate impacts for children, a reality that has policy implications and that surely deserves closer attention.

Children as a group, like communities in poverty, are likely to be affected by climate change in particular ways, and generally in more extreme ways, than the population at large because of their greater vulnerability to a range of associated stresses, as well as the long-term developmental implications of these vulnerabilities. This is not to say that all children are equally at risk. Events and changes that can have critical implications for children in poverty in some places may have little or no effect for children in most high-income countries and communities. Nor are all children more vulnerable than adults to all aspects of climate change or disaster. We must be wary of the kind of sentimental oversimplification of the facts that presents children always in the guise of helpless victims. Children can be extraordinarily resilient in the face of significant

[1] This article is a summary version of a Working Paper being prepared for the International Institute for Environment and Development (IIED) in London on urban children, climate change, and the implications for adaptation in low- and middle-income countries.

challenges.[2] But there are also concrete and particular ways in which children of different ages and in different places are especially at risk from conditions related to climate change. As in the case of many poor groups, if adaptations to climate change fail to take account of this, they will be less than adequate in responding to the challenges.

Almost all of the disproportionate impacts for children are exacerbated by poverty and by the difficult choices that must be made by poor households as they adapt to more challenging conditions. The pathways between poverty and poor developmental outcomes are numerous and well established (Walker et al. 2007). Many of these links are likely to be intensified by the added pressures of climate change.

There is not enough hard knowledge about the implications of climate change for children to present a comprehensive picture. Even where the more general impacts of climate change have been estimated, the figures are not disaggregated to reflect the specific implications for children. But it *is* possible to extrapolate from existing knowledge in a number of related areas. Work on environmental health, disaster responses, household coping strategies, the range of effects for children of poverty, the resilience of children, and the beneficial effects of their participation in various efforts—all contribute to a broad sense of the potential implications of both disasters and responses to disasters, as well as of more gradual change and the adaptations likely to be made at various levels. Nor is this extrapolation merely an academic exercise, given that the risks posed by climate change are, for the large part, intensifications of existing environmental problems in areas already at risk from weather-related phenomena. Events need not be caused specifically by changes in climate to demonstrate the high vulnerability of many areas and the people within them to extreme events and the limited capacity of both governments and international agencies to respond adequately.

## Some Background on Climate Change

The latest report from the IPCC states with high confidence that changes in climate, especially increases in temperature, are affecting a wide range of natural systems (Parry et al. 2007). There is no doubt at this point that lakes and rivers are warming, there is earlier greening in the spring, the range of plant and animal species is changing, and the oceans are warming and increasingly acid. Many other potentially damaging trends are also noted that require further scrutiny to be reported with this highest level of confidence.

It is also clear that over the last 25 years there has been an increase in the intensity of such extreme weather events as cyclones, hurricanes, and heavy rainstorms. These extreme events, along with other changes in weather patterns, have contributed to injury, illness, impoverishment, displacement, hunger, and death for hundreds of millions of people. We do not know precisely the contribution

[2] See, for instance, Kirschke and van Vliet--'s (2005) discussion of the energy and resourcefulness shown by many children in the wake of Hurricane Katrina, in contrast to the pictures portrayed by the media.

of rising greenhouse gas emissions to the mounting risks that people are facing, but it is clear that human-induced climate change is playing a role, and that there is an urgent need for mitigation. However, even if an effective international agreement is rapidly achieved and implemented, much of the world's population will still face increasingly frequent and intense extreme weather events and potentially damaging changes in weather for the next few decades.

The intensity of these changes will vary considerably from place to place, but some of the effects projected by the IPCC for the coming decades include:

- An increase in the extent of drought-affected areas, and a 10-30 percent decrease in precipitation over some dry regions, many of them already water-stressed areas;
- An increase in the frequency and intensity of rainfall, leading to increased flooding in some high-latitude areas and wet tropical areas, with annual river runoff increasing by 10-40 percent;
- Rising sea levels and coastal erosion, with many millions more people projected to be flooded every year;
- An increase in the severity of heat waves in many places;
- An increase in the range of disease vectors and in the numbers of people consequently exposed to malaria and other vector-borne diseases.

In some places, at least over the shorter term and in places with less intense effects, there may be benefits associated with climate change—fewer deaths from cold exposure, for instance, and better crop yields in some places. Nonetheless, the negative effects are definitely projected to outweigh the benefits, especially in lower-income countries. The impacts will be mediated both by the degree to which the environment has been adapted in response and the resilience of the people affected. The populations most at risk from climate change, according to the IPCC, will be

> *those in coastal and river flood plains, those whose economies are closely linked with climate-sensitive resources, and those in areas prone to extreme weather events, especially where rapid urbanization is occurring…. Poor communities can be especially vulnerable, in particular those concentrated in high-risk areas. They tend to have more limited adaptive capacities, and are more dependent on climate-sensitive resources such as local water and food supplies* (Parry et al. 2007, 9).

The report points in particular to Africa and parts of Asia, where multiple stresses and low adaptive capacity put millions at risk. Especially in the mega-delta areas of these regions, large concentrations of people live in areas already prone to extreme weather. In parts of Africa, in addition, increased water stress is expected to affect between 75 and 250 million people by 2020; in much of Asia by 2050, a billion people could be affected by shortages of fresh water. The effects, generally, are likely to be especially serious in urban areas, where a large and increasing proportion of the people and enterprises most at risk from extreme weather events and rising sea levels are located. The urban poor are particularly vulnerable. They often live in the most hazardous areas and are also least able to invest in

preventive measures, or to have their needs for risk reduction taken seriously by local governments (Satterthwaite et al. 2007).

Although these existing and projected impacts are not disaggregated by age, we know that children are a considerable part of the population in the countries most likely to be affected. In most high-income countries, people under 18 make up about 20 percent of the population; in the countries most exposed and most vulnerable to climate change, they are closer to half the population (for instance, 42 percent in Bangladesh, 51 percent in Nigeria, 57 percent in Uganda). Even more to the point is the proportion of highly vulnerable children under 5—they make up between 10 and 20 percent of the population in countries more likely to be seriously affected (for instance, 11 percent in India, 12 percent in Bangladesh, 17 percent in Nigeria and Mozambique, 21 percent in Uganda.) In higher income, and less vulnerable, countries the proportion of under-fives is closer to four or five percent (UNICEF 2007b).

## Mortality Related to Extreme Events

Small children, along with women and the elderly, are generally considered the most likely to be victims of such extreme weather events as flooding, high winds, and landslides. This makes sense given their lesser size and strength and capacity to move rapidly. Some studies point to higher mortality for adult males, related to their risk-taking behavior and activities after disasters (Jonkman and Kelman 2005). However, these kinds of figures appear primarily in high-income countries where adequate housing and infrastructure prevent most potential disaster-related mortality and injury. What these studies indicate more than anything is the huge potential that exists for preventing death and injury in the face of extreme events. In lower-income countries, and especially among the poor, the loss of life is repeatedly demonstrated to be disproportionately high among women and children (see, e.g., Neumayer and Plumper 2007).

A recently published paper, for instance, points to the significant disparities in the distribution of flood-related deaths in Nepal. These findings, which used an existing database to verify residency prior to the flood, demonstrated the higher vulnerability of younger children, girls in particular, and especially of those in poverty. Preschool girls were five times more likely to die than adult men, and the relative risk of those in poor households was over six times higher than that of high-income households (Pradhan et al. 2007).[3] The same general pattern held true in the 2004 Indian Ocean tsunami.[4]

[3] The higher mortality rates for girls than for boys is striking, given the much higher mortality risks demonstrated for boys in the USA, as presented in this issue by Zahran, Peek, and Brody (2008). It is hypothesized here that the preferential treatment often accorded to boys in South Asia must extend also to rescue efforts in the context of disaster.

[4] While the tsunami was not related to climate change, it provides a useful benchmark for considering the effects of high-magnitude disaster, as well as the capacity to respond. It has also been well documented.

In slower-onset disasters such as droughts and famines, mortality rates also tend to be more extreme for young children—as is reflected in the indicators used to define the severity of an emergency. For a situation to be considered an emergency, it is common to expect the death rate for children under five to be twice as high as that for the population at large.[5] This should be put into context. The relationship between crude mortality rates and under-five mortality rates varies a great deal from country to country, and is generally related to the wealth or poverty of that country. In wealthy countries, under-five mortality rates are lower than crude mortality rates. The poorer or more trouble-torn a country is, the higher the under-five mortality rate is compared to the crude rate (see Table 1). In some cases, these figures may be exaggerated by governments in order to stimulate higher levels of aid. Nonetheless, under-five child mortality rates in poor countries are routinely much higher than those of adults.

**Table 1. Under-five and crude mortality rates in a range of countries**

| Country | U-5 mortality rate (per thousand) | Crude mortality rate (per thousand) |
|---|---|---|
| Japan (high income) | 4 | 8 |
| Finland (high income) | 4 | 10 |
| Canada (high income) | 6 | 7 |
| China (lower middle income) | 27 | 7 |
| Guatamala (lower middle income) | 43 | 6 |
| Bangladesh (low income) | 73 | 8 |
| Mozambique (low income) | 145 | 20 |
| Somalia (low income) | 225 | 17 |

Source: (UNICEF 2007b)

Given these figures, an emergency threshold mortality rate for under-five children twice that of the crude rate is far from unrealistic. This highlights a dismal reality—that a higher mortality rate for young children, unthinkable in high-income countries, should be so routinely accepted as a baseline indicator of normalcy. A Mozambique study illustrates this bias. When research found that food aid programs in drought-stricken Tete province resulted in slightly lower death rates for children under five than for the population at large, the conclusion of the researcher was that the food aid had been poorly targeted (Renzaho 2007). The rate of child deaths commonly used to define an emergency (2/10,000/day) translates into an annual rate (73 per 1,000) that is exceeded in over a third of the world's countries (UNICEF 2007). An alarming proportion of children in the world, then, are routinely living in a state of emergency by this definition. Overall death rates for young children continue to drop in most parts of the world due to improved nutrition, health care, immunization rates and environmental health measures. Still, for many

[5] Although it is recommended by the Sphere standards that emergencies be defined relative to a local baseline mortality rate, when this baseline is unknown, it is common for a standard rate to be used. For crude mortality, this is 1/10,000/day; for under-five mortality, it is 2/10,000/day (Sphere Project 2004).

of the children most at risk from diarrheal disease, respiratory illness, malaria and malnutrition, the situation is likely to worsen with some of the effects of climate change. Many of the most disaster-prone countries are also those that already have extremely high infant and child mortality rates.

## The Exacerbated Health Risks Associated with Climate Change

Droughts, floods, heat waves, challenging living conditions and an increase in malaria and infectious disease take their toll on people of all ages, but the disproportionate burden for children is well documented: over two-thirds of all environmentally-related preventable illness is estimated to occur in children. A recent study calculating the extent to which environmental factors are responsible for the burden of death and disease worldwide provides an overview of this disparity (Prüss-Üstün and Corvalán 2006). According to these most conservative estimates, which include only disease burdens that can be reliably measured, 25 percent of deaths in the population at large can be attributed to environmental factors; among children under 14, this rises to 36 percent. The same kind of gap exists in terms of morbidity. The biggest killers are diarrheal disease, malaria and respiratory infections, all diseases that are closely linked to aspects of climate change whether in the context of post-disaster situations or just the increasing challenges presented by more gradual change. When these disease burdens are considered in terms of the loss of healthy life years, the figures become even more telling:

> *Globally, the per capita number of healthy life years lost to environmental risk factors was about five-fold greater in children under five years of age than in the total population. The difference was even greater (seven- to ten-fold greater) for major diseases, such as upper and lower respiratory infections, diarrhoea, malaria and malnutrition… Although these statistics are alarming, they do not capture the longer term effects of exposures that occur at a young age, but do not manifest themselves as disease until years after the exposure* (Prüss-Üstün and Corvalán 2006, 66).

Why are children more vulnerable? Young children especially are in a stage of rapid development and less well equipped to deal with deprivation and stress. Their faster metabolisms, immature immune systems, developing organs and nervous systems and their particular behavioral characteristics are all at issue here (see Table 2 for a biomedical perspective). Children are more vulnerable to certain risks, and their exposure may be more likely than adults' to have long-term repercussions.

**Table 2. Modalities and mechanisms by which children may be more susceptible to climate change than adults**

| Modality | Mechanism | Increased Exposure |
|---|---|---|
| Metabolic | > respiratory rate<br>> metabolic rate<br>> water demand per unit body mass | • Air pollution, allergens<br>• Malnutrition, thermal extremes<br>• Gastrointestinal disease, dehydration |
| Behavioral | > outdoor time<br>> vigorous activity<br>< ability to avoid unhealthy situations<br>< swimming capacity | • Infectious diseases, air pollution, allergens<br>• Weather extremes, UV radiation, thermal extremes<br>• Drowning |
| Physiology | > less surface area: volume<br>< detoxifying capacity<br>< skin development<br>< immunity | • Infectious diseases,<br>• air pollution, infectious diseases, thermal extremes<br>• UV radiation<br>• Allergens/mycotoxins |
| Time | > latency for genetic/ long-term effect<br>> lifetime exposure time | • UV radiation, allergens, malnutrition |
| Development | Undergoing development | • Malnutrition, stunting, psychosocial trauma<br>• Morbidity, quality of life |

Source: (Bunyavanich et al. 2003, 47)

**Sanitation-Related Illnesses**

A lack of easy access to sufficient supplies of clean water leads to a considerably higher incidence of water-washed and water-borne[6] disease for children. Water quantity is actually more important in this regard than its quality. Children themselves, as well as food, utensils, floors, and cooking surfaces are all less likely to be kept clean when water supplies are inadequate, and this contributes to high levels of endemic illness. Problems related to inadequate water supplies are complicated further by poor sanitation, which can contribute to the contamination of water supplies and which greatly increases the need for adequate hygiene. Sanitation-related illnesses (diarrheal diseases primarily) affect young children most heavily, in part because of their less-developed immunity, but also because of their behavior. They want to play and explore, they touch everything, and they have little consciousness of hygiene. This means they are much more likely to come into contact with excreta and pathogens. Children under five years of age are estimated to bear over 80 percent of the global burden of diarrheal disease, while school-aged

[6] Water-borne diseases are those that are spread through consumption of water contaminated by animal or human waste, and they include a range of diarrheal diseases, including cholera. Water-washed diseases are those that spread because of a lack of proper hygiene, and they include various skin and eye problems such as scabies, lice, trachoma, and typhus.

children have by far the highest rates and intensity of helminth (worm) infections (Murray and Lopez 1996). The quality of sanitation can be affected not only by inadequate water supplies, but also, ironically, by too much water. Flooding can make latrines overflow and cause waste of all kinds to be spread around a community, especially where drainage is poor. In Peru, for instance, hospital admissions of young children for diarrhea were reported to triple after the floods and high temperatures related to the 1997-98 El Niño (Checkley et al. 2000).

**Malaria and Other Vector-Borne Diseases**

Changes in climate, and especially increased temperatures and changes in precipitation, are increasing the incidence and range of various vector-borne diseases. Mosquito- and tick-borne encephalitis, for instance, are becoming more prevalent, with incidence estimated to be twice as high among children between five and ten years as among adults. Although dengue, another mosquito-borne disease, affects older children and adults more often, young children are more likely to experience severe symptoms (Bunyavanich et al. 2003). Most seriously, the prevalence of malaria has increased dramatically in recent years, and 50 percent of the world's population is now at risk, an increase of almost 10 percent in the last decade (Bremen et al. 2004). Children are most likely to be the victims—in Africa, for instance, 65 percent of malaria mortality is among children under five (Bremen et al. 2004). These numbers, however, fail to capture the larger effects of malaria for children. An analysis of 48 African demographic surveillance studies found that a higher prevalence of malaria parasites also contributes to deaths from other causes, more than doubling overall mortality for children under age five (Snow et al. 2004). There is also evidence that malaria contributes to impaired development and performance in children, resulting directly from the insult to the brain during acute episodes, but also mediated by the effects of anemia, repeated illness and under-nutrition associated with the disease (Holding and Snow 2004).

**Malnutrition**

An increase in malnutrition will inevitably be a consequence of climate change for many children. Food shortages, related to reduced rainfall, flooding, or other changes that negatively affect agriculture, will have especially serious implications for rapidly growing children. Malnutrition for young children is also closely tied to unsanitary conditions. Data collected from over 80 countries indicated that the best predictor of malnutrition, next to the household's capacity to pay for food, was the level of access to water (Lechtig and Doyle 1996). Frequent bouts of diarrhea and infestations of worms mean impaired absorption and a loss of nutrients. When children are raised in dirty surroundings, calories that should go towards growth are spent instead supporting their challenged immune systems. When children are malnourished, this, in turn, greatly increases their vulnerability to disease.

Generally speaking, in the aftermath of disaster, the nutritional risk for children tends to be low if they were previously well nourished (Magkos 2004). If the acute malnutrition associated with the event does not go on for too long, children can recover. They have been found, for instance, to catch up well after seasonal fluctuations. However, if they are already undernourished, or if the situation

continues for too long, the shortage may contribute to stunting and a long term failure to catch up (Del Ninno and Lundberg 2005; Hoddinot and Kinsey 2001).

Malnutrition appears to be a greater risk among children of displaced families (Barrios et al. 2000; Jayatissa et al. 2006). This may be related to the poor levels of sanitation in many temporary shelters as well as to the effects of displacement on household coping strategies.

An important consideration for infants is the effect emergencies may have on breast feeding, which has well-established benefits for both physical and emotional nurturance. Breast feeding protects infants from infection, and is hence all the more critical in environments without safe water and good sanitation (Caldwell 1996). But the stresses related to a crisis (including diminished health and nutrition of the mother) may affect the production of breast milk. Breast milk substitutes are a common component of emergency supports, and many mothers may feel it practical to switch to these substitutes. Yet, their preparation and storage in unsanitary environments presents real health risks to children. Mothers may also be unclear about the quantities to be mixed, placing children at risk of malnourishment (IFE 2006).

**Greater Heat Stress**

Heat stress, not only from higher absolute temperatures but from the loss of shade trees, will have the most severe impacts for the elderly and the very young, who sweat less and have a greater surface area-to-body mass ratio. According to a recent review, maximum daily temperatures are strongly associated with emergency hospital visits from young children with fever and gastroenteritis (Lam 2007). Research in São Paulo found that for every degree increase above 20°C, there was a 2.6 percent increase in overall mortality in children under 15—similar to the increase in people over 65 (2.5 percent) (Gouveia et al. 2003). For younger children, this increase is likely to be higher. In the United States, exposure to heat has been found responsible for 75 percent of all infant deaths associated with weather or forces of nature (Zahran et al. 2008).

**Respiratory Disease**

Respiratory illnesses remain a major killer and cause of morbidity for children. A number of factors are involved here, not all of which are directly affected by climate change. Children's vulnerability to respiratory disease may be related, for instance, to their proximity to traffic, the level of crowding in their homes, and the cooking or heating fuel burned within their homes. However, respiratory ailments are also significantly related to ambient outdoor air quality, and the various factors related to climate change that end up affecting air quality are also likely to have an effect on the prevalence of these illnesses. Changes in temperature and precipitation, for instance, are expected to increase the number of forest and bush fires, which can affect air quality for thousands of miles, and which are generally accompanied by increased numbers of people experiencing respiratory difficulty of various kinds (Confalonieri 2007). Changing pollen counts, fungal growth and molds related to flooding, and increases in ozone and other pollutants, can also play a part in increasing the rates of such respiratory problems as pneumonia, upper respiratory

diseases and asthma. Asthma is noted to have doubled worldwide over the last 15 years, for instance, with the greatest increases for children (Bunyavanich et al. 2003).

### Injury

After extreme events, injury rates are likely to go up, especially for children. Debris, damaged housing, muddy ground, broken power lines and overcrowded emergency camps with inadequate storage for hazardous materials can all pose significant risks. Children, because of their size and developmental immaturity, are known to be particularly susceptible to injuries of various kinds. They are curious and driven to explore, yet lack the capacity to understand and respond well to danger. Falls and burns, along with drowning, disproportionately affect children under five (Bartlett 2002). In the post-disaster context, with the general confusion and disruption of routines, the level of oversight needed to keep children from harm is greatly heightened.

Even the measures taken to adapt to more gradual change are likely to have implications for children's safety. As sea levels rise or floods become more prevalent or intense, more and more poor households are likely to live in overcrowded, precarious areas. Housing on stilts and with raised walkways, just to give one example, present a much-increased risk of falling and drowning for children (Cairncross and Ouano 1990).

### The Quality of Care

Basic to young children's health, especially in difficult circumstances, is the quality of care they receive. As conditions become more challenging to health, so do the burdens faced by caregivers. These problems are seldom faced one at a time—environmental risk factors generally exist in clusters. When inadequate water supplies are compounded by a lack of sanitation, overcrowded living quarters, and an absence of safe play space, the difficulties can become overwhelming and unmanageable. Overstretched and exhausted caregivers are more likely to leave children unsupervised and to cut corners in all the chores that are necessary for healthy living. It is easy to overlook the multitude of worries confronting families in difficult situations. The sheer drudgery resulting from challenging living conditions takes its toll on the capacity of families to function optimally, with potentially serious implications for children's health and well being.

Environments of poverty with their constellation of health risks also present a challenge for health care systems and institutions, which in many low-income countries struggle to cope with basic preventive and palliative care (see, e.g., Kemble et al. 2006). Deepening health risks, disasters, and long-term recovery scenarios will increase the burdens placed on these under-resourced systems.

## Challenges to Children's Psychosocial Well Being and Development

It is far simpler to determine the prevalence of diarrhea or malnutrition than to assess the effects of climate change-related hardship for children's level of psychological vulnerability or resilience or for their development as competent social beings. Levels of vulnerability and resilience depend not only on children's

health and internal strength, but are also closely tied to household dynamics, to the ways that adults are coping, and to levels of social support. The meanings attached to events are also critical. The way children understand and experience hardship will depend a great deal on local child-rearing practices and expectations, and the experiences they have had in their daily lives.

**Coping with Adversity**

There is little conclusive evidence that children are psychologically more severely affected than adults by stressful events or challenging conditions. Some may in fact respond with more flexibility and resilience than their elders (Palmer 1983). Age is just one of many factors that mediate experiences of adversity, but because of their level of understanding and their lack of social power within family and community, children may be particularly affected. The ways other family and community members cope may also have important ramifications for children's security and well being, and for their own ability to manage a stressful situation.

In their discussion of children's resilience in the context of extreme events, Boyden and Mann (2005) review literature pointing to a number of factors that may influence children's capacity to cope. There is some evidence that younger children may be more severely affected by stressful events than older children. Their more limited experience and understanding may complicate their perception of events, leaving them in greater need of support. Girls have also been frequently noted to have a more difficult time with extreme adversity than boys. Despite indications that they are biologically stronger, their lower status within many families and societies may leave them less emotionally resilient. Temperament, motivation, and personal experience can also play a role, but intrinsic factors are all mediated by social expectations and supports. Children who have experienced success and approval in their lives are more likely to adapt well and respond with confidence than those who have suffered rejection and failure. Poverty and social status can play an important role in this regard. For older children, the ramifications of an event for their social world and peer relationships play a big part in their capacity to respond with resilience. Also important, in the face of adversity, is the opportunity to be able exercise an active and purposeful role in the world. According to Chawla and Heft (2002, 208),

> *Just as the biological well-being of the individual rests on adequate functioning of various organ systems, the psychological well-being of the individual rests, to some extent, on efficacious functioning in domains of reciprocal individual-environment processes*.

It is often assumed that children who have experienced a disaster will be psychologically traumatized. Considerable research is devoted to assessing the prevalence and severity of children's trauma after extreme events (see, e.g., Bokszczanin 2007; Kar et al. 2007; Lee et al. 2004). This approach has been criticized by many as a Western construct with questionable validity for other cultural realities (Batniji et al. 2006; Boyden and Mann 2005). The expectation of negative outcomes in these situations can also unwittingly become part of the problem. Much of what is defined as symptomatic of pathology (such as bedwetting

or regression to younger behavior) may in fact be construed as a normal reaction to abnormal conditions (Engle et al. 1996). Although the shock and distress related to extreme events should not be minimized, frequently it is the aftermath of disasters and the slow recovery process that children and families themselves report as being the most stressful and debilitating (Becklund et al. 2005). Children may experience many deprivations and humiliations in the context of displacement or recovery, or in the gradual worsening of conditions, all devastating in their own way. The concept of trauma may be less than adequate in situations where there is continued and extended exposure to hardship.

Children may face numerous assaults on their resilience in the aftermath of extreme events. Especially in low-income countries, many end up orphaned or separated from family. Extended family or other community members may provide a secure alternative for children, but too often these important bonds are frayed to the breaking point in difficult situations, and extra children can become a target for mistreatment. Children who are being fostered, especially in unrelated families, are at particular risk of exploitation and abuse, and in some cases may have been taken in only for the subsidies they bring with them, or for the labor they can provide (Tolfree 2005). Even "minor" disasters can result in temporary separations from family. In Kathmandu, Nepal, for instance, flooding occurs regularly during the monsoon season in urban slums along the river banks, and many families are forced to withdraw to higher ground and to live under plastic sheets for the duration. Many mothers speak of sending their youngest children away to their home villages during this time of year (Save the Children Norway 2002).

Even if family remains intact, displacement is a challenge. The UN estimates that by 2010, there will be 50 million such environmentally displaced people worldwide (Save the Children 2007). Although children can be surprisingly resilient, this kind of displacement can also be deeply disturbing, especially when the adults in their lives are anxious, depressed, and feel a loss of control over their lives. Also at issue are the often chaotic physical conditions and disruptions to the temporal structure of life related to displacement. Daily routines and patterns of activity are an important component of stability, orientation, and identity for both children and adults. In the aftermath of the 2004 Indian Ocean tsunami, life in emergency shelters and camps was overwhelming for many—overcrowded, uncomfortable, and fraught with frustration and uncertainty. The lack of provision for privacy led in many places to tensions and the erosion of social norms of behavior. There have been numerous reports of children and women enduring abuse of various kinds. Adolescent girls in particular complained of the lack of privacy around sleep, washing, and dressing, and of the sexual harassment they faced (Fisher 2005). There were also reports of young girls being pressured to marry older men who had lost their wives to the disaster.

Household dynamics can be seriously affected by the stresses associated with disasters, and increased levels of irritability, withdrawal and family conflict are not unusual (McFarlane 1987; Save the Children Sweden 2007). Adult stress can have serious implications for children, with effects for development on all fronts. Maternal depression, as noted, has been linked to higher levels of malnutrition in children and

lower cognitive ability (Harpham et al. 2005). Increased rates of child abuse are also an issue, long associated with factors more prevalent after the upheaval of a disaster such as depression, loss of property or a breakdown in social support. Research in the USA found that in areas severely affected by Hurricane Floyd, pediatric hospitals reported rates of traumatic brain injury inflicted on small children over five times higher than usual in the six months following the event, compared to the previous six months (Keenan et al. 2004).

Children's behavior after disasters could well contribute to abusive responses from parents. When children exhibit high anxiety and such behaviors as bed wetting, nightmares, aggressiveness or clinging behavior, this may add to the stress of parents attempting to deal with disaster-related problems (Curtis et al. 2000). However, even in the United States, findings are not consistent. Research among survivors of three different natural disasters, for instance, found significantly elevated rates of reported child abuse in two cases, but not in the third (Curtis et al. 2000).

**Children's Learning and Competence**

Although it is far-fetched to see climate change as resulting in radical changes to children's cognitive and social development, for some children in some places, the added challenges presented by climate change could in fact contribute to a general erosion of both their capacities and their opportunities for learning and growth.

As far as capacity is concerned, it is well established that the early years are the most critical time for brain development, and that this development can be shaped by a range of environmental factors. Mental development does not just happen to children; it is a feedback process that requires their active involvement.

Good health is central; children who are sick or malnourished lack the energy and interest to be active learners (Grantham-McGregor et al. 2006). They are slower to develop and move around and have more limited contact with their surroundings. This, together with their lower energy levels, can result in less exploration of the environment, and lower levels of the stimulation that promotes cognitive development (Engle 1996.) There is an abundant literature relating lower cognitive performance and capacity to undernutrition. Children who are stunted at two or three years of age have repeatedly been found to demonstrate later cognitive deficits, along with lower school achievement and higher rates of school dropout (Walker et al. 2007).

Children's development is also closely tied to the health and nutritional levels of their mothers during pregnancy. Undernutrition for unborn children has been consistently related to lower cognitive performance later, and to infants that are less active, happy and outgoing (Walker et al. 2007). Maternal stress and anxiety during pregnancy can also affect the later cognitive development of unborn children. Research in Canada looked at stress in pregnant women associated with their exposure to an ice-storm disaster (King and Laplante 2005). The more severe the exposure of the mother to this event, the lower their toddler's cognitive and language abilities were found to be when they were tested at age two. The level of

prenatal stress was calculated to account for between 11 percent and 17 percent of the children's mental functioning and language abilities. Researchers suspected that high levels of stress, especially early in pregnancy, had a direct effect on the brain development of the fetus.

Children's mental growth can also be affected by intestinal parasites, diarrheal disease and malaria. Infection with parasites, for instance, has been related to lower language ability in children in Nicaragua (Oberhelman et al. 1998); the number of episodes of diarrhea in the first two years of life have been related to lower academic performance in children in a Brazilian shanty town several years later (Niehaus et al. 2002); and severe cases of malaria have been repeatedly associated with cognitive and neurological impairments (Boivin 2002). All of these factors can be expected to be exacerbated by climate change.

At issue is not just children's cognitive capacity; the opportunities available to children are critical to their competence, and can also be affected directly or indirectly by climate change. Critical to the development of new skills is the accessibility of safe, varied, and supportive environments, both physical and social. Children's learning takes place within a social and cultural context that is structured to help them acquire the experiences and competencies that they need to live their lives. They learn to think, solve problems, speak and act appropriately through interactions with other people in a range of settings, and through their intense engagement in varied and stimulating surroundings (Valsiner 1987; Vygotsky 1978). When this supportive environment breaks down, constructive opportunities for learning may become constrained.

"Environmental chaos," a summary term that includes high levels of noise and crowding with many people coming and going and a lack of physical and temporal structure in daily life, has consistently been found to have negative impacts on children's learning and development, distracting their attention and affecting the quality of their interactions with adults (Wachs and Corapci 2003). As noted above, this is an accurate description of many post-disaster settings, where children may live for months in overcrowded temporary housing. In the aftermath of disaster, children's critical need for a safe environment for play can easily be overlooked.[7]

Challenging events on a much smaller scale can also disrupt life repeatedly, diminishing the positive supports available to children, and putting a damper on play and exploration. In the context of increasingly challenging conditions, many caregivers face a difficult trade-off—either restricting their children's natural drive for play and competence, or accepting their exposure to threats to health and safety. This is not an issue just in the urban slums of low-income countries or in emergency camps. Even in wealthy countries, climate change can contribute to growing restrictions in children's play. The risk of tick-borne Lyme disease in the northern United States, for instance, is resulting in many parents forbidding outdoor play.

[7] It should be noted, however, that a number of child-focused organizations are erecting "safe play areas" as a temporary solution in the aftermath of disaster.

Parental anxiety and depression can also affect children's opportunities for play and productive interaction. Many caregivers respond after disasters by becoming more restrictive and protective of their children. Maternal depression and withdrawal (often linked to living conditions) have also been linked to children's learning. Studies from South Africa, Barbados, and India have pointed to lower levels of cognitive functioning and more behavioral problems in young children with depressed mothers. On the other hand, higher levels of maternal responsiveness are found to be a protective factor for the cognitive development of even malnourished children (Engle et al. 1996; Walker et al. 2007).

Although the emphasis here has been on younger children, for older children and adolescents as well, opportunities for purposeful, goal-directed activities and engagement in the world are primary avenues for the achievement of competence (see, e.g., Chawla and Heft 2002). In the course of displacement, or in the disruption of routines and local environments that can accompany even "minor" disasters, these opportunities (however rich or minimal they may in fact be) can become seriously constrained. Formal schooling, to point to just one example, is frequently interrupted after disasters or extreme weather events. Schools may be destroyed or damaged, or may just be shut down for an extended period. Not infrequently, schools are taken over as emergency shelters, and it may be many months before they are available again.[8] Even when their former schools remain open, children and youth may be pulled out because of displacement or because their disaster-affected families lack the resources to pay fees or provide the necessary uniforms. Conditions in emergency shelters or temporary housing may make it harder to do homework, also increasing the likelihood of dropout. Especially in areas where school dropout is common, children are much less likely to continue with school after an interruption, calling for extra supports (INEE 2004). Other less formal opportunities for learning, equally important, may be similarly disrupted.

## Household Coping Strategies

Although conditions after high-magnitude disasters may be especially challenging, it should not be assumed that they are unique in creating havoc within households. Less extreme events and deteriorating living conditions can also result in serious pressures on households—whether through short-term displacement, loss of work, reductions in food security, or just more challenging surroundings and daily routines. A report from participants in a workshop linking disasters and urban development in Africa points out that in the continuum between large-scale disasters and everyday hazards, it is the smaller scale but more frequent events that cumulatively take the greatest toll on life, livelihoods, and household well being (Bull-Kamanga et al. 2003).

When the household system faces more stress than it can easily adapt to, this can have critical consequences for children, with implications for all aspects of

[8] See, for instance, Maiko School's home page: "Disaster and School, The Lessons of the Great Hanshin-Awaji Disaster" (known as the Kobe Earthquake): www.hyogo-c.ed.jp/~maiko-hs/e/DM_edu/disaster.htm.

development. The stability of the household may reasonably be seen as far more important than the welfare of an individual child. The Bristol study of child poverty confirms the fact that the resources of a given household are not necessarily a reliable indicator of the well being of children within that household (Gordon et al. 2003). Many households make great sacrifices on behalf of their children; in others, however, few of the benefits of what is earned or produced actually trickle down to reach the youngest members. Children may, for instance, qualify as being in absolute poverty even in a household that does not.

When times are hard, children can become an asset that is drawn on to maintain the stability of the household. Rather than spending money on a child's education, for instance, that child may be pulled out of school in order to work or take care of younger siblings; this is more often the case for girls than for boys. Research in Guadalajara, Mexico looking at the household level adjustments made during a period of economic crisis in the 1980s, noted the increased entry of women and children into the labor market, as well as other kinds of changes:

> *There are members who are more vulnerable than others, such as women and children, since their positions in the household are subordinate. The distribution of food is, perhaps, one of the clearest examples of household dynamics vis-à-vis power relations. Since food is distributed according to the status of household members, the most prestigious items (such as meat and poultry) are devoted to men, especially working-age men, while women and children have soups, beans and tortillas, and, if they are lucky, any left-over* meat (Escobar Latapi et al. 1995, 70)*.*

Increased workloads for parents or longer distances to commute to work can also mean less time and energy available for child care. As a result of household and broader community pressures, children are more likely to face neglect and abuse, and even bonded servitude. Certain children may be considered more "expendable" than others (Engle et al. 1996). Many of Bombay's young prostitutes, for example, are girls from very poor rural villages in Nepal, where increasingly inadequate crop yields, among other factors, lead families to sacrifice one child in order that others may survive (Mukhopadhyay 1995).

The status of the mother (or other primary caregiver) within a household may be critical to children's well being. In extended families, women with lower status may have less capacity to minimize the risks their children face. The combination of economic problems, social isolation and psychological stress in a mother can result in significant risks for her children. Community-level supports are important here. Mothers who are involved in mutually supportive relationships through community institutions have been found to be less likely to have malnourished children, for instance, than those who are isolated within a family (Engle et al. 1996).

It is important also to consider those families that have been driven by changing conditions in rural areas to migrate to cities. Droughts and food shortages associated with climate change, for instance, can create situations where migration is the only alternative. These families may be especially ill-equipped to cope with urban living,

lacking the education, skills, knowledge and social networks to cope with their new environment (Revi 2008). They and their displaced children are doubly vulnerable to the many risks within the marginal settlements in which they end up. Even in situations in which only some household members migrate, the effects on families and children can be significant. In many cases it may be children and youth themselves who are sent away to become a lifeline for the rest of the household. Some research poses this as a route to exploitation of various kinds, while in other cases (more often where children themselves provide their perspective) it is viewed as an opportunity (Hashim 2003).

## Children as Active Agents[9]

Despite this litany of challenges, it is misleading to think of children simply as victims, and not to appreciate the level of resilience that they can actually bring to a situation. Although there are numerous accounts of disasters resulting in trauma for children, there are also accounts of their hardiness and resourcefulness in the face of both extreme events and everyday difficulty (Boyden 2003; Hestyanti 2006). The tendency of adults is often to miscalculate the effects of hardship for children—on the one hand assuming that they are passive victims; on the other hand taking refuge in the assumption that children, especially young children, are unlikely to understand what's going on and hence, by some strange logic, unlikely to be affected by it.

Children, in fact, tend to have a lively awareness of the events around them—even the youngest children take in more than is often acknowledged. Their awareness is not necessarily a liability. The benefits of having children active, informed and involved in responding to disaster, as well as to other factors in their lives, have been well established (see, e.g., Plan International 2005). Rather than adding to stress, an appropriate level of involvement can give children a sense of competence and control where they might otherwise feel helpless. Children's capacity to cope well in difficult situations has often been related to their own active engagement (Boyden and Mann 2005; Plan International 2005). A review of relevant disaster literature indicates, in fact, that activities involving active problem solving have been found to be more beneficial than anything else in helping people cope with recovery from extreme events (Norris et al. 2002). Opportunities to exercise and develop their competence in the aftermath of disaster, and to have their efforts responded to with approval, can build confidence in children and a sense of identity and effectiveness that can go a long way towards relieving distress. While children may certainly enjoy and profit from being brought together to engage in games or psychosocial support sessions, they can also find relief in being engaged in actively improving their surroundings. There are many real-life opportunities for problem solving in the post-disaster context and repeated experience demonstrates how capable children are of looking critically at local problems and coming up with creative solutions. The opportunity for constructive involvement is clearly not limited to the post-disaster context. Young people can also play a valuable role in

[9] This section could clearly be developed in far greater depth. However, given the many fine examples of children's active involvement in recent issues of *Children, Youth and Environments* (16(2)-17(3)), it seems unnecessary to go into detail here.

helping to document changing conditions and contributing their perspectives and concerns to risk reduction plans.

Although children and youth tend to be alert observers of the local scene, it is also true that slowly deteriorating conditions (along with repeated exposure to more extreme weather) may dull the awareness necessary for proactive responses. This tendency to accommodate to difficulty is a phenomenon for all age groups, but has particular relevance to children with their more limited frame of reference, an issue elaborated on by Peter Kahn in his discussion of "environmental generational amnesia" (Kahn 2002). The fact that children have a shorter time frame for evaluating change has implications for how best to support their active stewardship.

## Bringing Children into Focus

There are many vulnerable groups in the context of climate change—the poor, the elderly, pregnant women, and those in locations at particular risk. Children are not unique in this sense. However, they constitute a large percentage of those who are most vulnerable, and the implications, especially for the youngest children, can be long term. If discussion and policy regarding the impacts of climate change fail to take into account the particular vulnerabilities and capacities of children at different ages, measures for prevention and adaptation may prove to be inadequate in critical ways, failing to take advantage of the resource that children represent, as well as resulting in additional stresses for young minds and bodies.

More information is essential. We need more extensive documentation of the risks actually faced by children and youth, and the factors that have supported their resilience in different situations. Some areas call for attention more urgently than others. There is a fairly good understanding, for instance, of the probable health effects for young children of various aspects of climate change, although far more remains to be learned. However, we know very little about how household survival strategies in the face of climate change are actually affecting young children, or what the factors are that encourage or permit adults to make their children's needs a priority. Our knowledge of the effects of climate change on the mental health and resilience of caretakers (and the adult world generally) is also very limited, along with the supports that might realistically be brought to bear.

We also know very little about the impacts of changing conditions for older children and adolescents. How are young people coping with the upheaval of displacement and the loss of their social networks? How do the difficulties associated with climate change affect their chances of getting an education, and how many children are being pushed prematurely into work? For those who are a bit older, underemployment and unemployment are critical problems in much of the world. How do disasters or changing environmental conditions affect their chances of entering employment? How many young people are migrating from rural to urban areas because of droughts and increased difficulty with survival in rural areas? How many are having to invent new ways of surviving in the context of changing conditions? Without a better understanding of how young people are actually experiencing these kinds of realities, many of the costs of climate change remain

impossible to assess. Fortunately, young people themselves can be articulate informants, contributing to a better understanding of these issues.

There is also the issue of building on the understanding and information we already have. There are many actors in the climate change world—community groups and local authorities, disaster reduction specialists, NGOs, national governments, international agencies and others. While their roles are different, along with the kind of impact they can have on children's lives, there are a few basic guidelines that pertain to all of them:

- Unless they understand the implications of their decisions and actions for children and youth of various ages, the steps they take to respond to the crisis of climate change are likely to be mistargeted in some important ways.
- Children's experience of these implications may differ considerably from the assumptions made by adults on their behalf. This does not mean that young people (or their caregivers) need to be present at every level and in every forum. It *does* mean that the information on which decisions are based must be information that can be trusted to represent children's experiences.
- Children's requirements cannot be an afterthought or an add-on. To be effectively addressed, they need to be integrated into policy, planning and implementation from the start. Just as with gender, a consideration of age needs to be a routine feature of decision making on every front, not a separate set of activities. The add-on approach results in superficial band-aid solutions.

There is no such thing as a disaster, whether small or large, without a vulnerable population (Satterthwaite et al. 2007). In seeking to reduce vulnerability and enhance resilience in the face of various hazards and risks, and in the course of both preparedness and responses, how can the multiplicity of concerns for children of different ages be adequately represented without completely overwhelming any agenda? Again, there are a few general concerns that can be considered in the appropriate detail at each scale. Taking these guidelines into account will mean something very different to a donor agency and to a local disaster-preparedness committee.

- **Ensuring children's optimal health and nutrition:**
  This is not only for the obvious and immediate benefits, but because of the effects in enhancing children's resilience more generally. It is, in this sense, a form of disaster risk reduction. For example, a period of nutritional deprivation short-lived by adult standards may have more critical implications for children. If disaster strikes, both the urgency of the response and its effectiveness will be affected by children's pre-existing level of health. A few examples: for donors this may mean acknowledging that food aid programs in response to a crisis are relatively ineffective compared to long-term programs. When children's health is already compromised by illness and malnutrition, they are more likely to sustain long-term damage to their development in the wake of a crisis, even with emergency food programs. For local government, it may be an additional reason for tackling environmental sanitation problems.

- **Strengthening families' capacity to cope:**
  All adaptive measures should ideally enhance the capacity of households to come through periods of shock without succumbing to major catastrophe. "Coping" in this context may take on broader meaning where children are concerned, and will include adults' capacity to manage hardship without compromising the well being of their children. A few examples: an NGO might build a child-impact assessment into its micro-credit activities, ensuring that loan repayments do not compromise children's nutrition; a health care system might allocate more of its resources to mental health care for caregivers.

- **Maintaining and restoring children's routines, networks and activities:**
  Children need supportive functional adults in their lives, but they also rely on daily routines and activities as a context for stability and optimal development. Other functions, more critical to survival, will inevitably be prioritized (food, health, livelihoods), but in the course of addressing these things, it is important that children's spaces, activities, networks, and opportunities for gaining competence not be compromised; they should be identified, maintained, and restored wherever possible. A few examples: in paving and upgrading local streets to prevent them washing away during increasingly common floods, speed bumps could be included to ensure that children are not endangered by faster traffic; in an emergency camp, a quiet space can be made available where children can do homework away from the noise and chaos of the camp.

- **Respecting children's capacities; allowing them the chance for active involvement:**
  The chance to solve problems, contribute, and take action have been identified as potent protective forces for children in situations of adversity. Moreover, the contributions of children and youth are also potential community assets too seldom tapped in the process of development and adaptation. A few examples: local government disaster reduction teams might recognize children's extensive knowledge of their own neighborhoods and draw on this in the process of local risk assessment and monitoring; NGOs rebuilding after disaster could involve children along with adults in critiquing and modifying stock plans for relocated housing, since children will point to many concerns that adults will overlook.

Addressing these concerns for children may appear on many levels to be an unrealistic burden, adding unduly to the need for time and resources in the face of other compelling priorities. Fortunately, this is not a zero-sum game. There are strong synergies between what children need and the adaptations required to reduce or respond to more general risks. In the context of climate change, as in most situations, responses that work better for children tend to work better for everyone else as well.

***Sheridan Bartlett*** *is a research associate at the Children's Environments Research Group at The Graduate Center, City University of New York, and an associate fellow in the Human Settlements Programme at the International Institute for*

*Environment and Development in London. She works primarily in Asia on issues pertaining to children and their environments, providing support to various organizations, currently including Save the Children, SPARC, and the Aga Khan Foundation*.

## References

**Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O'Brien, J. Pulhin, R. Pulwarty, B. Smit, and K. Takahashi** (2007). "Assessment of Adaptation Practices, Options, Constraints and Capacity." In Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C. E. Hanson, eds. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press, 717-743.

**Barrios R.E., J.P. Stansbury, R. Palencia, and M.T. Medina** (2000). "Nutritional Status of Children under 5 Years of Age in Three Hurricane-Affected Areas of Honduras." *Revista Panamericana de Salud Pública* 8(6):380-384.

**Bartlett, Sheridan** (2002). "The Problem of Children's Injuries in Low-income Countries." *Health Policy and Planning* 17: 1-13.

**Bartlett, Sheridan and Selim Iltus** (2007). *Making Space for Children: Planning for Post-Disaster Reconstruction with Children and their Families.* Chennai, India: Save the Children.

**Batniji, Rajaie, Mark van Ommeren, and Benedetto Saraceno** (2006). "Mental and Social Health in Disasters: Relating Qualitative Social Science Research and the Sphere Standard." *Social Science and Medicine* 62(8): 1853-1864.

**Becklund, A., W. Wheaton, and M. Wessels** (2005). "Rapid Child Protection Assessments in Emergency Contexts." *Responses to Young Children in Post-Emergency Situations, Early Childhood Matters* 104: 12-15.

**Berger, L.R. and D. Mohan** (1996). *Injury Control: A Global View.* Delhi: Oxford University Press.

**Boivin M.J.** (2002). "Effects of Early Cerebral Malaria on Cognitive Ability in Senegalese Children." *Journal of Developmental and Behavioral Pediatrics* 23: 353–364.

**Bokszczanin, A.** (2007). "PTSD Symptoms in Children and Adolescents 28 months after a Flood: Age and Gender Differences." *Journal of Traumatic Stress* 20(3): 347-351.

**Boyden, Jo** (2003). "Children under Fire: Challenging Assumptions about Children's Resilience." *Children, Youth and Environments* 13(1). Available from: www.colorado.edu/journals/cye.

**Boyden, Jo and Gillian Mann** (2005). "Children's Risk, Resilience, and Coping in Extreme Situations." In Ungar, M., ed. *Handbook for Working with Children and Youth: Pathways to Resilience across Cultures and Contexts*. London: Sage, 3-27.

**Breman, J., M.S. Alilio, and A. Mills** (2004). "Conquering the Intolerable Burden of Malaria: What's New, What's Needed: A Summary." *American Journal of Tropical Medicine and Hygiene* 71(2): 1-15.

**Bull-Kamanga, L., K. Diagne, A. Lavell, E. Leon, F. Lerise, H. MacGregor, A. Maskrey, M. Meshack, M. Pelling, H. Reid, D. Satterthwaite, J. Songsore, K. Westgate, and A. Yitambe** (2003). "From Everyday Hazards to Disasters: The Accumulation of Risk in Urban Areas." *Environment and Urbanization* 15: 193-204.

**Bunyavanich, S., C. Landrigan, A.J. McMichael and P.R. Epstein** (2003). "The Impact of Climate Change on Child Health." *Ambulatory Pediatrics* 3(1): 44-52.

**Caldwell, Pat** (1996). "Child Survival: Physical Vulnerability and Resilience in Adversity in the European Past and the Contemporary Third World." *Social Science and Medicine* 43(5): 609-619.

**Cairncross, S. and E.A.R. Ouano** (1990). *Surface Water Drainage in Low-Income Communities.* Geneva: World Health Organization.

**Chawla, Louise and Harry Heft** (2002). "Children's Competence and the Ecology of Communities: A Functional Approach to the Evaluation of Participation." *Journal of Environmental Psychology* 22: 201-216.

**Checkley W., L. Epstein, R. Gilman, R. I. Cama, J. Patz, and R. Black** (2000). "Effect of El Nino and Ambient Temperature on Hospital Admissions for Diarrhoeal Disease in Peruvian Children." *Lancet* 355: 442-450.

**Confalonieri, U., B. Menne, R. Akhtar, K. Ebi, M. Hauengue, R. S. Kovats, B. Revich, and A. Woodward** (2007). "Human Health." In *IPCC WGII Fourth Assessment Report.* New York: Cambridge University Press, 391-433.

**Curtis, T., B.C. Miller, and E.H. Berry** (2000). "Changes in Reports and Incidence of Child Abuse following Natural Disasters." *Child Abuse and Neglect* 24(9): 1151-1162.

**Del Ninno, C. and M. Lundberg** (2005). "The Long-Term Impact of the 1998 Flood on Nutrition in Bangladesh." *Economics and Human Biology* 3(1): 67-96.

**Engle, P.** (1996). "Combating Malnutrition in the Developing World." In Carr, S.C. and J.F. Schumaker, eds. *Psychology and the Developing World*. Westport, CT: Praeger, 153-162.

**Engle, P., S. Castle, and P. Menon** (1996). "Child Development: Vulnerability and Resilience." *Social Science and Medicine* 43(5): 621-635.

**Epstein, Paul R., Sarah Meginness, John Rich, Roger Swartz, Jean McGuire, and John Auerbach** (2003). *Urban Indicators of Climate Change*. Boston: Center for Health and the Global Environment, Harvard Medical School, and The Boston Public Health Commission.

**Escobar Latapí, Agustín and Mercedes González de la Rocha** (1995). "Crisis, Restructuring and Urban Poverty in Mexico." *Environment and Urbanization* 7(1): 57-75.

**Fisher, Sarah** (2005). *Gender Based Violence in Sri Lanka in the Aftermath of the Tsunami Crisis*. Dissertation submitted to the University of Leeds.

**Gordon, David, Shaileen Nandy, Christine Pantazis, Simon Pemberton and Peter Townshend** (2003). *Child Poverty in the Developing World.* Bristol: The Policy Press.

**Gouveia, Nelson, Shakoor Hajat, and Ben Armstrong** (2003). "Socioeconomic Differentials in the Temperature–Mortality Relationship in São Paulo, Brazil." *International Journal of Epidemiology* 32: 390–397.

**Grantham-McGregor S., Y.B. Cheung, S. Cueto, P. Glewwe, L. Richter, and B. Strupp** (2006). "Developmental Potential in the First Five Years for Children in Developing Countries." *Lancet* 369: 60-70.

**Harpham T., S. Huttly, M.J. De Silva, and T. Abramsky** (2005). "Maternal Mental Health and Child Nutritional Status in Four Developing Countries." *Journal of Epidemiology and Community Health* 59(12): 1060-1064.

**Hashim, I.M.** (2003). "Child Migration: Pathological or Positive?" Paper Presented at the Conference on Child Abuse and Exploitation: Social, Legal and Political Dilemmas. Onati, Spain, May 29-30.

**Hestyanti, Yohana Ratrin** (2006). "Resilience in Children." *Annals of the New York Academy of Sciences* 1094: 303–307.

**Hoddinot, J. and B. Kinsey** (2001). "Child Growth in the Time of the Drought." *Oxford Bulletin of Economics and Statistics* 63: 409-436.

**Holding, P.A. and R. W. Snow** (2004). "Impact of Plasmodium Falciparum Malaria on Performance and Learning: Review of the Evidence." *American Journal of Tropical Medicine and Hygiene* 71(2): 68-75.

**IFE Core Group** (2006) *Infant and Young Child Feeding in Emergencies: Operational Guidelines for Emergency Relief Staff and Programme Managers.* Available from: http://ennonline.net.

**Inter-Agency Network for Education in Emergencies (INEE)** (2004). *Minimum Standards for Education in Emergencies, Chronic Crises, and Early Reconstruction.* Available from: www.ineesite.org/standards/MSEE_report.pdf.

**Jayatissa R., A. Bekele, C.L. Piyasena, S. Mahamithawa** (2006). "Assessment of Nutritional Status of Children Under Five Years of Age, Pregnant Women, and Lactating Women Living in Relief Camps after the Tsunami in Sri Lanka." *Food and Nutrition Bulletin* 27(2): 144-152.

**Jonkman, S.N. and Ilan Kelman** (2005). "An Analysis of the Causes and Circumstances of Flood Disaster Deaths." *Disasters* 29(1): 75-97.

**Kahn, Peter H., Jr.** (2002). "Children's Affiliations with Nature: Structure, Development, and the Problem of Environmental Generational Amnesia." In Kahn, P.H. and S.R. Kellert, eds. *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*. Cambridge, MA: MIT Press, 93-116.

**Kar N., P.K. Mohapatra, K.C. Nayak, P. Pattanaik, S.P. Swain, and H.C. Kar** (2007). "Post-Traumatic Stress Disorder in Children and Adolescents One Year after a Super-Cyclone in Orissa, India: Exploring Cross-Cultural Validity and Vulnerability Factors." *BMC Psychiatry* 7: 8.

**Keenan, H.T., S.W. Marshall, M.A. Nocera, and D.K. Runyan** (2004). "Increased Incidence of Inflicted Traumatic Brain Injury in Children after a Natural Disaster." *American Journal of Preventive Medicine* 26(3): 189-193.

**Kemble, Sarah K., Jennifer C. Davis, Talemwa Nalugwa, Denise Njama-Meya, Heidi Hopkins, Grant Dorsey, and Sarah G. Staedke** (2006). "Prevention and Treatment Strategies Used for the Community Management of Childhood Fever in Kampala, Uganda." *American Journal of Tropical Medicine and Hygiene* 74(6): 999–1007.

**King, S. and D.P. Laplante** (2005). "The Effects of Prenatal Maternal Stress on Children's Cognitive Development: Project Ice Storm." *Stress* 8(1): 1-3.

**Kirschke, Jennifer and Willem van Vliet--** (2005). "'How Can They Look So Happy?' Reconstructing the Place of Children after Hurricane Katrina: Images and Reflections." *Children, Youth and Environments* 15(2): 378-391. Available from: www.colorado.edu/journals/cye.

**Lam, L.T.** (2007). "The Association between Climatic Factors and Childhood Illnesses Presented to Hospital Emergency among Young Children." *International Journal of Environmental Health Research* 17(1): 1-8.

**Lechtig, A. and B. Doyle** (1996). "The Impact of Water and Sanitation on Malnutrition and Under 5 Mortality Rates." *WATERfront* 1996(8): 5-19.

**Lee I., Y.S. Ha, Y.A. Kim, and Y.H. Kwon** (2004). "PTSD Symptoms in Elementary School Children after Typhoon Rusa." *Taehan Kanho Hakhoe Chi* 34(4): 636-645.

**Magkos, F.F., Arvaniti, I. Piperkou, S. Katsigaraki, K. Stamatelopoulos, M. Sitara, and A. Zampelas** (2004). "Identifying Nutritionally Vulnerable Groups in Case of Emergencies: Experience from the Athens 1999 Earthquake." *International Journal of Food Sciences and Nutrition* 55(7): 527-536.

**McFarlane, A.C.** (1987). "Family Functioning and Overprotection following a Natural Disaster: The Longitudinal Effects of Post-Traumatic Morbidity." *Australian and New Zealand Journal of Psychiatry* 21(2): 210-218.

**Mukhopadhyay, K.K.** (1995). "Girl Prostitution in India." *Social Change* 25(2-3): 143-153.

**Murray, C.J. and A.D. Lopez** (1996). *The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries and Risk Factors in 1990 and Projected to 2020.* Boston: Harvard University Press.

**Neumayer, Eric and Thomas Plumper** (2007). "The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gap in Life Expectancy, 1981-2002." *Annals of the Association of American Geographers* 97(3): 551-566.

**Niehaus, M.D., S.R. Moore, P.D. Patrick, L.L. Derr, B. Lorntz, A.A. Lima, and R.L. Guerrant** (2002). "Early Childhood Diarrhea is Associated with Diminished Cognitive Function 4 to 7 Years Later in Children in a Northeast Brazilian Shantytown*." American Journal of Tropical Medicine and Hygiene* 66: 590–593.

**Norris, Fran H., Matthew Friedman, Patricia J. Watson, C. Byrne, E. Diaz and K. Kaniasty** (2002). "60,000 Disaster Victims Speak: Part I. An Empirical Review of the Literature, 1981-2001." *Psychiatry* 65: 207-239.

**Oberhelman R.A., E.S. Guerrero, M.L. Fernandez, M. Silio, D. Mercado, N. Comiskey, G. Ihenacho, and R. Mera** (1998). "Correlations between Intestinal Parasitosis, Physical Growth, and Psychomotor Development among Infants and Children from Rural Nicaragua." *American Journal of Tropical Medicine and Hygiene* 58: 470–475.

**Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson**, eds. (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of*

*the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press.

**Plan International** (2005). *Children and the Tsunami: Engaging with Children in Disaster Response, Recovery and Risk Reduction. Learning from Children's Participation in the Tsunami Response.* Bangkok: Plan International.

**Pradhan, E.K., K.P. West, J. Katz, S.C. LeClerq, S.K. Khatry, and S.R. Shrestha** (2007). "Risk of Flood-Related Mortality in Nepal." *Disasters* 31(1): 57-70.

**Prüss-Üstün, A. and C. Corvalán** (2006). *Preventing Disease through Healthy Environments: Towards an Estimate of the Environmental Burden of Disease*. Geneva: World Health Organization.

**Renzaho, A.** (2007). "Mortality Rates, Prevalence of Malnutrition, and Prevalence of Lost Pregnancies among the Drought-Ravaged Population of Tete Province, Mozambique." *Prehospital and Disaster Medicine* 22(1): 26-34.

**Revi, A.** (2008). "Climate Change Risk: An Adaptation and Mitigation Agenda for Indian Cities." *Environment and Urbanization*, in press.

**Save the Children** (2007). *Legacy of Disasters: The Impact of Climate Change on Children*. London: Save the Children UK.

**Save the Children Sweden** (2007). *Bridging the Gap—Save the Children's Transitional Housing Project after the Tsunami in Ampara District, Sri Lanka*. Available from: www.crin.org/docs/BridgingtheGapfinal1.pdf.

**Save the Children Norway** (2002). *Banshighat: Preparatory Research for ECD Programming*. Unpublished report. Kathmandu, Nepal.

**Snow, R.W., E.L. Korenromp, and E. Gouws** (2004). "Pediatric Mortality in Africa: Plasmodium Falciparum Malaria as a Cause or Risk?" *American Journal of Tropical Medicine and Hygiene* 71(2): 16-24.

**Sphere Project** (2004). *Humanitarian Charter and Minimum Standards in Disaster Response.* Available from: www.sphereproject.org.

**Tolfree, David** (2005). "Community-Based Care for Separated Children." *Responses to Young Children in Post-Emergency Situations, Early Childhood Matters* 104: 40-46.

**UNEP, UNICEF, WHO** (2002). *Children in the New Millennium: Environmental Impact on Health.* Geneva: United Nations Environment Programme, United Nations Children's Fund, World Health Organization.

**UNICEF** (2007a). *Climate Change and Children*. New York: United Nations Children's Fund.

**UNICEF** (2007b). *The State of the World's Children*. New York: United Nations Children's Fund.

**Valsiner, J.** (1987). *Culture and the Development of Children's Action.* New York: Wiley.

**Vygotsky, L.S.** (1978). *Mind in Society: The Development of Higher Mental Processes.* Cambridge, MA: Harvard University Press.

**Wachs, T. and F. Corapci** (2003). "Environmental Chaos, Development and Parenting across Cultures." In Raeff, C. And J. Benson, eds. *Social and Cognitive Development in the Context of Individual, Social, and Cultural Processes*. New York: Routledge, 54-83.

**Walker, Susan, Theodore D. Wachs, Julie Meeks Gardner, Betsy Lozoff, Gail A. Wasserman, Ernesto Pollitt, Julie A. Carter, and the International Child Development Steering Group** (2007). "Child Development: Risk Factors for Adverse Outcomes in Developing Countries." *The Lancet* 369: 145-157.

**Waterston, T.** (2006). "Climate Change—The Greatest Crisis for Children?" *Journal of Tropical Pediatrics* 52(6): 383-385.

**Zahran, Sammy, Lori Peek, and Samuel D. Brody** (2008). "Youth Mortality by Forces of Nature." *Children, Youth and Environments* 18(1): 371-388. Available from: www.colorado.edu/journals/cye.