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Theme: Climate Change and Cities - 2

Climate change and urban children

Impacts and implications for adaptation in low- and middle-income countries

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Contents

List of figures, tables and boxes

1 Summary

1.1 Introduction

This paper discusses the probable impacts for children of different ages from the increasing risk of storms, flooding, landslides, heat waves, drought and water supply constraints that climate change is likely to bring to most urban centres in Africa, Asia and Latin America. It also explores the implications for adaptation, focusing on preparedness as well as responses to extreme events and to changes in weather patterns. As is the case with many poor groups, if adaptations to climate change fail to take account of the disproportionate risks for children (who make up between a third and a half of the population in the most affected areas) they will be less than adequate in responding to the challenges.

1.1.1 Why children?

Children, especially young children, are in a stage of rapid development and are less well equipped on many fronts to deal with deprivation and stress. Their more rapid metabolisms, immature organs and nervous systems, developing cognition, limited experience and behavioural characteristics are all at issue here. Their exposure to various risks is also more likely than with adults to have long-term repercussions. Almost all the disproportionate implications for children are intensified by poverty and the difficult choices low-income households make as they adapt to more challenging conditions. Events that might have little or no effect on children in high-income countries and communities can have critical implications for children in poverty.

1.1.2 Why urban children?

Urban children are generally better off than their rural counterparts, but this is not true for the hundreds of millions living in urban poverty. Without adequate planning and good governance, poor urban areas can be among the world's most life-threatening environments. In some informal settlements, a quarter of all children still die before the age of five. Nor does the "urban advantage" come into play in terms of education and life opportunities for most of those in poverty. In many urban areas, the risks children face are likely to be intensified by climate change. Most of the people and enterprises at most serious risk from extreme weather events and rising sea levels are located in urban slums in low-income countries, where there is a combination of high exposure to hazards and inadequate protective infrastructure and services.

1.1.3 Children as resilient, active agents

Although children are disproportionately at risk on many fronts, it is a mistake to think of them only as victims in the face of climate change. With adequate support and protection, children can also be extraordinarily resilient in the face of stresses and shocks. Moreover, there is ample documentation on the benefits of having children and young people active, informed and involved in responding to the challenges in their lives, not only for their own learning and development but also for the energy, resourcefulness and knowledge that they can bring to local issues.

1.2 Understanding the impacts for children of climate change

There is not enough hard knowledge about the implications of climate change for children to present a comprehensive picture. Even where more general impacts are projected, figures are seldom disaggregated by age. But it is possible to extrapolate from existing knowledge in related areas: work on environmental health in urban areas, disaster responses, household coping strategies, the effects on children of urban poverty, children's resilience, and the beneficial effects of their participation in various efforts all contribute to a picture of the implications of disasters as well as more gradual changes, and the adaptations likely to be made.

Table 1: Some likely impacts of climate change

Change	Impact on natural systems, agri-culture, water	Impact on urban areas	Impact on health and household coping	Implications for children
Warm spells and heat waves: frequency up on most land areas	Reduced crop yields in warmer regions; wildfire risk up; wider range for disease vectors	Heat islands with higher temperatures (up to 10˚ higher); often large concentrations of vulnerable people; air pollution worse	Increased risk of heat-related mortality and morbidity; more vector-borne disease; impacts for those doing strenuous labour; increased respiratory disease where air pollution worsens; food shortages	Greatest vulnerability to heat stress for young children; high vulnerability to respiratory diseases and vector-borne diseases; highest vulnerability to malnutrition with long-term implications
Heavy precipitation events: frequency up over most areas	Damage to crops; soil erosion; water-logging; water quality problems	Floods and landslide risks up; disruption to livelihoods and city economies; damage to homes, possessions, businesses and to transport and infra-structure; loss of income and assets; often large displacements of population, with risks to social networks and assets	Deaths, injuries, increased food-borne, water-borne and water-washed diseases; more malaria from standing water; decreased mobility with implications for livelihoods; dis-locations; food shortages; risks to mental health, especially associated with displacement	Higher risk of death and injury than adults; more vulnerable to water-borne/water-washed illness and to malaria; risk of acute malnutrition; reduced options for play and social interaction; likelihood of being removed from school /put into work as income is lost; higher risk of neglect, abuse and maltreatment associated with household stress and/or displacement; long-term risks for development and future prospects
Intense tropical cyclone: activity increases	Damage to crops, trees and coral reefs; disruption to water supplies			
Increased area affected by **drought**	Land degradation; lower crop yields; livestock deaths, wildfire risks and water stress up	Water shortages; distress migration into urban centres; hydro-electric constraints; lower rural demand for goods/services; higher food prices	Increased food and water shortages; malnutrition and food- and water-borne diseases up; risk of mental health problems up; respiratory problems from wildfires	Young children at highest health risk from inadequate water supplies; at highest risk of malnutrition, with long-term implications for overall development; risk of early entry into work and exploitation
Increased incidence of **extreme high sea level**	Salinization of water sources	Loss of property and enterprises; damage to tourism; damage to buildings from rising water table	Coastal flooding, increasing risk of death and injuries; loss of livelihoods; health problems from salinated water	Highest rates of death for children; highest health risks from salinization of water supplies; long-term developmental implications

1.2.1 Health and survival

- *Mortality in extreme events:* In low-income countries, the loss of life is shown repeatedly to be disproportionately high among children, women and the elderly, especially among the poor during such extreme events as flooding, high winds and landslides. A study of flood-related mortalities in Nepal, for instance, found that the death rate for children aged two to nine was more than double that of adults; and pre-school girls were five times more likely to die than adult men. The risk for poor households was six times that of higher-income households.
- *Water and sanitation-related illnesses:* Children under five are the main victims (80 per cent globally) of sanitation-related illnesses (diarrhoeal disease primarily) because of their less developed immunity and because their play behaviour can bring them into contact with pathogens. This also results in higher levels of malnutrition and increased vulnerability to other illnesses, with effects on overall development. Droughts, heavy or prolonged rains, flooding and conditions after disasters all intensify the risks, which are already very high in poor urban areas.
- *Malaria and other tropical diseases:* Warmer average temperatures are expanding the areas where many tropical diseases can occur, with children most often the victims. In many locations, the most serious threat is malaria. Up to 50 per cent of the world's population is now considered to be at risk. In Africa, 65 per cent of mortality is among children under five. Malaria also increases the severity of other diseases, more than doubling overall mortality for young children.
- *Heat stress:* Young children, along with the elderly, are at highest risk from heat stress. Research in São Paulo found that for every degree increase above 20°C, there was a 2.6 per cent increase in overall mortality in children under 15 (same as for those over 65.) Risks for younger children are higher. Those in poor urban areas may be at highest risk because of the "urban heat-island" effect, high levels of congestion and little open space and vegetation.
- *Malnutrition:* Malnutrition results from food shortages (as a result of reduced rainfall, other changes affecting agriculture, interruptions in supplies during sudden acute events) and is also closely tied to unsanitary conditions and to children's general state of health. If children are already undernourished, they are less likely to withstand the stress of an extreme event. Malnutrition increases vulnerability on every front and can result in long-term physical and mental stunting.
- *Injury*: After extreme events, injury rates go up. Children, because of their size and developmental immaturity, are particularly susceptible and are more likely to experience serious and long-term effects (from burns, broken bones, head injuries, for example) because of their size and physiological immaturity.
- *Quality of care:* As conditions become more challenging to health, so do the burdens faced by caregivers. These problems are seldom faced one at a time – risk factors generally exist in clusters. 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.

1.2.2 Children's learning and competence

For some children in some places, the added challenges brought by climate change could contribute to an erosion of both their mental capacity and their opportunities for learning and growth. Abundant research relates lower cognitive capacity and performance to undernutrition, intestinal parasites, diarrhoeal diseases, malaria, maternal health and nutrition during pregnancy, as well as maternal stress during and after pregnancy. Learning is also dependent on supportive social and physical environments and the opportunities to master new skills. When supportive environments break down, so do opportunities for engagement in purposeful goal-directed activities. Disaster can also result in the interruption of formal schooling for months at a time, and children are more likely to be withdrawn from school when households face shocks.

1.2.3 Coping with adversity

Levels of psychological vulnerability and resilience depend on children's health and internal strengths as well as household dynamics and levels of social support. Children who have experienced success and approval in their lives are more likely to adapt well than those who have suffered rejection and failure. Poverty and social status can play an important role in this regard. But without question, the losses, hardships and uncertainties surrounding stressful events can have high costs for children.

Increased levels of irritability, withdrawal and family conflict are not unusual after disasters. Even gradually worsening conditions can contribute to mental health problems, which are closely tied to unpredictability, uncertainty and general insecurity. High stress for adults can have serious implications for children, contributing to higher levels of neglect. Increased rates of child abuse have long been associated with such factors as parental depression, increased poverty, loss of property or a breakdown in social support. (For instance, after a hurricane in the US, rates of inflicted head injury to children under two increased five-fold.)

Displacement and life in emergency or transitional housing have been noted in many contexts to lead to an erosion of the social controls that normally regulate behaviour within households and communities. Overcrowding, chaotic conditions, lack of privacy and the collapse of regular routines can contribute to anger, frustration and violence. Adolescent girls especially report sexual harassment and abuse. The synergistic and cumulative effects of such physical and social stressors can affect children's development on all fronts. As the numbers of displaced people grow, these dysfunctional environments are likely to become the setting within which more and more children spend their early years. Children's capacity to cope well in these difficult situations has been related to their own active engagement, opportunities for problem solving and for interaction with peers, and the presence of at least one consistently supportive adult in their lives.

Even less extreme events can create havoc in families' lives, deepening the level of poverty. When times are hard, children can become an asset that is drawn on to maintain the stability of the household. Children may be pulled from school to work or take care of siblings. Some children may be considered more "expendable" than others. Many of Bombay's young prostitutes are from poor rural villages in Nepal, where inadequate crop yields lead families to sacrifice one child so others may survive.

1.3 Implications for adaptation

In seeking to reduce vulnerability and enhance resilience in the face of various hazards and risks, how can the multiplicity of concerns for children of different ages be adequately represented without completely overwhelming any agenda?

In every aspect of adaptation – ***protection, preparation, relief and rebuilding*** – and at every level of response (community, local government, NGO, international agencies, etc.), some basic concerns need to be taken into account. These must be based on adequate knowledge of children's lives and experience and the challenges faced by their caregivers; and they must be integrated into planning, decision making and action, not treated as add-ons after the fact.

- *Ensuring children's optimal health and nutrition:* Ensuring children's health through preventive care and environmental health measures is a potent form of disaster risk reduction. Food aid and supports for health are vital after crises, but when health is already compromised by malnutrition or illness, children are more likely to suffer long-term damage from extreme events and worsening conditions, and also to be a drain on the family capacity to cope.
- *Strengthening families' capacity to cope:* All adaptive measures should ideally enhance the capacity of households to come through periods of shock with minimal upset. But "coping" may take on broader meaning where children are concerned, and will include the capacity to manage hardship without compromising the well-being of their children.

- *Maintaining and restoring children's routines, networks and activities:* Children 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, it is important not to compromise children's spaces, activities, networks and opportunities for gaining competence.
- *Respecting children's capacities; supporting their active involvement:* The chance to solve problems, contribute, take action, is a potent protective force for children in adversity. But the contribution of children and young people is also a potential community asset too seldom tapped in the process of development and adaptation. There are numerous precedents for effective action in this area, in disaster risk reduction, preparedness and rebuilding.

Addressing these concerns for children may appear to be an unrealistic burden in the face of so many 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. For instance, the most useful measures to protect children's health are also fundamental in reducing risks from potential disasters –such as adequate drainage, waste removal and proper sanitation. Supporting adults so that they are better able to address their children's needs also leaves them better equipped to work collaboratively on reducing risks, preparing for disasters and rebuilding their lives after a crisis.

1 Introduction

1.1 Climate change and children

This paper explores the particular and often disproportionate implications of extreme weather events and other aspects of climate change for urban children in low- and middle-income countries. In recent decades, there has been an increase in the intensity of extreme weather events that have contributed to injury, illness, impoverishment, displacement and hunger for hundreds of millions of people. We do not know precisely the contribution 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 the reduction of greenhouse gas emissions (or mitigation). However, even if an effective international agreement on this front 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. Attention to adaptation is as urgently needed as attention to mitigation. This paper discusses the kinds of adaptations that will be most useful in ensuring that children's needs are met.

There is growing discussion in the child advocacy world of the implications of climate change for children.[1] But systematic attention to children and young people does not feature much in the broader discourse on climate change and the adaptations needed to respond to it. The most recent IPCC report on adaptation demonstrates the imbalance in this regard: the chapter on health, for instance, gives excellent attention to some of the disproportionate vulnerabilities of young children.[2] However, the chapter on adaptation practices makes only two references to children (and old people), both embedded in a box on the vulnerability of women.[3] In some overviews, 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.[4] In fact, most of the numerous public health problems discussed in this report are likely to have significantly more severe impacts for children, a reality that has policy implications and that surely deserves closer attention.

A focus on children has implications not only for public health measures, but for a range of actions, calling for a reconsideration of the scope and nature of the evolving adaptation agenda. A useful parallel is the growing understanding of the disproportionate vulnerability of the urban poor to the impacts of climate change in many low- and middle-income countries. Adaptations and responses in these urban areas that

[1] See, for instance, Save the Children (2007) *Legacy of Disasters: The Impact of Climate Change on Children*, Save the Children UK, London; UNICEF (2007) *Climate Change and Children*, United Nations Children's Fund, New York; Waterston, T (2006) "Climate change – the greatest crisis for children?", *Journal of Tropical Pediatrics* 52(6), pp 383-385.

[2] Confalonieri, U, B Menne, R Akhtar , K Ebi, M Hauengue, RS Kovats, B Revich and A Woodward (2007) "Human health", in Parry, ML, OF Canziani, JP Palutikof, PJ van der Linden and CE 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 University Press, Cambridge, UK, pp 391-431.

[3] Adger, WN, S Agrawala, MMQ 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, ML, OF Canziani, JP Palutikof, PJ van der Linden and CE 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 University Press, Cambridge, UK, pp 717-743.

[4] Epstein, Paul R, Sarah Meginness, John Rich, Roger Swartz, Jean McGuire, John Auerbach (2003) *Urban Indicators of Climate Change*, Center for Health and the Global Environment, Harvard Medical School, The Boston Public Health Commission, p 19.

fail to take this into account are likely to fall seriously short of the mark.[5] To some degree, the same thing is true of children and young people.[6] This is not to say that all children are vulnerable to all aspects and impacts of climate change in ways that are not true of adults. We must be wary of the kind of sentimental oversimplifications that present children always as helpless victims. In fact, many children can be extraordinarily resilient in the face of significant challenges.[7] But there are also concrete, particular ways in which children of different ages and in different places are at more serious risk. As in the case of many poor groups, if adaptations to climate change do not take account of this, they will be less than adequate in responding to the challenges.

Almost all of the disproportionate implications for children are intensified by poverty and by the difficult choices that must be made by low-income households as they adapt to more challenging conditions. Events that might have little or no effect on children in high-income countries and communities can have critical implications for children in poverty. The pathways between poverty and poor developmental outcomes for children are numerous and well established.[8] In poor urban areas, these connections can be especially striking.

1.2 Why a concern for urban children?

Urban children, generally speaking, are better off than their rural counterparts – healthier, better educated, and with a wider range of options in life. But this is not true for the hundreds of millions of urban children living in overcrowded tenements or informal settlements, where challenging conditions and concentrations of people and wastes are unrelieved by the services and facilities that can turn urban living into an advantage for all groups.[9] In the absence of adequate planning and good governance, poor urban areas can be some of the world's most life-threatening environments. There are informal settlements where a quarter of all children still die before they reach the age of five, in dramatic contrast to other areas in the same cities, and to their countries as a whole.[10] Poor quality, overcrowded housing and a lack of provision for water, sanitation, drainage and waste management all contribute to high rates of preventable disease and injury. Nor does the "urban advantage" come into play for these children in terms of their education and long-term opportunities. The failure to complete, or even start, primary education is likely to be especially

[5] Douglas, Ian, Kurshid Alam, MaryAnne Maghenda, Yasmin Mcdonnell, Louise McLean and Jack Campbell (2008) "Unjust waters: climate change, flooding and the urban poor in Africa", *Environment and Urbanization* 20(1), pp 187-206; Satterthwaite, David, Saleemul Huq, Mark Pelling, Hannah Reid and Patricia Romero-Lankao (2007) *Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-income Nations*, International Institute for Environment and Development, London.

[6] In most countries children, legally, are those under 18, although this varies. The Convention on the Rights of the Child is most generally applied to those under 18. Children over 14 are often referred to as youth or young people. On the other hand, the term youth can apply to those up to 25 or older in some places. This paper sets no firm boundaries in this regard. Most of the material here focuses primarily on younger children, although adolescents or young people are also discussed where relevant.

[7] See, for instance, Jennifer Kirschke and Willem van Vliet's discussion of the energy and resourcefulness shown by many children in the wake of Hurricane Katrina, in contrast to the picture portrayed by the media: Kirschke, J and W 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), pp 378-391.

[8] 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, pp 145-157.

[9] See, for instance, Van den Poel, E, O O'Donnell, E Van Doorslaer (2007) "Are urban children really healthier?", Evidence from 47 developing countries, *Social Science and Medicine* 65, pp 1986-2003.

[10] In Nairobi, for example, figures for 2002 show mortality rates of 62 per 1,000 for children under five, as compared to 113 per 1,000 for Kenya's rural areas. But within the city's informal settlements, this rate rises to 151 per 1,000, and in the Embakasi slum to 254 per 1,000 – four times as high as for the city as a whole. APHRC (2002), *Population and Health Dynamics in Nairobi's Informal Settlements*, African Population and Health Research Center, Nairobi.

high among the urban poor, and the prospects of upward mobility can be dim.[11] Well over 900 million people in the world are now estimated to live in poverty in these overcrowded, insecure and underserved urban areas, and a large percentage of them are children.[12]

In high-income countries, people under 18 make up about 20 per cent of the population. In the countries most exposed and most vulnerable to climate change, they form closer to half the population (for instance, 42 per cent in Bangladesh, 51 per cent in Nigeria, 57 per cent in Uganda.) Even more to the point is the proportion of very highly vulnerable children under five – they make up between 10 and 20 per cent of the population in countries more likely to be seriously affected (for instance, 11 per cent in India, 12 per cent in Bangladesh, 17 per cent in Nigeria and Mozambique, 21 per cent in Uganda). In higher-income countries, the proportion of under fives is closer to four or five per cent.[13] If we consider children in urban areas alone, there are about 200 million in Africa, and more like 400 million in Asia. In other words, these poor urban children are not a special interest group, but a significant part of the world's population.

The risks these children face – to health, survival and long-term prospects – are likely in many urban areas to be intensified by climate change, whether directly or indirectly. Urban slums house not only a large and increasing proportion of the world's population, but also of the people and enterprises most seriously at risk from extreme weather events and rising sea levels. There is a high concentration of large cities on the coast[14] and in regions where hurricanes, cyclones or typhoons already have very serious impacts.[15] The urban poor live where they can best find land or afford rents within reach of livelihood opportunities. This can mean considerable compromises in terms of health, safety and the general quality of life. They often live in the most hazardous areas – flood plains, or other areas at risk of floods, places at risk from landslides, sites close to industrial wastes, areas unserved by the kind of infrastructure that can be strengthened and adapted to withstand more extreme conditions. Settlement in these areas can, in turn, increase the risk of flooding and landslides by changing drainage patterns or destabilizing slopes.[16] The poor are also the people least able to invest in preventive measures, or to find such investments worth the gamble when their land tenure is insecure or when they rent accommodation. Although they are at highest risk of loss and harm, they are the least likely to have their needs for risk reduction taken seriously by local governments.

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[11] A recent case study of rickshaw pullers in Dhaka, for instance, shows that the adult children of these first generation migrants were scarcely better educated than their fathers – 55 per cent had never attended school at all and only a small number were functionally literate. School attendance rates generally in Dhaka are only 58 per cent, compared to 73 per cent for villages. Begum, Sharifa and Binayak Sen (2005) "Pulling rickshaws in the city of Dhaka: a way out of poverty?", *Environment and Urbanization* 17(2), pp 11-25.

[12] UN–Habitat (2003) *The Challenge of Slums: Global Report on Human Settlements 2003*, Earthscan Publications, London.

[13] United Nations Children's Fund (2007) *The State of the World's Children*, UNICEF, New York.

[14] McGranahan, Gordon, Deborah Balk and Bridget Anderson (2007) "The rising tide: assessing the risks of climate change and human settlements in low-elevation coastal zones", *Environment and Urbanization* 19(1), pp 17–37.

[15] Parry, ML, OF Canziani, JP Palutikof, PJ van der Linden and CE 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 University Press, Cambridge, UK; Satterthwaite, David, Saleemul Huq, Mark Pelling, Hannah Reid and Patricia Romero-Lankao (2007) *Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-income Nations*, International Institute for Environment and Development, London.

[16] Diagne, Khady (2007) "Governance and natural disasters: addressing flooding in Saint Louis, Senegal", *Environment and Urbanization* 19(2), pp 552-562.

1.3 An adaptation agenda with children in mind

In cities in high-income nations, adaptation can focus on preventing disasters. Protective infrastructure and good quality housing are in place, serving almost everyone, and there is the potential for larger investments in adapting protective infrastructure. But most urban centres in low- and middle-income countries lack protective infrastructure and the adaptive capacity for disaster prevention, and risk levels are much higher. In these urban areas, adapting to climate change-related risks means attention to measures that can reduce the impacts of disasters. Better protective infrastructure is critical, but also disaster preparedness plans and the capacity for disaster response and long-term rebuilding.

An adaptation agenda developed with children in mind broadens the terms of discussion in several ways. Where infrastructure, housing and basic services are concerned, it means reconsidering a range of standards and objectives to take account of the concerns of children and those who care for them. Ensuring adequate water supplies, for instance, would mean paying closer attention to the quantities of water that are necessary to protect the health of small children, and the distances that caregivers can reasonably be expected to carry these quantities. Upgrading a road to ensure it is not washed away by flooding means considering the increased traffic that would then pass through a community and the speed of that traffic; when existing roadways are the primary play space for children, this can have implications that are not generally considered.

But the issues go well beyond infrastructure. To some degree, the lack of attention to children reflects a generally lower level of attention to the social and human implications of climate change – as compared, for instance, to the environmental and economic implications. A sharper focus on children within the context of climate change could bring along with it a better awareness of many of the human realities that could use closer consideration in the development of an adaptation agenda – the social dynamics as well as the economic implications, the mental health effects as well as the implications for survival and physical morbidity. Theory and practice regarding children has long stressed the necessity for an integrated approach to development and well-being,[17] and this same standard could be more broadly applied. Adaptation, in these terms, would mean considering, among other things, how to strengthen and support children's capacity to cope with the full range of risks associated with climate change, as well as that of the families and communities on which they depend.

This paper first discusses why and how children of different ages are at particular risk from certain aspects of climate change, whether directly or indirectly, explaining some of the impacts for their health and safety, learning, psychological well-being and social support. It then explores the implications for adaptation, focusing on risk reduction and preparation for extreme events, as well as responses to the immediate losses and threats of extreme weather events, and rebuilding to reduce future risks.

[17] Bronfenbrenner, U (1979) *The Ecology of Human Development: Experiments by Nature and Design*, Harvard University Press, Cambridge, Mass.

2 Some background on children

2.1 Risk factors and protective factors

Discussion of children's well-being and development is often couched in terms of vulnerability and resilience. Features of their daily lives can be seen either as risk factors that pose threats to their well-being and optimal development, or as protective factors, which buffer them from these threats and contribute to their resilience and capacity to cope and thrive.[18] These concepts can be particularly useful in considering children who routinely face challenges and hardships, and they are very apt for a discussion of the implications of climate change.

This approach is conceptually compatible with an assets and vulnerability approach to considering households in poverty.[19] The accumulation of risks or of protective factors is an important concern with children, as it is with vulnerable households. When children are in good health and well nourished, secure and well supported in the world, with opportunities to develop and exercise their competence, they are more likely to meet challenges with resilience and to recover quickly from hardships or shocks. But the likelihood of poor outcomes for children has been found to increase cumulatively with the number of risks that they face.[20] This is true whether we are talking about physiological stresses such as malnutrition or about psychological challenges. Children on the edge, like families on the edge, have fewer assets to draw on in every sense of the word, and are more likely to be adversely affected by the various challenges imposed by climate change. Children's level of health, confidence and competence as well as their standing within the family, their family's capacity to cope, the social support they receive, the quality of the physical surroundings and the range of services available within a community will all help to determine how they respond to both extreme weather events and to the slower-onset deterioration of living conditions. It is important to bear in mind that both risks and protective factors are mediated by the meaning that they hold for children and those around them; it is a mistake to take too mechanical an approach to the relationship between children and the conditions they face.

2.2 Children's disproportionate vulnerability to the impacts of climate change

Why are children as a group more vulnerable to many of the challenges associated with climate change? Children, and especially very young children, are in a stage of rapid development and are less well equipped on a number of fronts to deal with deprivation and stress. It is risky to try to draw hard conclusions about their relative vulnerability in areas that are more socially and culturally constructed. However, their more rapid metabolisms, immature organs and nervous systems, developing cognition, limited experience and particular behavioural characteristics are all at issue here. Table 2 provides a biomedical perspective on these differences. Children are more vulnerable to certain risks, and exposure to these risks may be more likely than it is with adults to have long-term repercussions. It is overly simplistic to lump boys and girls of different ages together. The concerns for a two-year-old boy are not the same as those of a 14-year-old girl (who may, in fact, be functioning as an adult woman in some settings.) Their concerns also vary in acuteness, which is not to say that the two-year-old is always the one at greatest risk.

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[18] Engle, P, S Castle and P Menon (1996) "Child development: vulnerability and resilience", *Social Science and Medicine* 43(5), pp 621-635.

[19] Moser, Caroline ON (1998) "The asset vulnerability framework: reassessing urban poverty reduction strategies", *World Development* 26(1), pp 1-19.

[20] See, for instance, Evans, Gary W and Kimberley English (2002) "The environment of poverty: multiple stress exposure, psychophysiological stress and socioemotional adjustment", *Child Development* 73(4), pp 1238-1248. See also Werner, E and R Smith (1992) *Overcoming the Odds: High Risk Children from Birth to Adulthood*, Cornell University Press, Ithaca, NY and London for classic research exploring resilience longitudinally in a cohort of children in Hawaii.

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

Modality	Mechanism	Increased exposure
Metabolic	> respiratory rate > metabolic rate > water demand per unit body mass	• air pollution, allergens • malnutrition, thermal extremes • gastrointestinal disease, dehydration
Behavioural	> outdoor time > vigorous activity < ability to avoid unhealthy situations < swimming capacity	• infectious diseases, air pollution, UV radiation, thermal extremes, allergens • weather extremes, UV radiation, thermal extremes • drowning
Physiology	> less surface area to volume < detoxifying capacity < skin development < immunity	• infectious diseases, UV radiation • air pollution, infectious diseases, thermal extremes • UV radiation • infectious diseases, allergens/mycotoxins
Time	> latency for genetic/long-term effect > lifetime exposure time	• UV radiation, allergens, malnutrition
Development	Undergoing development	• malnutrition, stunting, psychosocial trauma • morbidity, quality of life

Source: Bunyavanich, S, C Landrigan, AJ McMichael and PR Epstein (2003) "The impact of climate change on child health", *Ambulatory Pediatrics* 3(1), p 47.

2.3 Children as active agents

An important concept here is that of children as active agents. This is a vital component of a rights-based approach to children[21] and also an accepted reality within theory on children's development. Children do not just passively experience the process of development, but are actively engaged in it in purposeful ways, even from their earliest days.[22] On some essential level, they know what they need – be it nourishment, attention from caregivers, or opportunities to expand their knowledge and competence – and they help to create the circumstances of their own development. Even the youngest children can make their needs known to caregivers.

Older children have the capacity not only to play a valuable role in identifying and securing the conditions necessary for their own well-being; they also routinely make practical contributions to their households and communities. In some cases, they are already surviving on their own without the support of adults. When children's priorities and perspectives are ignored, it may be more difficult to come up with solutions that reliably meet their needs and those of the people around them. The practical everyday realities faced by children and those who care for them, and their perception of these realities, must be clearly understood in order to be effectively responded to. Ideally, for older children this will go beyond consultation to include active engagement in developing and managing solutions. There is ample documentation of the benefits of having children and young people active, informed and involved in responding to the

[21] According to the Convention on the Rights of the Child, children have rights not only to provision and protection but also to active participation. They have the right, for instance, to express their opinions in matters that concern them, and to have these opinions weighed when decisions are made, in accordance with their age, maturity and understanding of the situation (Article 12); the right to freedom of thought and conscience, subject to the guidance of parents or other guardians; the right to seek, obtain and impart information, and to have access to informational material not deemed harmful to their well-being (Article 17); the right to associate with others and to assemble freely (Article 15).

[22] Gibson, EJ and AD Pick (2000) *An Ecological Approach to Perceptual Learning and Development*, Oxford University Press, New York.

challenges in their lives, not only for their own learning and development as responsible citizens, but for the energy, resourcefulness and depth of knowledge that they can bring to local issues.[23]

3 Understanding the impacts for children of factors related to climate change

This section of the paper considers the range of risks that climate change-related factors pose for children, both directly and indirectly, and the potential impact of these risks. It considers several areas – children's health and survival, their learning and competence, their emotional security and the social support they receive within families and communities. There are considerable overlaps here – none of these areas can truly be considered in isolation. Poor health affects cognitive development, for instance, and an absence of love and attention may well be reflected in diminished health.

There is not enough hard knowledge about the implications of climate change for children to present a comprehensive picture. Even where there are projections for the more general impacts of climate change, these are not able to specify the likely changes for particular localities, and the figures are seldom disaggregated to reflect the specific implications for people of different ages. But it *is* possible to extrapolate from existing knowledge in a number of related areas. This includes work on environmental health in urban areas, on household strategies to cope with weather variability, on disasters caused by extreme weather events and their aftermath. It also includes work on the range of effects on children of urban poverty, on the resilience of children and on the beneficial effects of their participation in various efforts. All of this knowledge contributes to a broad sense of the potential implications – both of climate-related 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 simply an academic exercise, given that, at least for the next few decades, the risks posed by climate change are by and large extensions of the everyday risks that are already experienced in many cities. Table 3 provides a synopsis of these likely implications, which are then presented in greater detail in the following sections.

[23] A well-known overview of children's capacities in this regard is Hart, R (1997*) Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care,* Earthscan/UNICEF, London. For a few recent examples of children's active involvement, see Chatterjee, Sudeshna (2007) "Children's role in humanizing forced evictions and resettlements in Delhi", *Children, Youth and Environments* 17(1), pp 198-221; Awuor, George and James Njuguna (2007) "The Mathare Youth Sports Association (MYSA) ShootBack Project", *Children, Youth and Environments* 17(3), pp 227-235.

Table 3: Some likely impacts of climate change

Change	Impact on natural systems, agri-culture, water	Impact on urban areas	Impact on health and household coping	Implications for children
Warm spells and heat waves: frequency up on most land areas	Reduced crop yields in warmer regions; wildfire risk up; wider range for disease vectors	Heat islands with higher temperatures (up to 10˚ higher); often large concentrations of vulnerable people; air pollution worse	Increased risk of heat-related mortality and morbidity; more vector-borne disease; impacts for those doing strenuous labour; increased respiratory disease where air pollution worsens; food shortages	Greatest vulnerability to heat stress for young children; high vulnerability to respiratory diseases and vector-borne diseases; highest vulnerability to malnutrition with long-term implications
Heavy precipitation events: frequency up over most areas	Damage to crops; soil erosion; water-logging; water quality problems	Floods and landslide risks up; disruption to livelihoods and city economies; damage to homes, possessions, businesses and to transport and infra-structure; loss of income and assets; often large displacements of population, with risks to social networks and assets	Deaths, injuries, increased food and both water-borne and water-washed diseases; more malaria from standing water; decreased mobility with implications for livelihoods; dislocations; food shortages; risks to mental health, especially associated with displacement	Higher risk of death and injury than adults; more vulnerable to water-borne/water-washed illness, and to malaria; risk of acute malnutrition; reduced options for play and social interaction; likelihood of being removed from school /put into work as income is lost; higher risk of neglect, abuse and maltreatment associated with household stress and/or displacement, long-term risks for development and future prospects
Intense tropical cyclone: activity increases	Damage to crops, trees and coral reefs; disruption to water supplies			
Increased area affected by **drought**	Land degradation; lower crop yields; livestock deaths; wildfire risks and water stress up	Water shortages; distress migration into urban centres; hydro-electric constraints; lower rural demand for goods/services; higher food prices	Increased food and water shortages; malnutrition and food and water-borne diseases up; risk of mental health problems up; respiratory problems from wildfires	Young children at highest health risk from inadequate water supplies; at highest risk of malnutrition, with long-term implications for overall development; risk of early entry into work and exploitation
Increased incidence of **extreme high sea level**	Salinization of water sources	Loss of property and enterprises; damage to tourism; damage to buildings from rising water table	Coastal flooding; increasing risk of death and injuries; loss of livelihoods; health problems from salinated water	Highest rates of death for children; highest health risks from salinization of water supplies; long-term developmental implications.

What stands out in this table is not only the disproportionate vulnerability of children, and young children especially, to many of the hazards posed by climate change, but also the sheer repetitiveness of the impacts for children. Despite the numerous impacts and outcomes of climate change – land degradation, reduced crop yields, wildfires, decreased water quality and quantity, migration and displacement, higher food prices, property loss, disruptions to livelihoods and social networks, to name just some – the same few outcomes for children show up repeatedly: more malnutrition, more disease, more death and injury, more risk of neglect, abuse and exploitation. At issue for children, as indicated in the table, is not only their greater vulnerability to many of the stresses associated with climate change, but also the long-term

developmental implications of these vulnerabilities. Box 1 provides a hypothetical scenario that follows in greater detail the potential child outcomes of a certain chain of events related to climate change.

Box 1: A possible scenario in one African city

A small city in Africa has suffered several unbroken years of drought, in the course of which migrants from hard-hit surrounding areas have settled in such hazardous areas as the dry stream beds that are some of the only land available in the city. Food prices are high, water supplies are scarce and there is no provision in these new settlements for sanitation or waste collection – nor is there in many of the low-income parts of this city. Hygiene is generally poor as a result and many children are badly undernourished and prone to frequent illness. Mortality rates, especially for the youngest children, are high.

Despite the challenging conditions, low-income groups in this city have been resourceful in creating livelihoods. Many residents, for instance, have developed vending businesses, set up small workshops and are struggling to make a decent life for themselves and their children, despite the drought. It is uphill work, however. For example, although many want an education for their children, children who are malnourished, infected by worms and frequently ill do not make the best students. Despite their families' ambitions for them, many are stunted both physically and mentally, and their prospects for climbing out of poverty are slim.

After nine years of drought, the rains finally come. They are unexpectedly intense and prolonged, however, and the water rises quickly in the old stream beds. Hundreds of shacks are washed away or destroyed. Most people are able to run to safety but the elderly and those carrying small children are more easily caught by the rapid waters. Shacks, small businesses, family possessions are washed away in the torrent. Even in other parts of the city, which should have been safe, accumulations of waste have blocked the long-unused storm drains. Many houses are flooded and possessions destroyed. Thousands of people take refuge in local schools or camp on higher land.

Conditions are extremely difficult over the following months. Temporary shelters are overcrowded, hot and lacking in any privacy. Sanitation is appalling. Food supplies are scarce and prices are higher than ever, except for a few weeks of government and NGO aid. With many livelihoods destroyed, survival in these conditions becomes very difficult. Many people, young children in particular, fall ill from diarrhoeal diseases. Many of those who were already malnourished and sick succumb to these more extreme threats. Schools, all being used for shelter, have been closed for the duration. Many children, bored with nothing to do, are injured as they play in the receding waters, or hunt among the debris for objects they can sell or trade for food. Tensions run high within families and among people in overcrowded shelters, and often small children become an outlet for taking out frustration and anxiety.

People start to rebuild almost immediately, attempting to regain some control over their lives and to re-establish their livelihoods. In most cases, they are forced to construct their new shacks in places that they know are risky, but there is little choice. Competition for land and materials is high, resulting in further tensions and mutual mistrust. With resources very tight, families become more dependent on their older children, either to care for younger siblings or help with work, and many nine- and 10-year-olds are carrying an adult load. When schools finally re-open, many children are pulled out because families no longer have the money for fees and they continue to need their children's help. Rates of illness continue to be high, especially among young children whose resilience has been further undermined, and families lack the resources to turn to health services. Mental health problems are also rife, especially among women worried about their children, about their inability to feed them adequately, and about the possibility of another flood the following year.

3.1 Health and survival

Droughts, floods, cyclones or hurricanes, heat stress and an expansion in the range of various disease vectors take a physical toll on people of all ages. But the disproportionate health burden for children of challenging conditions is well documented. 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.[24] According to this report's very conservative estimates, which include only disease burdens that can be reliably measured, 25 per cent of deaths in the population at large can be attributed to environmental factors. Among children under 14, however, this rises to 36 per cent. The same kind of gap exists in terms of morbidity according to this report. (WHO, less conservatively, has estimated that two-thirds of all preventable ill-health due to environmental factors occurs in children[25]). The biggest killers for young children are diarrhoeal disease, malaria and respiratory infections, all threats that may be exacerbated by climate change, whether in the context of post-disaster situations or the increasing routine 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 10-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.*"[26]

These conservative estimates demonstrate that the disproportionate health burdens for children are not simply a minor matter of degree. As a group, young children in particular suffer dramatically greater health risks than do adults from challenging environmental conditions. While these health risks exist for many poor urban populations even in the absence of climate change, they are likely to be exacerbated in many cases by climate change, and realistic responses to these conditions must take this into account.

3.1.1 Mortality related to extreme weather 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.

There also are studies indicating higher mortality for adult men than for all other groups during these events.[27] A study analyzing the causes and circumstances of flood disaster deaths in Europe and the USA, for instance, found that the risk-taking behaviour of males contributed significantly to flood disaster deaths.[28] Another study in the USA found that men between 50 and 60 had the highest incidence of

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[24] Prüss-Üstün, A and C Corvalán (2006) *Preventing Disease through Healthy Environments. Towards an Estimate of the Environmental Burden of Disease*, WHO, Geneva.

[25] World Health Organization "Health and environment in sustainable development: five years after the Earth summit" (press release), http://www.who.int/archives/inf-pr-1997/en/pr97-47. html.

[26] Prüss-Üstün, A and C Corvalán (2006) *Preventing Disease through Healthy Environments. Towards an Estimate of the Environmental Burden of Disease*, WHO, Geneva, p 66.

[27] Nishikiori , N, T Abe, DGM Costa, SD Dharmaratne, O Kunii and K Moji (2006) "Who died as a result of the tsunami? – Risk factors of mortality among internally displaced persons in Sri Lanka: a retrospective cohort analysis", *BMC Public Health* 6, p 73, http://www.biomedcentral.com/1471-2458/6/73.

[28] Jonkman, SN and I Kelman (2005) "An analysis of the causes and circumstances of flood disaster deaths", *Disasters* 29(1), pp 75-97.

hurricane-related injury, largely related to activities after the hurricane (such as removing fallen trees).[29] However, these kinds of figures appear primarily in high-income countries where adequate housing and infrastructure prevents 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 low-income countries, and especially among the poor, the loss of life is repeatedly demonstrated to be disproportionately high among women and children.

A recently published paper drew on data more than 10 years old to demonstrate the significant disparities in the distribution of flood-related deaths (Box 2). These findings, which used an existing database to verify residency prior to the flood, indicated among other things that pre-school girls were five times more likely to die than adult men, and that the relative risk to those in poor households was more than six times higher than that of high-income households.[30]

Box 2: Flood fatalities in Nepal: highest for children

In 1993, a severe flash flood devastated the district of Sarlahi in the southern plains of Nepal. After an unprecedented 24-hour rainfall, a protective barrage on the Bagmati River was washed away during the night, sending a wall of water more than 20 feet high crashing through communities and killing more than 1,600 people. Two months later, a follow-up survey assessed the impact of the flood. This survey was unusual in that an existing prospective research database was available to verify residency prior to the flood. As part of a large community-based nutrition programme, longitudinal data existed on children between the ages of two and nine and their parents from 20,000 households, about 60 per cent of the households in the study area. The survey was able to establish age and gender-specific flood-related deaths among more than 40,000 registered participants (including deaths due to injury or illness in the weeks after the flood). Flood-related fatalities were 13.3 per 1,000 for girls aged between two and nine, 9.4 per 1,000 for boys, 6.1 per 1,000 for women and 4.1 per 1,000 for men. The difference between boys' and girls' fatalities existed primarily among children under five. This possibly reflects the gender discriminatory practices that are known to exist in this poor area – the fact that when hard choices must be made in the allocation of resources, boys are more often the beneficiaries. This could be reflected in rescue attempts as much as in the distribution of food or medical attention. There was also a significant difference in the relative risk of high- and low-income households, a reflection of the sturdiness of their homes. The homes of the poor were more than five times as likely to wash away as the homes of the rich, and those whose homes were swept away were 57 times more likely to die.

Source: Pradhan, Elizabeth Kimbrough, Keith P West, Joanne Katz, Steven C LeClerq, Subarna K Khatry and Sharada Ram Shrestha (2007) "Risk of flood-related mortality in Nepal", Disasters 31(1), pp 57-70.

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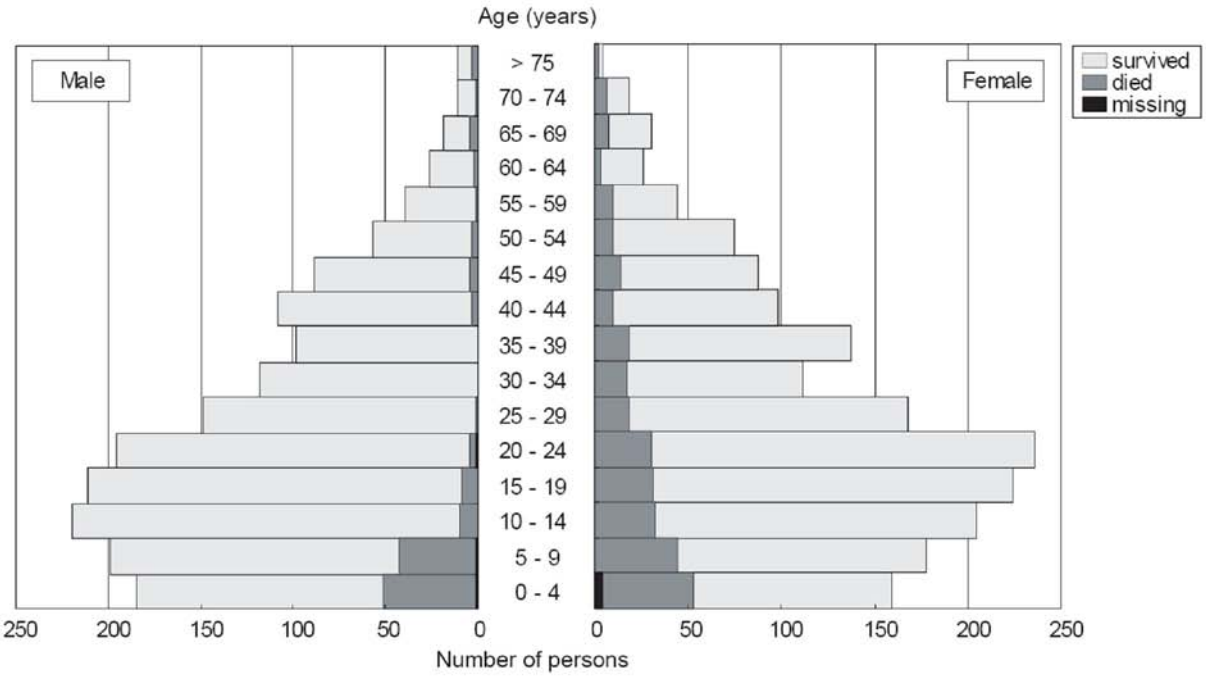
[29] Gagnon, EB, MB Aboutanos, AK Malhotra, D Dompkowski, TM Duane and RR Ivatury (2005) "In the wake of Hurricane Isabel: a prospective study of post-event trauma and injury control strategies", *The American Surgeon* 71(3), pp 194-197.

[30] Pradhan, Elizabeth Kimbrough, Keith P West, Joanne Katz, Steven C LeClerq, Subarna K Khatry and Sharada Ram Shrestha (2007) "Risk of flood-related mortality in Nepal", *Disasters* 31(1), pp 57-70.

The distribution of deaths related to the 2004 Indian Ocean tsunami followed a similar pattern. (Although the tsunami was not related to climate change, this calamity provides important lessons about both the impacts of a large-scale disaster, regardless of cause, and the effectiveness of responses.) A survey of 859 households in evacuation camps in Ampara, Sri Lanka, for instance, found that mortality among children was three to four times that of young adults; that mortality for children under five was double that for adults over 50; and that mortality for females of all ages was double that for males (Figure 1). The higher numbers of deaths for small children and women were attributed in part to the fact that they were more likely to be indoors when the tsunami came.[31]

Figure 1: Age and gender distribution of tsunami-related deaths



Source: Nishikiori, N, T Abe, DGM Costa, SD Dharmaratne, O Kunii and K Moji (2006) "Who died as a result of the tsunami? – Risk factors of mortality among internally displaced persons in Sri Lanka: a retrospective cohort analysis", *BMC Public Health* 6, p 73, http://www.biomedcentral.com/1471-2458/6/73.

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 that the death rate for children under five be twice as high as that for the population at large.[32] This should be put into context. The relationship between crude (or overall) 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. Roughly speaking, in a

[31] Nishikiori , N, T Abe, DGM Costa, SD Dharmaratne, O Kunii and K Moji (2006) "Who died as a result of the tsunami? – Risk factors of mortality among internally displaced persons in Sri Lanka: a retrospective cohort analysis", BMC Public Health 6, p 73, http://www.biomedcentral.com/1471-2458/6/73.

[32] 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) *Humanitarian Charter and Minimum Standards in Disaster Response*, www.sphereproject.org/.

wealthy country, under-five mortality rates are lower than crude mortality rates (Table 4). The poorer or more trouble-torn a country is, the higher the under-five mortality rate is compared to the crude rate (although there are exceptions; Cuba, for instance, is well known for being an anomaly in this regard.) In some cases, these figures may be exaggerated by governments in order to stimulate higher levels of aid. But certainly, under-five child mortality rates in poor countries are routinely much higher than those of adults.

Table 4: Under-five and crude mortality rates in a range of countries

Country	U-5 mortality rate (per 1,000)	Crude mortality rate (per 1,000)
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: Figures taken from United Nations Children's Fund (2007) *The State of the World's Children*, UNICEF, New York.

Given these figures, an emergency threshold mortality rate for children under five that is twice that of the crude rate is far from being unrealistic. But it does highlight a dismal reality – that a much higher mortality rate for young children, unthinkable in high-income countries, should be so routinely accepted as a baseline indicator of normality. A Mozambique study illustrates this bias. When research found that food aid programmes in drought-stricken Tete province resulted in slightly lower death rates for children under five than for the population at large, the conclusion was that the food aid had been poorly targeted.[33] 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.[34] 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 and immunization rates, as well as better environmental health. But for many of the children who are most at risk from diarrhoeal disease, respiratory illness, malaria and malnutrition (the most common causes of mortality for children), the situation is likely to worsen for most places in low- and middle-income nations 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.

3.1.2 Water and sanitation-related illnesses

A lack of easy access to sufficient supplies of clean water and to adequate sanitation is a major factor in the health risks associated with climate change – both the extreme events and the slower-onset changes. After disasters (whether related to extreme weather or not), a breakdown in provision can be the most serious threat to contend with (Box 3). According to the WHO:

> "*Indeed, diarrhoeal diseases, as a result of contamination of water supplies, breakdown of sanitation facilities and the need to scavenge for food, often take a larger toll of life than the original disaster.*"[35]

These diarrhoeal diseases, in almost all cases, primarily affect small children.

[33] 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), pp 26-34.
[34] United Nations Children's Fund (2007) *The State of the World's Children*, UNICEF, New York.
[35] www.who.int/entity/ceh/indictators/0_14disasterareas.pdf, downloaded October 15 2007.

Box 3 : The coping strategies of the urban poor in Bangladesh during the 1998 floods

In 1998, Bangladesh experienced the worst floods in recorded history. The floods lasted more than two months and 33 million people were marooned. Some of those worst affected were urban slum dwellers in Dhaka. More than half the city's population lives in settlements with inadequate water supplies, poor sanitation and drainage and few paved streets or lanes. Continuous rain and blocked drains meant floodwaters had risen to four feet in some areas. Most families moved into relief camps and shelters, driven out by the stench of stagnating water, the nuisance of mosquitoes, snakes, leeches and rats, and fears that babies would fall into water or that someone would be electrocuted because of loose electrical lines littering the area. But despite the appalling conditions, some families stayed in their homes, fearful of losing valuable possessions. They stayed on rooftops, or raised their beds on bricks or makeshift platforms. "I stay awake all night to guard our household things now that our house is under water," said one woman…, "…and the children sleep next to me." Women stood in line for hours at a time to get safe drinking water, and had to walk long distances to reach a usable latrine. Often they and their children were forced to urinate and defaecate in their homes, using newspapers or plastic bags that they then threw into the water; others simply stood in the water. People complained of fevers and diarrhoeal illnesses, skin infections and funguses on their legs and feet. Young children, who played in the dirty water out of boredom, even drinking and bathing in it, suffered from repeated diarrhoea. Most families had to cut down their food intake because costs had sky rocketed and they were without earnings. Unlike their rural counterparts, they had no food stocked up. The lack of work and anxieties about every aspect of life led to increasing tension and sometimes violence within families.

Source: Rashid, SF (2000) "The urban poor in Dhaka city: their struggles and coping strategies during the floods of 1998", Disasters 24(3), pp 240-253.

Slower-onset climate-related changes will also take a toll. The IPCC projects that climate change will increase the burden of diarrhoeal disease in low-income countries by approximately two to five per cent by 2020.[36] This is likely to be felt especially in poor urban settlements, where greater extremes of weather will exacerbate the already considerable difficulties experienced by those without proper provision for water, sanitation and drainage. Sewage and latrine overflows, for example, are far more likely to occur in under-served urban communities than anywhere else, rural or urban.

Small children are without question the principal victims of sanitation-related illnesses (diarrhoeal disease primarily). In part this is because of their less-developed immunity, but also because of their behaviour. They want to play and explore, they touch everything and they have little consciousness of hygiene. This means they are more likely to come into contact with excreta and pathogens. Children under five are estimated to bear more than 80 per cent of the global burden of diarrhoeal disease, while school-aged children have by far the highest rates and intensity of helminth infections.[37] Child mortality and morbidity rates are more highly correlated with inadequate access to potable water and proper sewerage connections than they are to any other commonly cited variables, such as the number of households in poverty within a community, or the lack of access to health services.[38]

[36] Confalonieri, U, B Menne, R Akhtar , K Ebi, M Hauengue, RS Kovats, B Revich and A Woodward (2007) "Human health", in Parry, ML, OF Canziani, JP Palutikof, PJ van der Linden and CE 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 University Press, Cambridge, UK.

[37] Murray, CJ and AD 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*, Harvard University Press, Boston.

[38] Shi, A (2000) *How Access to Urban Potable Water and Sewerage Connections Affects Child Mortality*, Development Research Group, World Bank, Washington DC.

For small children's health, water quantity is considered, in most circumstances, to be a more important factor than its quality.[39] Children, food, utensils, floors, cooking surfaces are all less likely to be kept clean when water supplies are inadequate or difficult to reach, and this contributes to higher levels of endemic illness. Studies have long indicated, for instance, that both mortality and morbidity for young children go up dramatically when water must be accessed from community wells or standpipes rather than in the house or compound, because households simply make do with less water than they need.[40] The amount considered necessary for basic health (about 40 litres per day per person) multiplied by four or five or more family members, adds up to an extremely heavy amount to carry, and a lot of time can be spent waiting at water points and walking back and forth. During times of drought, when water supplies may be especially low or erratic, households are more likely than ever to make do with less water than they need to meet their children's routine health needs. This problem will be exacerbated in some areas by climate change.

The IPCC's Fourth Assessment projects that in Africa, by 2020, between 75 and 250 million people will be exposed to increased water stress due to climate change.[41] Freshwater availability is also projected to decrease in Central, South, East and Southeast Asia, particularly in large river basins;

> *"…along with population growth and increasing demands arising from higher standards of living (this) could adversely affect more than a billion people by the 2050s."*[42]

During the twentieth century, mean precipitation in all seasons has tended to decrease in all the arid and semi-arid regions: Northern Chile, the Brazilian Northeast and Northern Mexico, West Africa and Ethiopia, the drier parts of Southern Africa, and Western China.[43] If these trends continue, water resource limitations will become more severe precisely where they are already most critical.[44]

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[39] Cairncross, S (1990) "Water supply and the urban poor" in Hardoy, J, S Cairncross and D Satterthwaite (eds) *The Poor Die Young: Housing and Health in Third World Cities*, Earthscan, London.

[40] Victoria, CG, PG Smith, JP Vaughan and LC Noble (1988) "Water supply, sanitation and housing in relation to the risk of infant mortality from diarrhoea", *International Journal of Epidemiology* 17(3), pp 651-654; Curtis, V, B Kanki, T Mertens, E Traore, I Diallo, F Tall and S Cousens (1995) "Potties, pits and pipes: explaining hygiene behaviour in Burkino Faso", *Social Science and Medicine* 41(3), pp 383-393.

[41] Adger, Neil, Pramod Aggarwal, Shardul Agrawala et al. (2007) *Climate Change 2007: Impacts, Adaptation and Vulnerability: Summary for Policy Makers*, Working Group II Contribution to the Intergovernmental Panel on Climate Change; Fourth Assessment Report, IPCC Secretariat, WHO AND UNEP, Geneva, subsequently published in Parry, ML, OF Canziani, JP Palutikof, PJ van der Linden and CE 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 University Press, Cambridge and New York, p 8.

[42] Adger, Neil, Pramod Aggarwal, Shardul Agrawala et al. (2007) *Climate Change 2007: Impacts, Adaptation and Vulnerability: Summary for Policy Makers*, Working Group II Contribution to the Intergovernmental Panel on Climate Change; Fourth Assessment Report, IPCC Secretariat, WHO AND UNEP, Geneva, subsequently published in Parry, ML, OF Canziani, JP Palutikof, PJ van der Linden and CE 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 University Press, Cambridge and New York, p 8.

[43] Wilbanks, Tom and Patricia Romero Lankao with Manzhu Bao, Frans Berkhout, Sandy Cairncross, Jean-Paul Ceron, Manmohan Kapshe, Robert Muir-Wood and Ricardo Zapata-Marti (2007) "Chapter 7: Industry, settlement and society", in Parry, ML, OF Canziani, JP Palutikof, PJ van der Linden and CE 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 University Press, Cambridge and New York, pp 357-390.

[44] Rhode, TE (1999) "Integrating urban and agriculture water management in southern Morocco", *Arid Lands News Letter* 45, quoted in Wilbanks, Romero Lankao et al. (2007) op. cit.

But the quality of water is also a significant issue, and problems with contamination are likely to be exacerbated by various features of climate change. For instance, for urban areas on the coast, rising sea levels may cause saline intrusion into groundwater and may cause latrine pits to flood, contaminating water sources. When water supplies become scarce or difficult to access, families are also more likely to have to store their water, a practice that greatly increases the potential for contamination (for instance, through children's grubby hands reaching into pails for drinking water.) In a low-income neighbourhood in Abidjan, Côte d'Ivoire, for instance, *E. coli* was found in only one per cent of water samples taken at the community source, but in 41 per cent of samples that had been stored at home.[45]

Problems related to inadequate water supplies are complicated further by poor provision for sanitation, which can contribute to the contamination of water supplies and greatly increases the need for hygiene. Ironically, sanitation problems and the associated illnesses can result from too much as well as too little water. In Dhaka, for instance, morbidity from diarrhoeal disease was found to increase by four per cent for every 10 mm that rainfall decreased below a certain threshold, but it also increased by five per cent for every 10 mm that rainfall increased above this threshold.[46] This again is especially an issue in low-income urban settlements, where there are so often high concentrations of both people and wastes without proper provision for sanitation, drainage and waste removal. A considerable body of research relates the quality of local provision to the incidence of diarrhoeal illness in children. Research in Salvador, Brazil, for instance, comparing low-income urban settlements with and without improvements to drainage and sewerage, found that the incidence of children's diarrhoea in neighbourhoods with drainage and sewerage was one-third that in otherwise similar neighbourhoods with neither.[47] A related study in the same city found that significant risk factors for infection with *Giardia duodenalis* were the number of children under five in the household, the absence of a toilet and the presence of visible sewage nearby.[48] Yet another Brazilian study points to the connection between diarrhoea in children under five and the presence of wastewater in the streets and flooding in the house lot.[49]

As the incidence and intensity of rain storms increases in many locations as a result of climate change, these conditions are likely to become increasingly prevalent.[50] During heavy or prolonged rains, flooding is far more likely to occur in these underserved communities – which are, in addition, the communities most often located in low-lying and flood-prone areas. Blocked drains and flooded latrines can cause faeces and waste of all kinds to be spread throughout a settlement, and faecal contamination can be difficult to avoid in densely settled areas. In Lagos, for instance, where many homes are built on stilts above the swamps that are natural flood basins, residents claim that flooding is happening more frequently. They say they are concerned not only about property damage but about the impact on child

[45] Dunne, EF, H Angoran-Benie, A Kamelan-Tano, TS Sibailly, BB Monga et al. (2001) "Is drinking water in Abidjan, Côte d'Ivoire, safe for infant formula?", *Journal of Acquired Immune Deficiency Syndrome* 28(4), pp 393-398.

[46] Hashizume M, B Armstrong , S Hajat, Y Wagatsuma , AS Faruque , Y Hayashi et al. (2007) "Association between climate variability and hospital visits for non-cholera diarrhoea in Bangladesh: effects and vulnerable groups," *International Journal of Epidemiology*, in press.

[47] Moraes LR, JA Cancio, S Cairncross, S Huttly (2003) "Impact of drainage and sewerage on diarrhoea in poor urban areas in Salvador, Brazil", *Transactions of the Royal Society of Tropical Medicine and Hygiene* 97(2), pp 153-158.

[48] Prado, MS, A Strina, ML Barreto, AM Oliviera-Assis, LM Paz and S Cairncross (2003) "Risk factors for infection with *Giardia duodenalis* in pre-school children in the city of Salvador, Brazil", *Epidemiology and Infection* 131, pp 899-906.

[49] Heller, L, EA Colosimo and CM de Figueiredo Antunes (2003) "Environmental sanitation conditions and health impact: a case control study", *Revista de Sociedade Brasileira de Medicina Tropical* 36(1), pp 41-51.

[50] Douglas, Ian, Kurshid Alam, MaryAnne Maghenda, Yasmin Mcdonnell, Louise McLean and Jack Campbell (2008) "Unjust waters: climate change, flooding and the urban poor in Africa", *Environment and Urbanization* 20(1), pp 187-206.

health, since floodwaters carry all sorts of organic waste into their homes.[51] In Peru, after the floods related to the 1997-98 El Niño, hospital admissions of young children for diarrhoea were reported to have tripled.[52]

In summary then, diarrhoeal illness for young children is a serious problem in many post-disaster scenarios, but the risks in poor urban settlements are also likely to increase as a result of both drought conditions and heavier rains and flooding. The implications of these increased risks may be seen not only in increased mortality and morbidity directly related to diarrhoeal illness, but also in higher levels of malnutrition, increased vulnerability to other illnesses, and effects on overall development, which will be discussed further.

3.1.3 Malnutrition

The available literature on the impacts of climate change for children gives greatest attention to the nutritional implications – a reasonable focus given that nutritional status can easily be checked and is also related to many factors associated with climate change. An increase in malnutrition rates is primarily related to food shortages, either because of reduced rainfall and other changes that negatively affect agriculture, or, in the case of sudden acute events, because of interruptions in food supplies. Children in Africa born in drought years, for example, are significantly more likely to be malnourished or stunted (in Kenya, 50 per cent more likely to be malnourished; in Niger, 72 per cent more likely to be stunted.)[53]

But malnutrition is also tied to unsanitary conditions and to children's general state of health. Data collected from over 80 countries indicated that the best predictor of malnutrition, next to the household's capacity to pay for food, is the level of access to water.[54] Frequent bouts of diarrhoea and infestations of worms mean impaired absorption and a loss of nutrients. There is a contention, also, that when children are raised in dirty surroundings, calories that should go towards growth are spent instead supporting their challenged immune systems.[55] In other words, children may become malnourished even when there is sufficient food to go around. When they are malnourished, their vulnerability to opportunistic infections is greatly increased, and so a vicious cycle is set in place, one that can have long term effects for their health and development.

Malnutrition may take the form of wasting (acute malnutrition), which is a reflection of children's current intake or of the failure to absorb nutrients because of diarrhoea or malabsorption. It can also take the form of stunting, the slowing down of linear growth that is the consequence of chronic malnutrition. Generally speaking, in a disaster or emergency, the nutritional risk for children tends to be low if they were previously well nourished.[56] 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

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[51] Douglas, Ian, Kurshid Alam, MaryAnne Maghenda, Yasmin Mcdonnell, Louise McLean and Jack Campbell (2008) "Unjust waters: climate change, flooding and the urban poor in Africa", *Environment and Urbanization* 20(1), pp 187-206.

[52] Checkley, W, L Epstein, R Gilman et al. (2000) "Effect of El Niño and ambient temperature on hospital admissions for diarrhoeal disease in Peruvian children", *Lancet* 355, pp 442-450.

[53] UNDP (2007) *Human Development Report 2007/2008*, Palgrave Macmillan, New York.

[54] Lechtig, A and B Doyle (1996) "The impact of water and sanitation on malnutrition and under-5 mortality rates", *WATERfront* 8, pp 5-19.

[55] Solomon, NW, M Mazariegos, KH Brown and K Klasing (1993) "The underprivileged developing country child: environmental contamination and growth failure revisited", *Nutrition Reviews* 51(11), pp 327–332.

[56] 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), pp 527-536.

fluctuations.[57] But if they are already undernourished, or if the situation continues for too long, it may contribute to stunting and a long term failure to catch up.[58]

In a study in Bangladesh after the severe 1998 floods, children under five who had been exposed to the flood were compared to those in their neighbourhoods who had not. Data were collected at 2, 8 and 15 months after the end of the flood. The data indicated that the linear growth of the flood-exposed children was interrupted and did not fully recover, at least not in the study period. Although children returned to normal growth rates by the end of the study period, they did not experience the "catch-up" growth that is common after a shock, and they remained shorter than the unexposed children. Households had been unable, over time, to compensate for the shortage of food and the general deterioration in the health environment during the flood.[59] Research in Zimbabwe found significant impacts on children's growth following a drought. Children who were in the critical 12 to 24-month age group at the time of drought in the early 1980s were found 13 to 16 years later to have had an average loss of stature of 2.3 inches. Their potential loss in lifetime earnings was calculated to be 14 per cent.[60]

There is some evidence that malnutrition for children is a greater risk among displaced families. In Sri Lanka after the tsunami, the prevalence of both acute and chronic malnutrition among children in relief camps was found to be significantly higher than the national average.[61] In Honduras, after Hurricane Mitch, similarly, children in shelters and resettlement camps were found to be significantly more malnourished than exposed children who had not been resettled.[62] It is possible that this is related at least in part to the very poor levels of sanitation that exist in many temporary shelters. Also at higher risk are children in households where adults are ill. A community-based study in an urban neighborhood in Bangladesh found that illness or incapacitation on the part of wage earners was strongly associated with the prevalence of severe undernutrition in under-five children.[63].

An important nutritional consideration for infants is the effect that emergencies may have on breast feeding. The benefits of breastfeeding for both physical and emotional nurturance are well established. Breastfeeding has the additional advantage of protecting infants from infection, and hence it is all the more critical to continue the practice in environments without safe water and good sanitation.[64] However, the stresses related to a crisis, together with the possibly diminished health and nutrition of the mother, may affect the production of breast-milk in the aftermath of a disaster. Since breast milk substitutes are a common component of the nutritional supports provided in an emergency, it is quite likely that many mothers, in the absence of adequate support and advice, will feel it is practical in this situation to switch to

[57] Del Ninno, Carlo and Matthias Lundberg (2005) "The long-term impact of the 1998 flood on nutrition in Bangladesh", *Economics and Human Biology* 3(1), pp 67-96.
[58] Martorell, R (1999) "The nature of child malnutrition and its long-term implications" *Food and Nutrition Bulletin* 20, pp 288-292.
[59] Del Ninno, Carlo and Matthias Lundberg (2005) "The long-term impact of the 1998 flood on nutrition in Bangladesh", *Economics and Human Biology* 3(1), pp 67-96.
[60] Alderman, H, J Hoddinott and B Kinsey (2004) "Long-term consequences of early childhood malnutrition", Mimeo, Department of Economics, Dalhousie University, Halifax, Canada, cited in Dercon, Stefan (2008) *Fate and Fear: Risk and its Consequences in Africa*, Global Poverty Research Group, GPRC-WPS-074.
[61] Jayatissa, R, A Bekele, CL Piyasena and 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), pp 144-152.
[62] Barrios, RE, JP Stansbury, R Palencia and MT 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), pp 380-384.
[63] Pryer, J (1993) "The impact of adult ill-health on household income and nutrition in Khulna, Bangladesh", *Environment and Urbanization* 5(2), pp 35-50.
[64] 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), pp 609-619.

the use of these substitutes. But the preparation and storage of breast milk substitutes, especially in unsanitary environments, can present real health risks to children, since there is ample opportunity for contamination. Without education, mothers may also be unclear about the quantities to be mixed, which may place children at risk of malnourishment. While some infants may require substitutes – those who are separated from mothers for instance, or those in need of temporary supplementation – it is critical that adequate information, clean water and fuel be available for preparation, that every effort be made to restore the mother's health and nutrition, and that mothers be encouraged to continue breastfeeding even while their supplies are depleted in order to maintain and stimulate their supply.[65]

3.1.4 Malaria and other vector-borne and infectious diseases

Altering weather patterns, especially increased temperatures and changes in precipitation, are increasing the incidence and range of various vector-borne diseases. This, too, has particular implications for children. Mosquito- and tick-borne encephalitis, for instance, are becoming more prevalent, and their incidence is estimated to be twice as high among children between five and 10 as among adults. Dengue, another mosquito-borne disease, affects older children and adults more often, but young children are more likely to experience severe symptoms.[66] Changes in temperature and rainfall affect the range of disease vectors, but extreme weather events can also contribute to situations where disease vectors (as well as bacteria, viruses, mildew and mould) can thrive and spread.[67] Diseases spread by rodents (such as leptospirosis), for instance, appear to increase during flooding or heavy rainfall, especially where there are open sewers and drains.[68] After the floods in Mumbai in 2000, 2001 and 2005, the incidence of leptospirosis increased as much as eight-fold. Outbreaks were associated primarily with children playing in floodwater or wading to get to school. [69]

The most serious vector-borne threat, however, is malaria, exposure to which is increasingly prevalent. Up to 50 per cent of the world's population is now considered to be at risk, an increase of almost 10 per cent in the last decade.[70] This increase is reflected in higher mortality and morbidity rates. Each year now, there are up to three million deaths from malaria throughout the world and about five billion episodes of non-fatal illness. More than 90 per cent of the burden is in Africa, and approximately 65 per cent of the mortality is among children under five.[71] In Kinshasa, the capital of the Democratic Republic of Congo, the *P. falciparum* parasite was found in the blood smears of 17 per cent of sampled schoolchildren in 1983; by 2000 this rate had doubled.[72] High rates of malaria in places such as Kinshasa are related more to poverty and poor management than to changing climate. By 2002, climate change was considered to be

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

[66] Bunyavanich, Supinda, Christopher P Landrigan, Anthony J McMichael and Paul R Epstein (2003) "The impact of climate change on child health", *Ambulatory Pediatrics* 3, pp 44-52.

[67] Ligon, BL (2006) "Infectious diseases that pose specific challenges after natural disasters: a review", *Seminars in Pediatric Infectious Diseases* 17(1), pp 36-45.

[68] Confalonieri, U, B Menne, R Akhtar, K Ebi, M Hauengue, RS Kovats, B Revich and A Woodward (2007) "Human health", in Parry, ML, OF Canziani, JP Palutikof, PJ van der Linden and CE 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 University Press, Cambridge, UK, pp 391-431.

[69] Kovats, RS and Rais Akhtar (2008) "Climate, climate change and human health in Asian cities", *Environment and Urbanization* 20(1), pp 165-176.

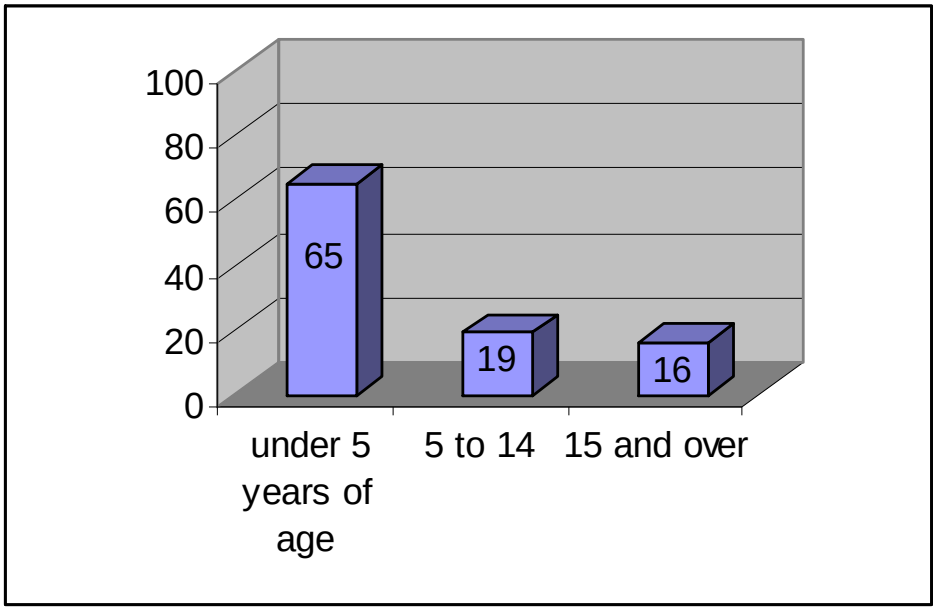
[70] Breman, J, MS Alilio and A Mills (2004) "Conquering the intolerable burden of malaria: what's new, what's needed: a summary", American Journal of Tropical Medicine and Hygiene 71(2) supplement, pp 1-15.

[71] Breman, J, MS 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) supplement, pp 1-15.

[72] Breman, J, MS 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) supplement, pp 1-15.

directly responsible for only about six per cent of the burden of malaria in some countries.[73] But given the expanding populations at risk of malaria, it is important to consider existing knowledge about the implications for children, and the success of efforts to prevent and manage the disease.

Figure 2: The age distribution of deaths from malaria in Africa (%)



Source: Figures taken from World Health Report (2002) *Reducing Risks, Promoting Healthy Life*, World Health Organization, Geneva.

The disproportionate numbers of children affected by malaria, taken alone, fail to capture the larger implications 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 five. In areas with a "low" prevalence of malaria parasite infection (under 25 per cent), mortality was 13.7 per 1,000 per year for children under five years of age; where parasite prevalence was 25-49 per cent, mortality increased to 35 per 1,000.[74] Malaria results in chronic anemia and increases the severity of other diseases, making mortality from all other causes more likely.

Although the links remain poorly defined, there is also evidence that malaria contributes to impaired development, performance and behaviour in children (including severe motor deficit, visual and hearing impairments, behavioural difficulties, learning problems, language impairment and epilepsy). These potential effects result directly from the insult to the brain during acute episodes of malaria, but are also related to the effects of anemia, repeated illness and undernutrition associated with the disease.[75]

[73] WHO (2002) *Reducing Risks, Promoting Healthy Lives; World Health Report 2002*, WHO, Geneva.
[74] Snow, RW, EL 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) supplement, pp 16-24.
[75] Holding, PA and RW Snow (2004) "Impact of *Plasmodium falcipraum* malaria on performance and learning: review of the evidence", *American Journal of Tropical Medicine and Hygiene* 71(2) supplement, pp 68-75.

There are also other indirect effects on children, through the impact that malaria has on household coping strategies. African families may spend a significant part of household income on malaria prevention and control, in addition to the indirect costs of missing work because of illness or in order to care for sick family members. The consequences over time can have a serious impact on a family's capacity to cope.[76] When resources are tight, children's nutrition and schooling are often the first things to be affected.

Although malaria transmission is considered to be less intense in urban areas because of the greater likelihood of a history of control, the urban population can also be at higher risk because of its lower level of immunity. The danger of epidemics may therefore be higher, and the resulting strain on health services could arguably lead to much higher fatality rates.[77] However, epidemics aside, the urban rates are dependent on living conditions. Rates can be especially high in communities where a lack of good drainage creates breeding places for mosquitoes.[78] Response measures in poor areas are seldom adequate. A survey in Kampala of families in all income groups, for instance, found that children in 36 per cent of surveyed households had experienced an episode of fever in the last two weeks, but less than one per cent of these received adequate treatment at the correct dose within 24 hours of onset of fever, as recommended. Only 11 per cent of households used treated nets, and these were all among the wealthiest group (Box 4).[79] Even this level of net use is high for Africa. According to a sample survey of several African countries, insecticide-treated nets are used only two per cent of the time with children under five.[80]

Box 4: Preventing and treating malaria in children in Kampala, Uganda

There is some evidence that in urban areas in Africa, children, the primary victims of malaria, are likely to receive better preventive care and better treatment when they are ill than those in rural areas. A community-based study in Mulago III parish, Kampala, however, suggests that the level of care may be far from meeting recommended standards.

A large swamp extends along the northern border of Mulago III parish, which has poor drainage and frequent flooding during rainy seasons. Malaria is considered to be meso-endemic here. The area is well served with health facilities, however. Mulago Hospital, Uganda's main public hospital, is no more than two kilometres from any part of the parish, and in addition there are nine private clinics and 16 drug shops.

A survey was undertaken in 339 randomly selected households, all of which included at least one child between one and 10 years of age. Based on household occupation, housing materials and access to electricity, the sample was considered to be slightly better off than the average household in the area. Houses were typically one room, occupied by five family members. Most caregivers were literate and nearly half had finished secondary school. Yet despite these protective factors, over a quarter of

[76] Chuma, Jane M, Michael Thiede and Catherine S Molyneux (2006) "Rethinking the economic costs of malaria at the household level: Evidence from applying a new analytical framework in rural Kenya", *Malaria Journal* 5, p 76, http://www.malariajournal.com/content/5/1/76.

[77] Breman, J, MS Alilio, 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) supplement, pp 1-15.

[78] Breman, J, MS Alilio, 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) supplement, pp 1-15.

[79] Kemble, Sarah, 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), pp 999-1007.

[80] Breman, J, MS Alilio, 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) supplement, pp 1-15.

caregivers reported that a child in their care had died, and in over half the households, a child had been hospitalized. Continued overleaf

While ownership of bed nets was relatively common in this sample, only 11 per cent owned an insecticide-treated net, and many of these had not treated the net in the last six months. Most of those who owned treated nets were in the highest-income group. This is not surprising, given that the cost of a treated net may be the equivalent of a week's wages for many households.

In parts of Africa where malaria is endemic, it is widely advocated that children with fever be treated presumptively with anti-malarials, and that treatment with either quinine or combination therapy be initiated within 24 hours. Of the 339 caregivers surveyed in Mulago III parish, 39 per cent reported that a child in their care had had an episode of fever in the previous two weeks. The illnesses lasted between four and seven days on average, and most caregivers had spent an average of two days caring for sick children rather than dealing with their other responsibilities.

Almost all the affected children had been treated with commercially produced pharmaceuticals and none were taken to conventional healers. About a third were taken to a private clinic and just a very small number (four per cent) went to the hospital. Care from clinics and the hospital tends to involve long waiting times, and is also about four times as costly as simply obtaining medication from a pharmacy – the first option that was chosen in more than half the cases. However, when children did not improve (this was the case for more than a third of them), they were then most often taken to a clinic or the hospital.

Overall, only 15 per cent of the children were treated within 24 hours, as is recommended. Only five per cent received the recommended kind of medication within 24 hours, and only a single child received the correct dose of that medication in that important window of time. Even at the hospital and in the clinics, then, the recommended treatment was seldom reliably dispensed.

Source: 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), pp 999-1007.

3.1.5 Respiratory illness

Respiratory illness remains a major killer and cause of morbidity for children, causing almost 20 per cent of all under-five deaths. 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. But respiratory ailments can also be related to ambient outdoor air quality. According to the WHO, five million children die annually from diseases linked to air pollution;[81] and various factors related to climate change that end up affecting air quality may also 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.[82] Changing pollen counts, fungal growth and moulds related to flooding, increases in ozone and other

[81] World Health Organization (1997) "Health and environment in sustainable development: five years after the Earth summit", http://www.who.int/archives/inf-pr-1997/en/pr97-47. html.

[82] Confalonieri, U, B Menne, R Akhtar , K Ebi, M Hauengue, RS Kovats, B Revich and A Woodward (2007) "Human health", in Parry, ML, OF Canziani, JP Palutikof, PJ van der Linden and CE 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 University Press, Cambridge, UK, pp 391-431.

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,[83] and deaths from asthma are expected by the WHO to increase by 20 per cent by 2016.[84]

However, the associations between different factors affecting air quality and the prevalence or severity of different respiratory ailments are far from clear. Factors that appear to be closely related in one situation may not show the same relationship in another – the variables are simply too numerous.[85] Nor are children always those most affected. For instance, while children under 14 appeared to be more seriously affected than their elders by elevated rates of air pollution in Hong Kong (based on hospital admissions),[86] they were the age group least likely to be admitted as a result of smoke exposure during forest fires in Kuching, Malaysia.[87] This could be related to the proximity of fewer children to these fires, however, since a number of physiological and behavioural factors are known to make children more vulnerable to respiratory illness related to pollutants: they breathe more rapidly, and because of their play behaviour, tend to take in more air than adults, and more often through the mouth, all leading to relatively more unfiltered air and potentially damaging air going to the lungs.[88]

The evidence is that acute respiratory infection (the number one killer of young children) is more closely tied to the quality of indoor air than to outdoor air pollution, especially in the homes of the poor, where the use of smoky cooking or heating fuels in confined spaces can increase the risk of severe respiratory infection by a factor of two to six. In houses with open fires or poorly vented stoves, concentrations of particulates have been estimated to be up to 100 times higher than health standards allow for, and to be many times higher than the outdoor urban concentrations.[89] The children most at risk are those who spend the greatest amount of time indoors – often tied to the backs of caregivers as they cook.[90] Although indoor air pollution is unlikely to be affected by factors related to climate change, the number of hours spent indoors arguably could be. Where rain storms are increasing in severity and duration, for instance, many children in poor urban communities without adequate drainage are likely to be trapped indoors by flooding for more of the time.

3.1.6 Heat stress

Global climate change is likely to mean an increase in the frequency and intensity of heat waves, and those most at risk of heat stress are the elderly and the very young, who sweat less and have a greater surface area to body mass ratio.[91] According to a recent review:

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[83] Bunyavanich, S, C Landrigan, AJ McMichael and PR Epstein (2003) "The impact of climate change on child health", *Ambulatory Pediatrics* 3(1), pp 44-52.
[84] World Health Organization (2006) *Asthma Fact Sheet* No 307, August 2006, WHO, Geneva.
[85] Maynard, RL (2001) "Asthma and air pollution (editorial)", *Clinical and Experimental Allergy* 31, pp 518-520.
[86] Ko, FWS, W Tam, TW Wong, CKW Lai, GWK Wong, TF Leung, SSS Ng and DSC Hui (2007) "Effects of air pollution on asthma hospitalization rates in different age groups in Hong Kong", *Clinical and Experimental Allergy* 37, pp 1312-1319.
[87] Mott, Joshua A, David M Mannino, Clinton J Alverson, Andrew Kiyu, Jamilah Hashim, Tzesan Lee, Kenneth Falter and Stephen C Redd (2005) "Cardiorespiratory hospitalizations associated with smoke exposure during the 1997 Southeast Asian forest fires", *International Journal of Hygiene and Environmental Health* 208(1-2), pp 75-85.
[88] Bunyavanich, S, C Landrigan, AJ McMichael and PR Epstein (2003) "The impact of climate change on child health" *Ambulatory Pediatrics* 3(1), pp 44-52.
[89] Hardoy, J, D Mitlin and D Satterthwaite (2001) *Environmental Problems in Third World Cities*, Earthscan, London.
[90] Pandey, MR, RP Neupane and AG Gautam (1987) "Domestic smoke pollution and acute respiratory infection in Nepal", in Seifert, B, H Esdorn, M Fischer et al. Fourth International Conference on Indoor Air Quality and Climate Vol 4, Berlin, Institute for Water, Soil and Air Hygiene.
[91] Bytomski, JR and DL Squire (2003) "Heat illness in children", *Current Sports Medicine Reports* 2(6), pp 320-324.

"Maximum daily temperature is strongly associated with emergency presentations of fever and gastroenteritis among young children, with UV index negatively associated with gastroenteritis."[92]

In São Paulo, an investigation into the impact of temperature on mortality found that for every degree increase above 20°C, there was a 2.6 per cent increase in overall mortality in children under 15 – very similar to the increase found in those over 65 (2.5 per cent).[93] For younger children, this increase will almost certainly be higher.

The impact is likely to be most serious in cities, where the urban "heat island" effect can mean differences of as much as 10°C by the end of the night between the city and surrounding areas.[94] There can also be statistically significant differences in temperature between neighbourhoods in the same city during heat waves, with lower socioeconomic groups more likely to live where temperatures are higher. Research in the United States found that higher settlement density, less vegetation and a lack of open space in a neighbourhood were significantly correlated with higher temperatures. In addition, people living in these warmer neighborhoods had fewer resources to cope with the extreme heat.[95] Although the São Paulo research mentioned above did not demonstrate this effect, it was acknowledged that results were disaggregated only by large and socially heterogeneous city districts, which probably obscured such findings.[96] In low-income countries, the urban poor have even less chance of being able to cope adequately with extreme heat. The public health advice that the response to heat stress should be cool baths[97] has little chance of being observed in the poorest urban settlements where water is at a premium.

Another effect of heat waves is the natural tendency of those who do strenuous work (most often the poor) to slow down or take more breaks. The lower resulting earnings could have critical implications for some poor households and for the nutritional levels of their young children.[98]

3.1.7 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 such materials as fuel, pesticides or medicines, can all pose significant risks. Some research from high-income countries, as noted above, has pointed to higher injury rates for men in the immediate aftermath of a disaster, both because of their involvement in clean-up activities and because of general risk-taking behaviour.[99] But children, because of their size and developmental immaturity, are also 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,

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[92] Lam, LT (2007) "The association between climatic factors and childhood illnesses presented to hospital emergency among young children", *International Journal of Environmental Health Research* 17(1), pp 1-8.
[93] Gouveia, Nelson, Shakoor Hajat and Ben Armstrong (2003) "Socioeconomic differentials in the temperature–mortality relationship in São Paulo, Brazil", *International Journal of Epidemiology* 32, pp 390–397.
[94] Kovats, RS and R Akhtar (2008) "Climate, climate change and human health in Asian cities", *Environment and Urbanization* 20(1), pp 165-176.
[95] Harlan SL, AJ Brazel, L Prashad, WL Stefanov and L Larsen (2006) "Neighborhood microclimates and vulnerability to heat stress", *Social Science and Medicine* 63(11), pp 2847-2863.
[96] Gouveia, Nelson, Shakoor Hajat and Ben Armstrong (2003) "Socioeconomic differentials in the temperature–mortality relationship in São Paulo, Brazil", *International Journal of Epidemiology* 32, pp 390–397.
[97] Keatinge, WR and GC Donaldson (2004) "The impact of global warming on health and mortality", *South Medical Journal* 11, pp 1093-1099.
[98] Kovats, RS and R Akhtar (2008) "Climate, climate change and human health in Asian cities", *Environment and Urbanization* 20(1), pp 165-176.
[99] Sullivent, EE 3rd, CA West, RS Noe, KE Thomas, LJ Wallace and RT Leeb (2006) "Nonfatal injuries following Hurricane Katrina – New Orleans, Louisiana, 2005", *Journal of Safety Research* 37(2), pp 213-217.

disproportionately affect children under five.[100] In the post-disaster context, with the general confusion and disruption of routines, the level of supervision needed to keep children from harm is much heightened.

There is very little research focusing on injuries after extreme events, however, except in the context of high-income countries, and even there it is quite limited. One compelling USA study of admissions at pediatric hospitals found that the rate of accidental ("non-inflicted") traumatic brain injury for children under two went up more than 10-fold in the six months after a hurricane in severely affected areas. The number of admissions for these injuries dropped somewhat after six months, but remained seven times higher than the pre-hurricane levels. Reasons for this increase were speculated to include the greater presence of environmental hazards due to displacement to temporary housing and reduced parental supervision.[101] Another USA study in the aftermath of Hurricane Katrina has pointed to the greater likelihood of injury for children in evacuee shelters, and the need for proactive measures to ensure their safety. [102]

The absence of similar post-disaster studies from low-income countries does not mean that injury is a less common problem there. It is likely that both the research agenda and the public health measures are more focused on the disease-related impacts of disaster, since these remain such a critical threat in low-income countries. More general research points to far higher rates of injury for children in low-income countries and communities.[103] The literature also associates injury with a range of factors that contribute to complexity in the environment and to higher levels of preoccupation or stress on the part of adults.[104] This suggests the likelihood of far higher injury rates in the aftermath of disaster.

It is not just the sudden, extreme events or their aftermath that are a concern with regard to child injury, however. Even adaptations to more gradual change are likely to have implications for children's safety. As sea levels rise, for instance, or floods become more frequent or intense, more and more poor households are likely to live in areas that are hazardous for children. Housing on stilts and with raised walkways, to give just one example, present a much increased risk of falling and drowning for children.[105] Injuries for small children are closely related to overcrowded, challenging living conditions, and their prevalence appears to be much higher in poor urban settlements. In Johannesburg, South Africa, for instance, a study undertaken in six neighbourhoods in a low-income area found sharply elevated rates of injury in the informal settlements as compared to those with formal council housing.[106] The risks for many households will undoubtedly go up in the absence of measures to provide safe land for secure housing.

In addition to being more susceptible to injury, children are likely to experience more serious and long-term effects from injuries because of their size and physiological immaturity (Table 5). For instance, because their bones are still growing, fractures in children are more likely to result in permanent disfigurement; because of their thin epidermis and larger body surface area relative to volume, burns are

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[100] Bartlett, Sheridan (2002) "The problem of children's injuries in low-income countries", *Health Policy and Planning* 17, pp 1-13.
[101] Keenan, Heather T, Stephen W Marshall, Mary Alice Nocera and Desmond K Runyan (2004) "Increased incidence of inflicted traumatic brain injury in children after a natural disaster", *American Journal of Preventive Medicine* 26(3), pp 189-189.
[102] See, for instance, Brandenburg, MA, MB Ogle, BA Washington, MJ Garner, SA Watkins and KL Brandenburg (2006) "'Operation Child-Safe': a strategy for preventing unintentional pediatric injuries at a Hurricane Katrina evacuee shelter", *Prehospital and Disaster Medicine* 21(5), pp 329-365.
[103] Bartlett, Sheridan (2002) "The problem of children's injuries in low-income countries", *Health Policy and Planning* 17, pp 1-13.
[104] Berger, LR and D Mohan (1996) *Injury Control: A Global View*, Oxford University Press, New Delhi.
[105] Cairncross, S and EAR Ouano (1990) *Surface Water Drainage in Low-income Communities*, WHO, Geneva.
[106] Butchart, A, J Kruger and R Lekoba (2000) "Perceptions of injury causes and solutions in a Johannesburg township: implications for prevention", *Social Science and Medicine* 50, pp 331-44.

more likely to be serious; and because of the immaturity of their nervous systems and organs, they are more likely to be susceptible to toxins.[107]

Table 5: Percentage of the total burden of injury experienced by children and young adults (in DALYs*)

Age	% of total injury-related DALYs	% of population
0-4	22	10
5-14	27	20
0-14	49	30
15-44	42	47

* DALYs are disability-adjusted life years.
SOURCE: Figures from Murray, CJ and AD 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*, Harvard University Press, Boston.

3.1.8 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 (Box 5). 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, by overcrowded living quarters, by 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.

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.[108] Deepening health risks, disasters and long-term recovery scenarios will increase the burdens placed on these under-resourced systems.

Box 5: Keeping children clean in Banshighat

The informal settlement of Banshighat in Kathmandu, Nepal, lies by a river that swells to flood the community after heavy monsoon rain storms. The settlement is criss-crossed by foul-smelling open drains that run down to the river, carrying wastewater from other parts of the city as well as from this community. Because there is no provision for waste removal, all local garbage is also dumped into these drains. Most people in the community use the riverbank for defaecation. But small children are not allowed down by the river, so caregivers throw their stools into the drains – the simplest way to keep the narrow walkways clean. This means that faecal matter is present in the drains throughout the community. During heavy rains, when the river rises, the drains back up and overflow, and faecal matter and garbage are spread all over the settlement.

[107] Berger, LR and D Mohan (1996) *Injury Control: A Global View*, Oxford University Press, New Delhi.

[108] See, for instance, Kemble, Sarah, 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), pp 999-1007.

Continued overleaf

Parents are well aware of the health hazard that these conditions present, but their awareness is no match for their children's drive to play. Even the most vigilant caregivers, who are careful to wash children's hands before meals and every time they defaecate, have trouble protecting children from their contaminated environment. One mother described to a researcher all the measures she took to ensure that her children did not touch the foul water from the drains. While she was speaking, her young son dropped his ball into the drain behind her, jumped in to retrieve it, and continued throwing it back and forth to other children. Another small boy was observed driving his "car" – a small slab of wood – down to the edge of the drain, through the water and out the other side, while his mother washed clothes nearby. The generally dirty conditions present a constant threat to health for small children in Banshighat, and diarrhoea, worm infestations, skin problems and eye infections are a routine part of their lives.

Source: Save the Children Norway (2002) "Banshighat: preparatory research for ECD programming", unpublished report, Kathmandu.

3.2 Learning and competence

Climate change is unlikely to mean radical changes to children's cognitive development, but for some children in some places the added challenges could contribute to a general erosion of both their capacities and their opportunities for learning and growth. As far as capacity is concerned, the early years are the most critical time for brain development, which can be shaped by a range of environmental and social factors that could be affected by climate change.[109] But it is not just a matter of capacity. The opportunities available to children are also critical to their competence, and can also be affected directly or indirectly by climate change.

3.2.1 How health is related to learning

Mental growth and development does not just happen to children; it's a feedback process that requires their active involvement.[110] Good health is central; children who are sick or malnourished lack the energy and interest to be active learners.[111] 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.[112] 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 been found repeatedly to demonstrate later cognitive deficits, along with lower school achievement and higher rates of school dropout.[113] Early malnourishment has also been found to affect children's behaviour and social relationships later on.[114] It is not just overall malnutrition that affects development, but also the lack of specific nutrients such as iodine, iron or zinc,

[109] 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, pp 145-157.

[110] 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, pp 145-157.

[111] Grantham-McGregor, S, YB 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, pp 60–70.

[112] Engle, P (1996) "Combating malnutrition in the developing world", in Carr, SC and JF Schumaker (eds) *Psychology and the Developing World*, Praeger, Westport, Connecticut.

[113] 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, pp 145-157.

[114] Chang, SM, SP Walker, S Grantham-McGregor and CA Powell (2002) "Early childhood stunting and later behaviour and school achievement", *Journal of Child Psychology and Psychiatry* 43, pp 775-783.

the availability of which could be affected as critical local foods become more difficult to access for one climatic reason or another.[115]

Children's mental growth can also be affected by intestinal parasites, diarrhoeal disease and malaria, as described above. Infection with parasites, for instance, has been related to lower language ability in children in Nicaragua.[116] The number of episodes of diarrhoea in the first two years of life has been related to lower academic performance in children in a Brazilian shanty town several years later;[117] and cognitive and neurological impairments have been repeatedly associated with severe cases of malaria.[118] An increase in all of these factors could be associated with climate change. Children's development is also closely tied to the health and nutritional levels of their mothers during pregnancy. Undernutrition in unborn children has been related consistently to lower cognitive performance later and to infants that are less active, happy and outgoing.[119] 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. The more severe the exposure of the mother had been 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 pre-natal stress was calculated to account for between 11 and 17 per cent of the children's mental functioning and language abilities. Authors suspected that high levels of stress, especially early in pregnancy, had a direct effect on the brain development of the foetus.[120]

A growing body of literature points to the ways in which stress erodes the cognitive capacity of children, whether in the womb or after birth. Stress causes the secretion of various hormones that affect the brain in a number of adverse ways. Although the specific processes involved are not yet fully understood, there is growing evidence of the toxic effects on children's developing brains. These stress hormones are potentially most damaging to the immature brain, altering anatomy and function over the long term[121] and showing particular effects on the development of language, memory and cognitive control.[122] There is clear support at this point for the links between chronic poverty and elevated physiological stress in children,[123] and ample reason to believe that the added challenges posed by climate change can add to this risk. The implications of stress surrounding extreme events will be discussed further below.

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[115] Engle, P, S Castle and P Menon (1996) "Child development: vulnerability and resilience", *Social Science and Medicine* 43(5), pp 621-635.

[116] Oberhelman, RA, ES Guerrero, ML 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, pp 470–475.

[117] Niehaus, MD, SR Moore, PD Patrick, LL Derr, B Lorntz, AA Lima et al. (2002) "Early childhood diarrhoea is associated with diminished cognitive function four to seven years later in children in a northeast Brazilian shantytown", *American Journal of Tropical Medicine and Hygiene* 66, pp 590-593.

[118] See, for instance, Boivin, MJ (2002) "Effects of early cerebral malaria on cognitive ability in Senegalese children", *Journal of Developmental and Behavioral Pediatrics* 23, pp 353-364; Carter, JA, V Mung'ala-Odera, BG Neville et al. (2005) "Persistent neurocognitive impairments associated with severe *falciparum* malaria in Kenyan children", *Journal of Neurology, Neurosurgery and Psychiatry* 76, pp 476-481.

[119] 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, pp 145-157.

[120] King, S and DP Laplante (2005) "The effects of prenatal maternal stress on children's cognitive development: Project Ice Storm", *Stress* 8(1), pp 1-3.

[121] McEwen, Bruce S (2002) "The neurobiology of stress: from serendipity to clinical relevance",*Brain Research* 886(1-2), pp 172-189.

[122] Farah, Martha, Kimberley Noble and Hallam Hurt (2005) "Poverty, privilege and brain development: empirical findings and ethical implications", in Illes, J (ed) *Neuroethics in the 21st Century*, Oxford University Press, New York.

[123] Evans, GW and P Kim (2007) "Childhood poverty and health: cumulative risk exposure and stress dysregulation", *Psychological Science* 18, pp 953-957.

3.2.2 Children's access to supportive physical and social environments

Children's development of new skills and capacities 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, to speak, to act appropriately through their interactions and activities with other people in a range of settings.[124] When this supportive environment breaks down, constructive opportunities for learning may become constrained.

Much of young children's learning grows out of their drive to play. Play, in this sense, is far from being a frivolity. It is part of children's development as capable, resourceful problem solvers and social beings. Through physical activity, exploration of their surroundings, experimentation with the things around them, children grow in their understanding of principles and properties, of cause and effect, and their own capacity to make things happen. Through their interaction with other children they learn about rules and social norms and how to get along in their particular world. Through their imitation of the activities of those around them, using objects in culturally sanctioned ways, they master new skills, experiment with social roles and participate in the life of their households and communities. An environment rich in stimulation and the potential for purposeful activity supports opportunities for learning. When children lack easy access to a varied, stimulating world, both their cognitive and social growth can potentially suffer.[125]

Not all stimulation is positive for learning, however. "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.[126] This is an accurate description of many post-disaster settings, where children may live for months on end in overcrowded emergency camps. But challenging events on a smaller scale can also disrupt life repeatedly.

The harmful outcomes of environmental chaos are considered to be related to both the distracting effects on children's attention and the impacts on the quality of interaction between children and caregivers. High noise levels have long been related to memory problems, speech perception, and deficits in complex task performance and reading comprehension in children.[127] Overcrowding, also, has been related to poor cognitive development and lower motivation, both in India and the USA.[128]

Even outside of a chaotic emergency camp setting, however, many caregivers respond to disaster by becoming more fearful and restrictive with their children. In Tamil Nadu, after the tsunami, for instance, even when families were resettled in rebuilt housing, women wanted to watch their young children all the time. They either kept them close by indoors or else refused to use the indoor kitchens that had been provided, setting up makeshift cooking arrangements outside their reconstructed homes so they could

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[124] Valsiner, J (1987) *Culture and the Development of Children's Action*, Wiley, New York; Rogoff, B (2003) *The Cultural Nature of Human Development*, Oxford University Press, New York and Oxford; Vygotsky, LS (1978) *Mind in Society: The Development of Higher Mental Processes*, Harvard University Press, Cambridge, Mass.

[125] Wohlwill, J and H Heft (1987) "The physical environment and the development of the child", in Stokols, D and I Altman (eds) *Handbook of Environmental Psychology*, Wiley, New York.

[126] 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*, Routledge, New York, pp 54-83.

[127] Stansfield, S, M Haines et al. (2000) "Noise and health in the urban environment", *Review of Environmental Health* 15(1-2), pp 43-82.

[128] Evans, GW, S J Lepore, B Sejwal and MN Palsane (1998) "Chronic residential crowding and children's well-being: an ecological perspective", *Child Development* 69(5), pp 1514-1523.

watch children closely as they played.[129] This kind of parental anxiety limits opportunities, but can also put a damper on play and exploration.

Maternal depression and withdrawal while children are young have been linked in a number of studies to children's learning. Studies from South Africa, Barbados and India have all pointed to lower levels of cognitive functioning and higher levels of behavioural problems in young children who have depressed mothers.[130] On the other hand, higher levels of maternal responsiveness and stimulation have been found to be a protective factor for the cognitive development of even malnourished children.[131]

The emphasis here has been on younger children. But even for older children and adolescents, opportunities for purposeful goal-directed activities and engagement in the world are primary avenues for the achievement of competence.[132] 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.

3.2.3 Formal supports for learning and development

The benefits of good early childhood programmes for all aspects of development have long been recognized.[133] The combination of security and stimulation offered by a good programme can be an important protective factor in the face of various challenges, providing a source of support for both children and parents.

But these kinds of programmes, along with formal schooling, are frequently interrupted after disasters or extreme weather events. Schools and child care centres 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 weeks or even months before they are available again. For instance, in the city of St Louis in Senegal, which is prone to frequent flooding, schools take in flood victims, with several families sharing each classroom, and the school year is effectively reduced to a few months each year.[134] Even when their former schools remain open, children may be pulled out because of displacement or because their disaster-affected families lack the resources to pay the fees or provide the necessary uniforms. Conditions in emergency shelters or temporary housing may make it harder for children to do homework, also increasing the likelihood of dropping out.[135] Especially in areas where school dropout is common, children are much less likely to continue with school after an interruption.

3.3 Coping with adversity: psychological well-being and social support

It's far simpler to determine the prevalence of diarrhoea or malnutrition after a disaster, or in the face of challenging circumstances, than it is to assess children's psychological vulnerability or resilience, or the effects on their development as competent social beings. Not only are these things more difficult to measure; they are complex concepts to understand, mediated as they are by many factors.

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[129] Author's field visits in Tamil Nadu.

[130] 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, pp 145-157.

[131] Engle, P, S Castle and P Menon (1996) "Child development: vulnerability and resilience", *Social Science and Medicine* 43(5), pp 621-635.

[132] 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, pp 201-216.

[133] Evans, J (1993) "Early childhood care and development: issues from the developing country perspective", in Spodek, B and ON Saracho *Handbook of Research on the Education of Young Children*, Macmillan, New York.

[134] Diagne, Khady (2007) "Governance and natural disasters: addressing flooding in Saint Louis, Senegal", *Environment and Urbanization* 19(2), pp 552-562.

[135] Inter-Agency Network for Education in Emergencies, http://www.ineesite.org/standards/MSEE_report.pdf.

Levels of vulnerability and resilience depend not only on children's health and internal strengths, 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 critical. Culture is widely acknowledged to play a significant role in mediating both perceptions and behaviour. The way children understand and experience hardship will depend a great deal on local child-rearing practices and expectations, on the experiences they have had in their daily lives, and on local values and beliefs.[136] For all these reasons, determining the effects of adversity for children's well-being can be a matter of uncertainty and even contention. But without question, there is a risk that the losses, hardships and uncertainties surrounding stressful events can have high costs for children and may overwhelm their capacity to cope and thrive.

This section focuses most heavily on the impact of more extreme events, especially the 2004 tsunami, because of the research and documentation that is available. At least in low-income countries, far more attention has been given to the experiences of children in the days and months after extreme events than to the realities in areas affected by more slow-moving change. Experiences in the wake of a major disaster may be faster breaking and often more extreme, and the sudden and shocking accumulation of hardship can in itself be a risk. But families and children can also face considerable stress and upheaval in the context of smaller disasters or more slow-moving changes – the loss of possessions and livelihoods, the erosion of social networks, the tension and strains within households, high levels of environmental chaos can all accompany even more "minor" crises.

3.3.1 Factors influencing children's capacity to cope

There is little hard evidence that children as a group are psychologically more severely affected than adults by the difficulties that accompany extreme events or challenging conditions. Some may in fact respond with more flexibility and resilience than their elders.[137] Age is just one of many factors that appear to mediate experiences of adversity. But children of different ages, because of their level of understanding and especially their lack of social power within family and community, may be particularly affected. It is not just their responses that are important either. The way other family and community members cope with difficult events may have important ramifications for children's security and well-being, and for their own capacity to manage a stressful situation.

In their discussion of children's resilience in the context of extreme events, Boyden and Mann review literature pointing to a number of factors that may influence children's capacity to cope well.[138] 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 coping than boys. Despite indications that they are biologically stronger, their lower status within families and societies may leave them less resilient emotionally. Temperament, motivation and personal experience can also play a role. These intrinsic factors, however, 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 effects on their social world and

[136] Boyden, Jo and Gillian Mann (2005) "Children's risk, resilience and coping in extreme situations", in Ungar, Michael (ed) *Handbook for Working with Children and Youth: Pathways to Resilience across Cultures and Contexts*, Sage Publications, London, pp 3-27.
[137] Palmer, OJ (1983) *The Psychological Assessment of Children* (2nd editon), John Wiley, New York.
[138] Boyden, Jo and Gillian Mann (2005) "Children's risk, resilience and coping in extreme situations", in Ungar, Michael (ed) *Handbook for Working with Children and Youth: Pathways to Resilience across Cultures and Contexts*, Sage Publications, London, pp 3-27.

peer relationships play a big part. Also important, in the face of adversity, is the continued opportunity to be able exercise an active and purposeful role in the world. According to Chawla and Heft:

> "*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.*"[139]

3.3.2 Trauma in children – a contentious area

It is often assumed that children who have experienced a disaster will be psychologically damaged or traumatized, with long-term effects.[140] There is considerable research assessing the prevalence and severity of children's distress after extreme events, most of it framed in terms of post-traumatic stress disorder (PTSD).[141] Studies in various settings describe high rates of PTSD among children in the months following a disaster, generally related to the intensity of the event and the degree of the exposure.[142]

This approach has been criticized by many as a western construct with questionable validity for other cultural realities.[143] A diagnosis of PTSD may fail to include symptoms of distress that are relevant within a particular culture or, on the other hand, may not be strongly associated with children's actual capacity to function and cope.[144] After an Orissa cyclone, for instance, parents and teachers reported mental health concerns in only a small percentage of the children diagnosed with PTSD, and in almost as many who were not diagnosed with PTSD.[145] It is difficult to know, however, whether this says more about the inadequacy of the PTSD criteria in a non-western setting or about the capacity of adults to identify distress in children. There is evidence that children's experience and understanding of adversity may not match all that well with adults' perceptions of children's experience.[146]

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[139] 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, pp 201-216.

[140] Jones, Lynne (2008) "Responding to the needs of children in crisis", *International Review of Psychiatry* 20(3), pp 291-303.

[141] This psychiatric diagnosis is based on a number of criteria including such factors as flashbacks, intrusive thoughts and memories, hyper-vigilance, nightmares and intense anxiety occurring at levels that disrupt daily functioning. American Psychiatric Society (2000) *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (DSM-IV).

[142] For example, more than 30 per cent of sample children in Orissa, India, a year after a super-cyclone; 18 per cent in Poland, 28 months after flooding; 12 per cent in Korea following a typhoon. See Kar N, PK Mohapatra, KC Nayak, P Pattanaik, SP Swain and HC 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* 14(7), p 8; Bokszczanin, A (2007) "PTSD symptoms in children and adolescents 28 months after a flood: age and gender differences", *Journal of Traumatic Stress* 20(3), pp 347-351; Lee, I, YS Ha, YA Kim and YH Kwon (2004) "PTSD symptoms in elementary school children after Typhoon Rusa", *Taehan Kanho Hakhoe Chi* 34(4), pp 636-645.

[143] 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), pp 1853-1864; Boyden, Jo and Gillian Mann (2005) "Children's risk, resilience, and coping in extreme situations", in Ungar, Michael (ed) *Handbook for Working with Children and Youth: Pathways to Resilience across Cultures and Contexts*, Sage Publications, London, pp 3-27.

[144] 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), pp 1853-1864.

[145] Kar N, PK Mohapatra, KC Nayak, P Pattanaik, SP Swain and HC 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* 14(7), p 8.

[146] See Boyden, Jo and Gillian Mann (2005) "Children's risk, resilience, and coping in extreme situations", in Ungar, Michael (ed) *Handbook for Working with Children and Youth: Pathways to Resilience across Cultures and Contexts*, Sage Publications, London, pp 3-27. In support of this contention, research in Nepal in the context of conflict found

As Engle and colleagues point out, the expectation of negative outcomes in these situations can unwittingly become part of the problem.[147] Much of what is defined as symptomatic of pathology (such as bedwetting or regression to younger behaviour) may also be construed as a normal reaction to abnormal conditions.

Disagreements in this area extend to treatment. One response to stereotypes about the traumatic consequences of disaster is an emphasis on trauma counselling on the part of humanitarian agencies. Some professionals see western-style counselling and talk therapy as appropriate for children experiencing distress; others feel these interventions may do more harm than good by ignoring the social meanings given to events in a particular locality, and even violating cultural norms about the discussion of painful events.[148] The emphasis on individual pain may also isolate children (or adults) from the reality of broader social distress and undermine family and community cohesion.[149]

Without question, the shock of a sudden disaster can be extreme for both children and adults, resulting in distress for all age groups. Reports of nightmares, sleeplessness, fear of being alone, trouble with concentration and severe anxiety must be taken seriously. But there is a growing consensus that most children exposed to traumatic events do not in fact experience trauma unless they experience multiple events or have a history of anxiety.[150] Frequently, it is the aftermath of traumatic events, and the deprivations and humiliations of a slow recovery process, that children and families themselves report as being the most stressful and debilitating.[151] These kinds of longer-term hardships are often overlooked when the primary focus is on trauma, yet they may be the areas that call most for greater support.

3.3.3 Separation from family

There can be numerous assaults on children's resilience in the aftermath of extreme events. Especially in low-income countries, some children may end up orphaned or separated from family. These may be accidental separations, or they may result from a family's inability to manage a crisis. A priority on the part of many organizations after a disaster is focusing on reunification with family as the optimal response, and otherwise, or in the meantime, encouraging fostering arrangements. Institutional care is generally considered to be the worst alternative.[152] This is another area subject to debate. Extended family or other community members, for instance, may provide a secure alternative, but too often even these bonds are frayed to breaking point, and extra children can become a target for mistreatment. Children who

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that parents and teachers perceived children as being relatively unaffected by the situation and unaware of the dangers. Children, on the other hand, reported a sophisticated awareness of the threats and a much higher level of anxiety than was recognized by adults. Bartlett, S (2007) *Finding Hope in Troubled Times; Education and Protection for Children in Nepal*, Save the Children USA and Norway, Kathmandu, Nepal.

[147] Engle, P, S Castle and P Menon (1996) "Child development: vulnerability and resilience", *Social Science and Medicine* 43(5), pp 621-635.

[148] Boyden, Jo and Gillian Mann (2005) "Children's risk, resilience, and coping in extreme situations", in Ungar, Michael (ed) *Handbook for Working with Children and Youth: Pathways to Resilience across Cultures and Contexts*, Sage Publications, London, pp 3-27.

[149] 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), pp 1853-1864.

[150] Jones, Lynne (2008) "Responding to the needs of children in crisis", *International Review of Psychiatry* 20(3), pp 291-303.

[151] 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, pp 12-15, Bernard van Leer Foundation.

[152] Prabhu, Nina (2007) *International Donor Agencies Guidelines for Responding to Children in Emergencies*, Ryerson University, http://www.ineesite.org/ineedownloads/viewall.asp?pid=1387&cp=21.

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 labour they can provide. [153]

Reunification may also be difficult to arrange. In some spontaneous fostering arrangements, there may be suspicion of those asking questions about children; children may also be unwilling to be taken away. Reunification with a family that has abandoned a child may not always be the best solution for that child, and if he or she has developed a bond with a foster family, there is also the risk of another upheaval if reunification takes place after an extended period.[154] In some cases, institutional care, undesirable at it may be in most situations, could offer children the best chance of remaining with siblings or friends who represent an important source of stability and security. The rights-based principle of acting in the child's best interests may be sorely tested here, as different parties see different solutions as being best for children. Of great importance is the continued monitoring of any solutions, to ensure that children are not placed in untenable situations.[155]

Although separation from family is generally viewed as inherently traumatic for children, even this cannot be assumed. The priority given to reunification may ignore the often fluid domestic arrangements of many cultural communities, in which exclusive parental care may be quite rare. There is evidence in many situations that the restoration of a sense of security and belonging for children may have as much to do with the re-establishment of daily life patterns and routines as with reunification with their families.[156] On the other hand, there is also testimony from children in various settings who feel that separation from their families is their deepest fear.[157]

Even lesser disasters can result in temporary separations. In Kathmandu, Nepal, for instance, flooding occurs regularly during the monsoon 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.[158]

3.3.4 Family stress and tensions

Even when family remains intact, the challenge of picking up the pieces may be overwhelming. Displacement, the outcome of both small and large disasters for hundreds of thousands of families a year, can be profoundly disturbing for families. Save the Children cites a UN estimate that by 2010, there will be 50 million such environmentally displaced people worldwide.[159] The number goes up when we take into account those who are displaced by war and violence – which may, in some cases, result from conflict over increasingly scarce resources.

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[153] Tolfree, David (2005) "Community-based care for separated children", Responses to Young Children in Post-emergency Situations, *Early Childhood Matters* 104, pp 40-46, Bernard van Leer Foundation.
[154] Tolfree, David (2005) "Community-based care for separated children", Responses to Young Children in Post-emergency Situations, *Early Childhood Matters* 104, pp 40-46, Bernard van Leer Foundation.
[155] Prabhu, Nina (2007) *International Donor Agencies Guidelines for Responding to Children in Emergencies*, Ryerson University, http://www.ineesite.org/ineedownloads/viewall.asp?pid=1387&cp=21.
[156] Mann, G (2000) "Networks of support: a literature review of care issues for separated children", unpublished paper.
[157] See, for instance, Save the Children and UNICEF (2006) "Watermarks", Child Protection During Floods in Bangladesh, Save the Children and UNICEF; Bartlett, S (2007*) Finding Hope in Troubled Times*, Save the Children USA, Kathmandu, Nepal.
[158] Personal communications.
[159] Save the Children (2007) *Legacy of Disasters: The Impact of Climate Change on Children*, Save the Children UK, London.

Although children can be surprisingly resilient, displacement can also be deeply troubling, especially when the adults in their lives are anxious, depressed and feel a loss of control over their lives. The immediate loss of life and property can be compounded by the hardships that follow. Basic requirements may be hard to come by, livelihoods may have disappeared. Relief may be inequitably distributed. A disaster can mean the abrupt collapse of community life and social supports. Displacement for children and their families, even outside the context of emergency camps, can mean isolation, humiliation, depression and anxiety.[160] Also at issue are the disruptions to the temporal structure of life. Daily routines and patterns of activity are an important component of stability, orientation and identity for children and adults. The disruption of play, school, daily chores, livelihoods and other familiar activities can leave both children and adults aimless, lost and more vulnerable to distress.

Resilience for children in situations of adversity has been related repeatedly in part to the presence of at least one actively supportive adult in their lives.[161] Even this can be difficult to ensure when adults themselves are withdrawn, apathetic and depressed, or angry and frustrated. Household dynamics can be seriously affected by the stresses associated with disasters, and increased levels of irritability, withdrawal and family conflict are not unusual.[162]

But high levels of stress are not unique to those who survive major disasters. The fear and worry associated with recurring threats and worsening conditions can also be severe. There is increasing evidence globally of the high burden of mental health problems, with women and the poor in low-income countries being at highest risk.[163] This evidence is not specifically related to climate change, but many of the risk factors for such common mental problems as anxiety, depression, insomnia and irritability are likely to be exacerbated by some of the effects of climate change. There is growing evidence, for instance, both from high- and low-income countries, of significant associations for women between food insecurity and anxiety and depression.[164] More generally, these common mental health problems are considered to be related to unpredictability, uncertainty and general insecurity,[165] factors that are undoubtedly intensified by many of the effects of climate change. Women also speak of the punishing workloads they face in the context of poverty and adversity, and the resulting fatigue, anxiety and "problems of the mind" that characterize their days. They describe headaches, unhappiness, disturbed sleep patterns and just "thinking too much" as undermining their capacity to cope adequately with their lives and their children.[166]

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[160] ***Mann, Gillian (2002) "'Wakimbizi, wakimbizi': Congolese refugee boys' and girls' perspectives on life in Dar es Salaam, Tanzania",*** Environment and Urbanization *14(2), pp 115-122.*

[161] Engle, P, S Castle and P Menon (1996) "Child development: vulnerability and resilience", *Social Science and Medicine* 43(5), pp 621-635; Werner, E and R Smith (1992) *Overcoming the Odds: High Risk Children from Birth to Adulthood* Ithaca, Cornell University Press, NY and London.

[162] McFarlane, AC (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), pp 210-218; Save the Children Sweden (2007) *Bridging the Gap - Save the Children's Transitional Housing Project after the Tsunami in Ampara District, Sri Lanka 2007*, http://www.crin.org/docs/BridgingtheGapfinal1.pdf.

[163] WHO (2001) *The World Health Report. Mental Health: New Understandings, New Hope*, WHO, Geneva.

[164] Heflin, CM, K Siefert and DR Williams (2005) "Food insufficiency and women's mental health: findings from a 3-year panel of welfare recipients", *Social Science and Medicine* 61(9), pp 1971-1982; Hadley, C and CL Patil (2007) "Seasonal changes in household food insecurity and symptoms of anxiety and depression", *American Journal of Physical Anthropology* 28, November [E-pub ahead of print].

[165] Patel, V, R Araya, M de Lima, A Ludermir and C Todd (1999) "Women, poverty and common mental disorders in four restructuring societies", *Social Science and Medicine* 49, pp 1461-1471; WHO (2001) *The World Health Report. Mental Health: New Understandings, New Hope*, WHO, Geneva.

[166] Avotri, Joyce Yaa and Vivienne Walters (1999) "'You just look at our work and see if you have any freedom on earth': Ghanaian women's accounts of their work and their health", *Social Science and Medicine* 48, pp 1123-1133; Aidoo, Magna and Trudy Harpham (2001) "The explanatory models of mental health amongst low-income women and health care practitioners in Lusaka, Zambia", *Health Policy and Planning* 16(2), pp 206-213.

High levels of adult stress can have serious implications for children, with effects on development on all fronts. The impact of maternal stress and depression for children's cognitive development was noted above. Maternal depression has also been linked to higher levels of malnutrition in children.[167] Neglect and abuse can also become an issue. Increased rates of child abuse have long been associated with factors that generally become more prevalent after a disaster or household upheaval – such as maternal depression, poverty, loss of property or a breakdown in social support. In order to investigate the impact of a disaster on rates of child maltreatment, a study in the USA looked at rates of inflicted traumatic brain injury in children under two in the six months following Hurricane Floyd in 1999. Drawing on records from nine paediatric hospitals, the research found that in areas severely affected by the storm, rates of traumatic brain injury inflicted on small children increased more than five-fold in the six months following the hurricane, when compared to the previous six months.[168]

Children's behaviour after disasters or in adversity could well contribute to abusive responses from parents. Where children exhibit high anxiety and such behaviours as bed wetting, nightmares, aggressiveness or clinging behaviour, this may add to the stress of parents attempting to deal with disaster-related problems.[169] Common mental disorders in parents have been related to behavioural problems in their children,[170] and so a feedback cycle can be established especially under stressful situations. A child's temperament can also affect the kinds of responses they elicit from others, and easy-going children may be less likely to be treated with impatience and irritation. However, it should be noted that the findings with regard to abuse are not consistent. Research among survivors of three different natural disasters in the USA, for instance, found significantly elevated rates of reported child abuse in two cases, but not in the third.[171] Even within one country, it is difficult to make generalizations.

3.3.5 The breakdown of social norms and routines in the aftermath of disaster

Disasters and their aftermath have been noted in many contexts to lead to social breakdown, with a frequent erosion of the social controls that normally regulate behaviour within communities.[172] Life in emergency shelters and transitional housing camps is overwhelming for many people – not only overcrowded and uncomfortable, but fraught with frustration, uncertainty and even danger (Box 6).

The lack of provision for privacy, along with the collapse of regular routines and activities, can lead to many problems. Sexual violence is commonly reported. There have been numerous reports of children and women enduring abuse of various kinds. Adolescent girls in particular complain of the lack of privacy around sleep, washing and dressing, and of the sexual harassment they face.[173] In Sri Lanka after the tsunami, according to local field workers on the ground, as well as women and children living in

[167] Harpham, T, S Huttly , MJ 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), pp 1060-1064.
[168] Keenan, Heather T, Stephen W Marshall, Mary Alice Nocera and Desmond K Runyan (2004) "Increased incidence of inflicted traumatic brain injury in children after a natural disaster", *American Journal of Preventive Medicine* 26(3), pp 189-89.
[169] Curtis, T, BC Miller and EH Berry (2000) "Changes in reports and incidence of child abuse following natural disasters", *Child Abuse and Neglect* 24(9), pp 1151-1162.
[170] Blue, I and T Harpham (1996) "Urbanization and mental health in developing countries", *Current Issues in Public Health* 2(4), pp 181-185.
[171] Curtis, T, BC Miller and EH Berry (2000) "Changes in reports and incidence of child abuse following natural disasters", *Child Abuse and Neglect* 24(9), pp 1151-1162.
[172] Gururaja, S (2000), "Gender dimensions of displacement", *Forced Migration Review*, http://www.fmreview.org/FMRpdfs/FMR09/fmr9.5.pdf.
[173] Fisher, Sarah (2005) *Gender-based Violence in Sri Lanka in the Aftermath of the Tsunami Crisis*, Dissertation submitted to the University of Leeds.

emergency shelters, the lack of privacy was responsible for most of the social problems that were experienced:

> "*There were repeated references to the difficulties associated with many families living together in one open space, with no privacy for dressing or bathing – or even for families crowded together in a tent. Many were reluctant to acknowledge the extent of the problems, and said that given the situation, people had managed well. But staff from both Save [the Children] and partner organizations, along with some of the more vocal women, made it clear that the situation resulted in many abuses*."[174]

There have also been reports of abuse of children's trust by staff members themselves. Many organizations, scaling up rapidly in response to disaster, must hire many new staff, but have little time for the kind of training and orientation they might usually consider essential to ensure that people are not using their positions inappropriately.[175] Staff members, often local people, may themselves be suffering from the impact of the event.

Box 6: Conditions in emergency barracks in Aceh, Indonesia, 10 months after the 2004 tsunami

The barracks consist of long buildings made up of rooms measuring about 20 square metres, each of which houses at least six people, sometimes from more than one family if the family consists of fewer than six people. Toilet blocks containing pit latrines are located close to the barracks and there are central water tanks (in this site, two tanks for 120 families). Because the barracks were built as a temporary measure, materials are flimsy and the buildings are already starting to deteriorate.

Drainage is very bad; stagnant pools of water, often slimy and garbage filled, are everywhere. Toilets are filthy and the risk of faecal contamination is high. People have to carry water from the water tanks in order to wash their hands and the toilets after using them. Small children defaecate in the open, especially in drainage ditches where they say they also play, because their mothers do not have the time or energy to go back and forth all day to the water tanks. Children expressed embarrassment at the filthy conditions. People wash at the water tanks, but there are no provisions for privacy.

People cook indoors with no arrangements for venting. In order to keep the mosquitoes out, doors and windows are kept closed and there is little air flow.

The potential for injury is high. Families are crowded into small rooms and cook where they live, exposing small children to the risk of burns. There are sharp pieces of debris on the ground, walkways are slippery and pools of water hide potential hazards. Children are afraid to walk to latrines alone when it is dark, for these among other reasons (the potential for harassment is also there). People are clearly making superhuman efforts to protect small children from the challenging conditions, but keeping them indoors all day is not ideal for supporting their development in other areas. The safe play area is open only for a couple of hours a day.

Overcrowding contributes to tension between households (e.g. noisy children) and within households. Conflicting demands on limited space raises the stress level for everyone (e.g. no quiet place to pray, no place to do homework, no place to dress).

Continued overleaf

[174] Save the Children Sweden (2007) *Bridging the Gap - Save the Children's Transitional Housing Project after the Tsunami in Ampara District, Sri Lanka 2007*, http://www.crin.org/docs/BridgingtheGapfinal1.pdf.
[175] Prabhu, Nina (2007) International Donor Agencies Guidelines for Responding to Children in Emergencies, Ryerson University, http://www.ineesite.org/ineedownloads/viewall.asp?pid=1387&cp=21.

Social norms and practices are being undermined by these living conditions. People have to bathe in public, adolescent girls cannot undress out of sight of other family members or guests, there is discomfort about children sleeping in the same room as adults, and embarrassment around women breastfeeding and washing in public. These challenges to accepted norms result in a general lowering of standards of behaviour, which feels especially threatening to the girls.

Conditions in these barracks were considered by staff to be typical of most emergency shelters in the area, although they say people still living in tents are undoubtedly in an even worse situation.

The general sense of demoralization is made worse by the fact that people are in the dark about their future – they don't know when they will be leaving this place. Adults seem to lack the energy to take any initiative; they are getting used to NGOs taking care of everything. (For instance, one organization comes in every week to pick up garbage around the camp). The post-disaster culture of complaint and dependency is clearly a major problem.

Source: Notes from a field visit to Aceh, November 2005.

Evans and Saegert argue that the synergistic and cumulative effects of such physical and social stressors should not be underestimated. In research with low-income families in the USA, they found that the effects of density on young children were amplified by family turmoil and by the range of stressors typically experienced by those living in urban poverty, leading to substantially greater developmental dysfunction than was found in prior studies.[176] As the numbers of displaced people grow, these dysfunctional environments are likely to become the setting within which more and more children spend their early years.

3.3.6 Children's resilience

Despite this litany of challenges, it is, again, misleading to think of children simply as victims, and not to appreciate the level of emotional resilience and competency that they can actually bring to a situation. Although there are numerous accounts of disasters resulting in trauma for children, as described above, there are also accounts of their hardiness and resourcefulness in the face of both extreme events and everyday difficulty.[177] Children may in fact be more flexible than adults in their capacity to adapt to extreme situations. It is easy to forget that many children function competently in adult roles, running households, caring for younger children, handling jobs, negotiating a variety of complex realities. This level of responsibility for children may be less than ideal, but this does not diminish the respect they deserve for their capacity to handle such situations.

Children's capacity to cope well in difficult situations has been related to their own active engagement.[178] A review of relevant literature indicates, in fact, that activities involving active problem solving have been found to be more beneficial than anything else in coping with recovery after a disaster.[179] Opportunities to

[176] Evans, G and S Saegert (2000) "Residential crowding in the context of inner-city poverty", in Wapner, S, J Demick, T Yamamoto and H Minami (eds) *Theoretical Perspectives in Environment-Behavior Research*, Kluwer Academic/Plenum Press, New York, Boston, Dordrecht, London, Moscow.

[177] Hestyanti, Yohana Ratrin (2006) "Resilience in children", *Annals of the New York Academy of Sciences* 1094, pp 303–307; Boyden, Jo "Children under fire: challenging assumptions about children's resilience", *Children, Youth and Environments* 13(1), Spring, http://colorado.edu/journals/cye.

[178] Boyden, Jo and Gillian Mann (2005) "Children's risk, resilience, and coping in extreme situations", in Ungar, Michael (ed*) Handbook for Working with Children and Youth: Pathways to Resilience across Cultures and Contexts*, Sage Publications, London, pp 3-27.

[179] Norris, FH, M Friedman, PJ 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, pp 207-239.

exercise and develop their competence, 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. There are many real-life opportunities for problem solving and improvement of the surroundings in both the post-disaster context (Box 7) and in the more "everyday" context of urban poverty.[180] It should never be assumed that these are not appropriate for children. Repeated experience demonstrates how capable children are of looking critically at local problems and coming up with creative solutions, and how much pleasure they can take in this.[181] Building on this potential in children will be discussed further in the sections on adaptation.

Box 7: Activities engaged in by children in Indonesia after the tsunami

• Roadway: children cleared trees and branches from streets and suggested road reconstruction to replace the damaged ones.
• Camp perimeters: children cut down kuda-kuda (barricade trees) to make fences to prevent cattle from coming inside, planted new trees and put gravel on the ground so it would not get muddy.
• Shelters: once a week children work together to clean the terrace, toilets and bathrooms; they help build gates and help advocate for continuous electricity.
• Kitchens: children help clean the tables, floors, cooking utensils and water containers.
• Soccer and volleyball fields: children cleared the tsunami rubble, measured the size of the field, cut down palm trees to make poles for goal posts and put up the net.
• Mosques: children cleared the rubble thrown up by the tsunami.
• Plan's kindergarten/Early Childhood Care and Development Centre: children assisted in building schools. Some of the children teach younger children from Monday to Saturday, and clean and tidy up the balee.
• Children lead activities, such as counselling, child's rights, reproductive health and drugs awareness.
• Children cheer up their parents so that they won't be too depressed.
• Children work as volunteers/teachers who teach their younger friends.
• Children lead prayer groups.

Source: 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, Plan International, Bangkok, p 8.

3.4 Household coping strategies in difficult times

It should not be assumed that high magnitude disasters are unique in creating havoc within households and deepening the level of poverty. "Smaller" disasters, and even gradually deteriorating living conditions, can also result in serious pressures on households – whether through short-term displacement, loss of work, reductions in food security, rising prices for basics, or just the time and energy drain associated with more challenging surroundings and daily routines. Higher rates of illness in children, for instance, can add considerably to the load that households carry, depleting cash reserves and adding to time burdens. As Diagne describes the situation in St Louis, Senegal:

> "*For those who live in flood-prone districts, each flood increases their poverty, depleting their incomes and meagre asset bases.*"[182]

[180] Chawla, L (ed) (2001) *Growing Up in an Urbanizing World*, London, Earthscan/UNESCO.
[181] Hart, R (1997) *Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care*, Earthscan/UNICEF, London; Chawla, L (ed) (2001) *Growing Up in An Urbanizing World*, Earthscan/UNESCO, London.
[182] Diagne, Khady (2007) "Governance and natural disasters: addressing flooding in Saint Louis, Senegal", *Environment and Urbanization* 19(2), pp 552-562, p 556.

The 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.[183]

Nor is it simply a matter of the shocks that households face. There is also the question of anticipating and managing risk. This seldom presents simple choices, especially for the poor. Actions taken by households to limit their exposure to risk can result in substantial losses in income and security, with long-term implications. Households in two flood-prone squatter settlements in Dhaka, for instance, were asked to consider the incentives that would encourage them to relocate to safer locations. Despite the extent and difficulty of their experience coping with floods, many residents felt that relocation was simply not feasible without considerable incentives – including free land, non-repayable grants and long-term employment opportunities.[184] Stefan Dercon points out that in research on risk management and household coping mechanisms, more emphasis has been placed on short-term implications, ignoring the longer-term consequences for the deepening of poverty. Often, as Dercon explains,

> "*... the best that poor people can do is to make choices that perpetuate poverty via choosing low return, low risk portfolios of activities and assets*" (page 18).

Research on this topic, he says, has been especially limited in urban areas.[185]

When the family system faces more pressure than it can easily adapt to, this can have critical consequences for children, with implications for all aspects of development. The stability of the household may be seen as far more important than the welfare of an individual child. This can find expression, for instance, in the allocation of food and other resources. For instance, research from Guadalajara, Mexico, looking at household level adjustments during a period of crisis, noted the subordinate status of women and children:

> "*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 tortilla, and, if they are lucky, any left-over meat*."[186]

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. Many households make great sacrifices on behalf of their children; but in others, few of the benefits of what is earned or produced actually trickle down to reach children. Children can qualify as being in absolute poverty even in a household that does not.[187]

When times are hard, children can become an asset that is drawn on to maintain the stability of the household.[188] 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; and this is more often the case for girls

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[183] 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 "From everyday hazards to disasters: the accumulation of risk in urban areas", *Environment and Urbanization* 15(1), pp 193-204.

[184] Rashid, Harun, Len Hunt and Wolfgang Haider (2004) "Urban flood problems in Dhaka, Bangladesh: slum residents' choices for relocation to flood-free areas", *Environmental Management* 40(1), pp 95-104.

[185] Dercon, Stefan (2007) *Fate and Fear: Risk and its Consequences in Africa*, Global Poverty Research Group, GPRC-WPS-074.

[186] Escobar Latapí, Agustín and Mercedes González de la Rocha (1995) "Crisis, restructuring and urban poverty in Mexico", *Environment and Urbanization* 7(1), pp 57-75, p 70.

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

[188] ***Wamsler, C (2007) "Bridging the gaps: stakeholder-based strategies for risk reduction and financing for the urban poor",*** Environment and Urbanization *19(1), pp115-142.*

than for boys. Certain children may be considered more "expendable" than others.[189] Many of Bombay's young prostitutes, for instance, 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.[190] Multi-dimensional definitions of poverty encourage broad thinking about the assets and risks that actually affect a family's capacity to cope and move ahead in the world. However, these definitions would be still more comprehensive if they took into account the degree to which families are drawing on their children as an asset, or investing in them to ensure their optimal development.

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.[191] Although children have long been considered to be at higher risk in poor households headed by single mothers, there is also evidence that the more child-centred priorities of mothers may in fact lead to better outcomes for children in these households.[192] Nonetheless, in difficult circumstances, the priority given by women to their children's needs can result in levels of fatigue and stress that take a serious toll. Women in a Ghana town, for instance, spoke of the degree of their chronic anxiety, tiredness and physical aches and pains:

> "*What will the children eat? What will they wear? One of them is sick, she has to go to the hospital, where do I get the money?... So every time you are thinking. When it's night and I lie down I won't sleep*." [193]

It is important also to consider those families that have been pushed by changing conditions in rural areas to migrate to cities. Droughts and food shortages associated with climate change, for instance, can create a situation where migration becomes the only practical alternative. These families may be especially ill-equipped to cope with urban living, lacking the education, skills, knowledge and social networks they need to cope with their new environment.[194] Even where only some household members migrate, the effects on families and children may be significant.[195] In many cases, it may be children and young people themselves who are sent to become a lifeline for the rest of the household. Some research poses this as a route to exploitation of various kinds for numerous children, while in other cases (more often where children themselves provide their perspective), it is viewed as an opportunity.[196]

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[189] Engle, P, S Castle and P Menon (1996) "Child development: vulnerability and resilience", *Social Science and Medicine* 43(5), pp 621-635.
[190] http://www.speakout.org.za/about/child/child_childprostitution.htm.
[191] Engle, P, S Castle and P Menon (1996) "Child development: vulnerability and resilience", *Social Science and Medicine* 43(5), pp 621-635.
[192] Engle, P, S Castle and P Menon (1996) "Child development: vulnerability and resilience", *Social Science and Medicine* 43(5), pp 621-635.
[193] Avotri, YA and V Wakters (1999) "'You just look at our work and see if you have any freedom on earth': Ghanaian women's accounts of their work and their health", *Social Science & Medicine* 48, pp 1123-1133, p 1126.
[194] Revi, A (2008) "Climate change risk: an adaptation and mitigation agenda for Indian cities, *Environment and Urbanization*, in press.
[195] Hugo, G (2002) "Effects of international migration on the family in Indonesia", *Asian and Pacific Migration Journal* 11(1), pp 13-46.
[196] Castle, S and A Diarra (2003) *The International Migration of Young Malians: Tradition, Necessity or Rite of Passage?*, London School of Hygiene and Tropical Medicine, London; Hashim, IM (2003) *Child Migration: Pathological or Positive?*, Paper presented at the Conference on Child Abuse and Exploitation: Social, Legal and Political Dilemmas, Onati, Spain, 29-30 May 2003.

3.5 The need for more information

Although it is possible to make an estimation of the potential impact of climate change for urban children, there are considerable gaps in our knowledge. We need far more extensive documentation of the risks actually faced by children and young people in particular contexts, and the factors that are most likely to support 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 on young children of various aspects of climate change, although far more remains to be learned within specific situations. But 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. Generally speaking, we have more information on the outcomes of high magnitude disasters than on the slower-onset problems or gradually eroding conditions.

We also know very little about the impact 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 just changing 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, along with the adaptations that can best reduce the risks and enhance vulnerability. Fortunately, young people themselves can be articulate informants, contributing to a better understanding of these issues.

This limited list of the gaps in our knowledge must also include a very basic concern, namely the lack of local information bases that are essential for effective planning and adaptation. These too need to be developed, with close attention to the implications for children, but this will be discussed in more detail below.

4 The implications for adaptation

Existing knowledge in a range of areas, limited though it may be, provides a basis for discussing the likely impacts of climate change for children. The same process applies when considering the practical adaptations that are most likely to reduce the risks for children and build their resilience in the face of climate change – as well as the capacity of families, communities and children themselves to contribute to these responses.

Where children are concerned, as with the urban poor more generally, it is clear that adaptation and risk reduction primarily involve more effective local development measures.

4.1 Some basic guidelines for adaptation actors

In reducing vulnerability to various hazards and risks, how can the multiplicity of concerns for children of different ages be adequately tackled without completely overwhelming any agenda? There are many actors that can have an impact at the local level – community groups and local authorities, disaster reduction specialists, NGOs, national governments, international agencies and others. While their roles for adaptation are different, there are a few basic guidelines that pertain to all of them with regard to children.

- Unless various actors understand the implications of their actions for children and young people of various ages, the steps they take to respond to the crises of climate change will be mis-targeted in some important ways. Children's experience may differ from the assumptions made by adults on their behalf. This does not mean that children (or their caregivers) and young people need to be present at every level and in every forum. It *does* mean that the information on which decisions are based can be trusted to represent children's experience.
- A focus on children may mean changing the threshold at which an event or situation is considered potentially "disastrous", or at which adaptation is considered necessary. It will also mean broadening the scope of adaptation to include issues that are not always considered to be central – but that in fact have benefits beyond those for children.
- Children's requirements cannot be an afterthought or an add-on. To be addressed effectively, 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.

Within each aspect of planning for adaptation – protection, preparedness, response or recovery – four basic concerns can guide responses to children and these can be considered in the appropriate detail at each level of action. Taking these guidelines into account, in other words, will mean something 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 also because of the effects on enhancing their resilience generally. A few examples: for donors this may mean acknowledging that food aid programmes in response to a crisis are less effective than long-term programmes. 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 programmes. For local government, children's vulnerability to sanitation-related illness may be an additional reason for tackling environmental sanitation problems.
- ***Strengthening families' capacity to cope:***
  All adaptive measures geared at the urban poor should ideally enhance their capacity to come through periods of shock without succumbing to major household catastrophe. But "coping" takes on broader meaning where children are concerned, and includes the capacity of households to manage hardship without compromising the well-being of their children. A few examples: an NGO might build a child-impact assessment into its microcredit activities, ensuring that loan repayments do not compromise children's nutrition; a health care system might allocate more of its resources to mental health support for caregivers.
- ***Maintaining, restoring and enhancing the potential for children's daily routines and activities:***
  Children need supportive functional adults in their lives, but they also rely on their daily routines and activities for stability and optimal development. Other functions, more critical to survival, are inevitably prioritized (food, health, livelihoods), but in the course of addressing these things, it is important that children's spaces, activities and networks not be compromised – they should be identified, maintained and restored wherever possible. A few examples: when 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 is a potent protective force for children in situations of adversity. But the contribution of children and young people is also a potential community asset that is 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 they will point to many concerns that adults will overlook.

Adding these concerns to the already long list of urgent priorities for adaptation may appear to be unrealistic. Fortunately, there is considerable overlap between the measures needed to protect and support children and those that are essential for reducing and responding to risk more generally. The most useful measures to protect children's health, for instance, are also fundamental to reducing risks from potential disasters. Adequate waste removal and drainage makes faecal contamination less likely in the event of heavy downpours and reduces the risk of some vector-borne diseases – but also protects communities from the risk of flooding. Safe, appropriate land for housing for low-income groups may diminish the risks of flooding or landslides that most seriously threaten children, but will also encourage greater investment in homes and neighbourhoods, further minimizing the likelihood of storm-related damage.[197]

Risk reduction measures can even have unexpected benefits for children. In Bangladesh, for instance, flood control embankment projects to protect people in low-lying areas and to stabilize river banks turned out to have highly significant effects on child mortality rates, which were 29 per cent higher outside these areas. Differences were apparent especially for infectious disease, drowning and malnutrition. Improvements in agriculture and fishery production, easier access by land to health centres, and a lower risk of drowning were all reasons in themselves to undertake flood control, and involved no additional investment.[198]

Table 6 summarizes the ways attention to children might be addressed in the course of four different aspects of adaptation, and the subsequent text covers these areas in more detail:

- protection, or the reduction of longer-term risks and hazards;
- preparation for disaster;
- immediate responses in the aftermath of extreme events; and
- longer-term rebuilding – with an eye to the reduction of future risks.

[197] Satterthwaite, David, Saleemul Huq, Mark Pelling, Hannah Reid and Patricia Romero-Lankao (2007) *Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-income Nations*, IIED, London.

[198] Myaux, JA, M Ali, J Chakraborty and A de Francisco (1997) "Flood control embankments contribute to the improvement of the health status of children in rural Bangladesh", *Bulletin of World Health Organization* 75(6), pp 533-539.

Table 6: Adaptations and responses that take children into account

	Reducing longer-term risks	**Preparing for extreme weather events**	**Responding to immediate losses and threats following extreme weather events**	**Adapting to impacts and losses, and rebuilding to reduce future risks**
Children's health, safety and nutrition	* Nutritional programmes to ensure children can withstand a crisis * Piped water, toilets and drains (with synergies for disaster reduction) * Measures such as mosquito nets	* Teach children basic survival skills (such as swimming in flood-prone areas) * Families develop strategies for avoiding separation, such as rendez-vous points * Ensure adequate supplies food and drinking water	* Reduce the risk of sanitation-related diseases in emergency camps * Attend to safety hazards in post-disaster environments * Reproductive health services for young girls as well as women * Support for breastfeeding mothers	* Ensure that rebuilding/ upgrading is a chance to address environmental health issues and reduce risk generally * Rebuild in ways that make children's play and mobility possible without risk * Ensure adequate storage space in houses to keep hazardous items away from small children
Family and community coping strategies	* Child impact assessments to accompany poverty reduction measures * Financial incentives for managing risk, with a focus on children's vulnerabilities * Collaboration between child-focused agencies and those supporting community development	* Encouraging collaborative community measures rather than individualistic responses * Dissemination of local disaster preparedness information, with a focus on children's well-being	* Organize shelter so that family members and communities are kept together * Support children's resilience by supporting stable, functioning adults * Involve communities in post-emergency planning and decision making; allow them to decide on their own needs and priorities	* Location – access to jobs, markets, facilities etc. * Local space flexible enough for small enterprises * Register house sites in women's names; women's involvement in decision making * Housing design responsive to need for privacy * Vegetation, common space to encourage social interaction
Family and community coping strategies	* Child impact assessments to accompany poverty reduction measures * Financial incentives for managing risk, with a focus on children's vulnerabilities * Collaboration between child-focused agencies and those supporting community development	* Encouraging collaborative community measures rather than individualistic responses * Dissemination of local disaster preparedness information, with a focus on children's well-being	* Organize shelter so that family members and communities are kept together * Support children's resilience by supporting stable, functioning adults * Involve communities in post-emergency planning and decision making; allow them to decide on their own needs and priorities	* Location – access to jobs, markets, facilities etc. * Local space flexible enough for small enterprises * Register house sites in women's names; women's involvement in decision making * Housing design responsive to need for privacy * Vegetation, common space to encourage social interaction

Children's daily activities and routines	* Place speed bumps on upgraded roads * Plant shade trees where heat stress is an issue * Ensure that accommodating to risks does not become a substitute for preventive adaptations	* Avoid selecting schools as emergency shelters * Include play spaces and recreational areas as priorities for preparation	* Get schools and child centres up and running again as soon as possible * Quiet space where children can do homework * Safe play space for young children * Keep children safe from harassment and abuse, e.g. lighting the way to the toilet * Restore a sense of normalcy by recreating, as far as possible, daily chores and routines	* Pockets of space where small children can play close to home * Community space that supports varied activities for older children * Space where girls can socialize without feeling exposed to criticism or harassment * Sidewalks, layouts, street lights that encourage safe mobility
Involving children in decision making	* Involving children in environmental monitoring and assessment * Child-to-child health approaches, e.g. assessing patterns of diarrhoeal disease * Supporting children's active stewardship through training and education	* Make disaster-related information available and understandable to children * Involve children in monitoring hazards, in disaster preparations and risk reduction measures	* Relief information accessible and understandable to a 12-year old child * Young people to have input on issues that concern them in emergency camps * "Participation" that means genuine engagement, not tokenistic activities	* Giving children a genuine say concerning their own priorities * Embedding children's responses into more general planning

4.2 Protection: reducing the longer-term risks with children in mind

Most disasters are failures of development. They should have been anticipated and protective measures taken – there is no disaster in the absence of vulnerable populations.[199] The huge backlog in provision for protective infrastructure in most low-income urban settlements and neighbourhoods creates highly vulnerable populations, increasing the risk of disaster in the wake of an extreme event but also the everyday threats to the health, survival and coping strategies of the poor (such as diarrhoea, malaria, difficulties in transportation and so on) that can be exacerbated by more gradual changes in weather. Many international agencies support disaster responses – but refuse to support the kinds of pro-poor infrastructure and service provision that prevent disasters or greatly reduce their impacts. For instance, in Guyana, it has been difficult to arrange international finance for the maintenance of sea walls or for incremental improvements. But once the sea walls

[199] Satterthwaite, David, Saleemul Huq, Mark Pelling, Hannah Reid and Patricia Romero-Lankao (2007) *Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-income Nations*, IIED, London.

are breached, funding is made available.[200] The advantages of prevention – as opposed to action after the fact – apply not only to infrastructure and material assets but also to the full range of efforts that affect children and their families.

Preparing adequately for change in many low-income communities may mean upgrading housing and infrastructure, or even resettling people in less hazardous areas. Whether these efforts happen in anticipation of weather events or after the fact of a disaster, the implications for children are the same, and will be discussed together in the section on rebuilding.

4.2.1 Supporting children's resilience through preventive attention to health and nutrition

The advantages of preventive health measures are well established, but have added significance in the context of climate change. Investing in children's health is as compelling a preventive strategy as investing in infrastructure. Children who are healthier and better nourished are far better able to withstand a crisis.

In Bangladesh after the 1998 floods, a study looking at children's nutritional status found that aid programmes that intervened after the crisis were relatively ineffective when compared to long-term programmes that had been in place beforehand. When children's health is already compromised by illness and malnutrition, they are far more likely to sustain long-term damage to their development in the wake of a crisis, even with emergency food programmes.[201] A Mozambique study also pointed to the significant difference that more extended food aid can make in the face of drought and famine: in drought-ravaged Tete province, nutritional support programmes had for four years aimed to reduce mortality and malnutrition in the most severely affected districts through an array of supplementary nutrition programmes. The under-five mortality rate, as a result of these programmes, dropped to 41 per cent below the national average, even in the context of the severe drought.[202]

Ensuring that children's health is adequately supported *before* rather than after the upset of smaller or larger disasters means investments in health services and nutrition but also, critically, in infrastructure that supports environmental health. The synergies between environmental health measures and disaster preparedness and prevention provide another compelling reason for provision of basic infrastructure. A focus on children's needs, however, may change the standards for such provision, ensuring that they address the realities and capacities of children and their caregivers.[203]

In unsanitary environments, a common public health response is to focus on hygiene awareness. But measures that depend too heavily on the time and efforts of caregivers are not very effective. Washing children's hands, boiling water, preventing the contamination of food and cooking utensils, keeping floors and surfaces clean, ensuring the adequate disposal of children's faeces may all be simple tasks. But when added together, they become a heavy burden that leaves caregivers too tired to cope. Studies have shown how difficult it is to apply such information in unsanitary environments without unreasonable investments

[200] Satterthwaite, David, Saleemul Huq, Mark Pelling, Hannah Reid and Patricia Romero-Lankao (2007) *Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-income Nations*, IIED, London, p 46.
[201] Del Ninno, Carlo and Matthias Lundberg (2005) "The long-term impact of the 1998 flood on nutrition in Bangladesh", *Economics and Human Biology* 3(1), pp 67-96.
[202] 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), pp 26-34.
[203] Bartlett, Sheridan (2003) "Water, sanitation and urban children: the need to go beyond 'improved' provision", *Environment and Urbanization* 15(2), pp 57-70.

of time and attention[204] (Box 5). Efforts to improve hygiene through education have little effect on changing behaviour in the absence of supportive provision. Water piped to houses and proper latrines are the best preventive measures for illnesses related to sanitary conditions.

Measures costing money that families can't easily spare also have poor results. Even when treated mosquito nets are relatively inexpensive, for instance, people in poverty make do with untreated nets (Box 4). There has been an assumption that people will not properly value and use supports that are given free of cost. Experience proves otherwise: a mass free distribution of mosquito nets in Kenya increased the number of children sleeping under treated nets from five to 52 per cent and cut child deaths from malaria in half in high-risk areas.[205] Most caregivers rely on the least expensive healthcare options, at least until they prove to be ineffective.[206] When recommended health responses are the more expensive options, it is unreasonable to expect people in poverty to make use of them.

The most effective health measures are those that pay close attention to local realities. Injury prevention measures, for example, cannot be generalized from place to place. The causes of injury are likely to be very specific to a given area and must be identified through careful local surveys. The solutions in one informal settlement may be very different from those in another nearby.[207] The identification of risks to safety at a community level can help address the very prevalent notion of injury as "accident" – an event, in other words, that is unfortunate but unavoidable.[208] This rule of thumb has clear relevance for conditions surrounding both extreme events and more gradual change.

Preventive care, as opposed to reactive responses to children's health and nutrition, may be considered too costly in the context of events that may or may not happen. But any calculation that looks at the long-term implications and indirect costs for children, in addition to the time and money costs of illness for households, would challenge this as a short-sighted view.

4.2.2 Strengthening families' capacity to cope as part of risk reduction

A number of measures can strengthen the capacity of households to prepare for and adapt constructively to the various crises and shocks related to climate change, including the availability of relevant information, a greater capacity to influence local governments, and various financial systems that increase the incentive and capacity to manage risk – such as insurance schemes, revolving loan funds, microcredit and community-managed savings schemes, and credits for construction materials.[209]

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[204] Gilman, RH, GS Marquis, G Ventura, M Campos et al. (1993) "Water cost and availability: key determinants of family hygiene in a Peruvian shanty town", *American Journal of Public Health* 83(11), pp 1554–1558; Curtis, V, B Kanki et al. (1997) "Dirt and diarrhoea: formative research in hygiene promotion programmes", *Health Policy and Planning* 12(2), pp 122–131.

[205] http://www.guardian.co.uk/international/story/0,,2150475,00.html.

[206] 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), pp 999–1007.

[207] Butchart, A, J Kruger and R Lekoba (2000) "Perceptions of injury causes and solutions in a Johannesburg township: implications for prevention", *Social Science and Medicine* 50, pp 331-344.

[208] Tursz, A (1986) "Epidemiological studies of accident morbidity in children and young people: problems of methodology", *World Health Statistics Quarterly* 39(3), pp 257-268.

[209] Satterthwaite, David, Saleemul Huq, Mark Pelling, Hannah Reid and Patricia Romero-Lankao (2007) *Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-income Nations*, IIED, London; Wamsler, C (2007) "Bridging the gaps: stakeholder-based strategies for risk reduction and financing for the urban poor", *Environment and Urbanization* 19(1), pp115-142.

A perspective that takes children into account would ensure that such measures did not have the unintended effect of putting children at risk (through, for instance, cutting back on food expenditures or school fees in order to invest in risk reduction measures). As with poverty more generally, improved status at the household level does not necessarily ensure (and may even be at the cost of) the well-being of children.[210] Child-impact assessments and built-in safety nets should be routine components of efforts to enhance household stability. This could be a productive area for closer collaboration between agencies and practitioners that work with children, and the community, NGO and government groups that work to strengthen household and community strategies.

Creating adequate local information bases for risk reduction is an essential component of protection. There are numerous precedents for community-managed enumerations and surveys,[211] which also help to support stronger networks of solidarity among households. They should be undertaken, however, with a recognition of the particular risks for children and their implications.

Strengthening family coping strategies would ideally include enhancing social capital and recognizing and responding to the costs of fear, anxiety and depression. These are important not only to the resilience of households but also, indirectly, to children's well-being and security in taxing situations. There are marked synergies between preparations to avoid the risk of material losses and measures that enhance community solidarity and mental resilience. Mental health problems are strongly correlated with insecurity and unpredictability. When people feel reasonably well prepared for various eventualities, this sense of control is likely to enhance their capacity to cope well. This is not to suggest that there is no need for mental health services – but rather, to point to the important role that better overall protection and preparedness can play in this regard.

4.2.3 Maintaining and improving opportunities for children's activities and routines

Some of the measures taken to reduce hazards and risks in low-income communities may increase risks for children, or limit their opportunities for optimal development. For instance, replacing dirt roads and alleys with well drained all-weather roads may reduce flood damage and ensure accessibility. But improved roads are also likely to increase the speed of traffic, a safety hazard for children walking to school or running errands. Speed bumps and sidewalks can help to ensure that the improvements work for everyone. In many cases, roadways are also the only space in a densely settled community where children can play. As long as traffic is minimal and slow moving, this is not a problem; but improved roads may eliminate a community's relatively safe play space, and alternatives must be found.

A related factor is the tendency of households and communities to accommodate gradually to increasingly difficult conditions and to begin to see as normal what is, in fact, far from acceptable.[212] Where resources are limited and few alternatives exist for external support, this kind of accommodation is a necessary survival strategy. But this state of mind can also mean a failure to acknowledge all the ways children's health and optimal development are being undermined. Here again is a role for child-focused organizations and agencies, to maintain a focus on how children may be affected in the course of routine adaptation strategies. When poor drainage in a repeatedly flooded neighbourhood, for instance, exposes children to the risk of water-borne illnesses, accommodating to this risk by keeping children indoors is not an adequate adaptation for the longer term. When school grounds are repeatedly flooded, closing the school for more and more days in the year is not a sufficient response.

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

[211] See http://www.sdinet.org/rituals/ritual2.htm.

[212] Satterthwaite, David, Saleemul Huq, Mark Pelling, Hannah Reid and Patricia Romero-Lankao (2007) *Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-income Nations,* IIED, London.

Protecting health, survival and livelihoods must clearly take precedence. But keeping in mind the significance of children's daily activities and opportunities can mean giving greater priority to responses that might otherwise be seen as having minor importance but that, in fact, affect the quality of life for all (such as planting shade trees in areas affected by heat waves, or ensuring that playing fields are adequately drained). A sharper focus on children's long-term well-being can add to the pressure for adequate provision and adaptation within a neighbourhood.

4.2.4 Respecting children's capacity for active involvement in the aftermath of crisis

Reducing long-term risks in any community involves a fine-grained assessment of the local environment and the ways that people, enterprises and activities may be affected by changing conditions or extreme events. To some degree this is a matter for experts of various kinds. But the capacity of local community members to assess local risks is well documented.[213] Children and young people also have the proven ability to be involved effectively in environmental monitoring and assessment, as well as in planning solutions and decisions.[214]

Many people feel impatient at the notion of involving children in real-life planning and monitoring, seeing their participation as something that is an inappropriate waste of people's time or, at best, a learning exercise that should take place on the sidelines.[215] A common assumption is that children are too young to really notice what is going on around them or to have anything useful to contribute.

Children and young people, in fact, tend to have a lively awareness of the events that surround them – even the youngest children take in more than is often acknowledged. They generally have a detailed knowledge of their surroundings and can be excellent informants on local realities.[216] It is clear from experience that children can make a significant contribution, often bringing a fresh perspective to issues and coming up with concerns and solutions that may have been overlooked.[217] It is worth noting, however, that while children and young people can be alert observers of the local scene, 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 has particular relevance for children with their more limited frame of reference. This is an issue elaborated by Peter Kahn in his discussion of "environmental generational amnesia".[218] The fact that children have a shorter time frame for evaluating change has implications for how best to support their active stewardship.

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[213] For example, see Douglas, Ian, Kurshid Alam, MaryAnne Maghenda, Yasmin Mcdonnell, Louise McLean and Jack Campbell (2008) "Unjust waters: climate change, flooding and the urban poor in Africa", *Environment and Urbanization* 20(1), pp 187-206; Wamsler, C (2007) "Bridging the gaps: stakeholder-based strategies for risk reduction and financing for the urban poor", *Environment and Urbanization* 19(1), pp 115-142.

[214] Chatterjee, Sudeshna (2007) "Children's role in humanizing forced evictions and resettlements in Delhi", *Children, Youth and Environments* 17(1), pp 198-221; Chawla, L (ed) (2001) *Growing Up in an Urbanizing World*, Earthscan/UNESCO, London.

[215] See West, Andy (2007) "Power relationships and adult resistance to children's participation", *Children, Youth and Environments* 17(1), pp 123-135 for an account of the resistance on the part of adults and organizations to involving children.

[216] ***See, for instance, Swart Kruger, Jill and Louise Chawla (2002) "'We know something someone doesn't know'; children speak out on local conditions in Johannesburg",*** Environment and Urbanization *14(2), pp 85-96*.

[217] Hart, R (1997*) Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care*, Earthscan/UNICEF, London.

[218] Kahn, Peter H Jr (2002) "Children's affiliations with nature: structure, development and the problem of environmental generational amnesia", in Kahn, Peter H Jr and Stephen Kellert (eds) *Children and Nature*, MIT Press, Cambridge, Mass, pp 93-116.

Health promotion is another area where children can be actively involved. In many settings, a more effective alternative to hygiene awareness programmes for overburdened caregivers appears to be the use of "child-to-child" health education measures. This approach, promoted by the Child-to-Child trust in Britain,[219] developed around the notion that in many places, children are the de facto caregivers for younger siblings and need to be adequately informed about everyday health risks. The child-to-child approach focuses also on children caring for themselves, and improving the level of health awareness within their communities. Experience with this approach shows that children can be well-informed advocates for change within their communities.[220] They might be involved in such activities as, for instance, surveying the changing incidence of diarrhoea in their communities during different kinds of weather, or looking at patterns of injury, and informing people of their findings.[221]

4.3 Preparing for extreme weather events

The urban poor are resourceful and experienced at coping with multiple daily challenges. In the face of repeated storms, floods and other events, however, their resourcefulness can be tested to the extreme. A woman from the Alaja slum in Accra, Ghana, for instance, describes the situation she faces every time there is heavy rain, an increasingly frequent event in recent years:

> "*When the rain starts falling abruptly, we turn off the electricity meter in the house. We climb on top of our wardrobes and stay awake till morning. Our house was built in such a way that ordinarily water should not flood our rooms, but this is not so. Our furniture has been custom made to help keep our things dry from the water. For instance, our tables are very high and so also are our wardrobes, they are made in such a way that we can climb and sit on top of them. These measures are adaptive strategies as old as I can recollect. I have two children but because of the floods my first child has been taken to Kumasi to live with my sister in-law.*"[222]

Urban areas, with their concentrations of people and wastes, may be especially at risk from extreme events, but also have greater potential for effective preparation and response measures because of the lower per capita costs of establishing early warning systems and responses to imminent disaster. Where children are concerned, this may mean shifting the point at which an imminent event is considered to be a potential disaster.

4.3.1 Health and safety as a focus for preparation

Wherever possible, children should be taught basic survival skills. In flood-prone areas, for instance, they should learn how to swim. In any area at risk of disaster, they should be familiar with evacuation routes – which should be designed with the capacity of children and caregivers in mind (as well as that of the elderly and of those with disabilities). They should also learn about the potential hazards in case of extreme events, knowing what to avoid. Measures can be taken to diminish the risk of separation of family members. For instance, children can be taught early how to identify themselves and their parents, they can carry identification, and parents can carry pictures of children.[223] Families can also discuss strategies for avoiding separation, such as establishing pre-arranged rendezvous points.

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[219] Morley, D (1993) "The very young as agents of change", *World Health Forum* 14(1), pp 23-24.

[220] Lansdown, R (1995) "Learning and teaching: child to child", *Dialogue Diarrhoea* 60, p 6; Mohapatra, SC, H Sankar and P Mohapatra (1993) "Child to child: the programme in survival and development of children", *Indian Journal of Maternal and Child Health* 4(4), pp 118-121.

[221] For a recent description and evaluation of the child-to-child approach, see Pradhan, Uma (2007) "The child-to-child approach to community and health development in South Asia, *Children, Youth and Environments* 17(1), pp 257-268.

[222] Douglas, Ian, Kurshid Alam, MaryAnne Maghenda, Yasmin Mcdonnell, Louise McLean and Jack Campbell (2008) "Unjust waters: climate change, flooding and the urban poor in Africa", *Environment and Urbanization* 20(1), pp 187-206.

[223] Johnston, Carden and Irwin Redlener (2006) "Critical concepts for children in disasters identified by hands-on professionals: summary of issues demanding solutions before the next one, *Pediatrics* 117(5), pp S458-S460.

4.3.2 Family and community coping strategies in the course of disaster preparedness

In their account of people's adaptation strategies in the face of imminent flooding in some African cities, Douglas and colleagues note the scarcity of community-wide responses or coordinated measures. People by and large described actions undertaken on a household-by-household basis.[224] In El Salvador too, most of the measures taken to reduce risks were found to be carried out individually. Far from generating joint responses, the threat of disaster was found, in this case, more likely to be a cause for increased tension among neighbours.[225] The very common phenomenon of household-by-household responses to risk reduction can result in an increased overall level of risk. In Saint Louis, Senegal, for instance, large parts of the city are at risk of serious flooding. This risk is increased by the widespread practice of dumping waste in the streets, thereby blocking drainage channels. Many families also construct flood defences and embankments out of their household waste – thus, in effect, causing waste to be spread throughout a community when flooding occurs. The resulting increase in sanitation-related illness has, of course, the most serious consequences for children. Saint Louis, with support from the NGO ENDA, is addressing this problem by supporting the dissemination of information, making training available and strengthening cooperation among all stakeholders.[226]

4.3.3 Children's routines as part of preparedness

Extreme events, by their nature, upset routines and regular activities. It is unrealistic to expect that children can be protected from this reality. However, preparations for extreme events can place greater priority on ensuring that children's lives will be minimally disrupted. For instance, when sites are selected for emergency shelter, schools should not be the first choice unless they are the only sizeable public building around. As mentioned before, education for children in Saint Louis was reduced to a few months a year because of this practice. Where this is a repeated problem, concerted measures might be taken to identify alternative sites – either for temporary shelter or for ad hoc classrooms.

Disaster preparedness, in places at risk, can also become part of children's regular activities, as will be described below.

4.3.4 Involving children in disaster preparation

In the Philippines, one of the key lessons learned in an effort to mainstream a community-based disaster risk management project into city good governance was the importance of including children, to ensure that their needs were met.[227]

There are numerous accounts of children being involved constructively in risk assessment and reduction, for instance, in such activities as mapping out and helping to create evacuation routes. Plan International describes the sophistication and wide-ranging nature of children's responses when they are given the chance*:*

> *"In the consultations, the children were given the opportunity to discuss how they and their communities can be better prepared for future disasters, including tsunamis. They are very aware of the risks but also are convinced that more lives can be saved if they are prepared…Their extensive ideas on preparedness include the development of warning systems, efficient evacuation plans and*

[224] Douglas, Ian, Kurshid Alam, MaryAnne Maghenda, Yasmin Mcdonnell, Louise McLean and Jack Campbell (2008) "Unjust waters: climate change, flooding and the urban poor in Africa", *Environment and Urbanization* 20(1), pp 187-206.

[225] Wamsler, C (2007) "Bridging the gaps: stakeholder-based strategies for risk reduction and financing for the urban poor", *Environment and Urbanization* 19(1), pp 115-142.

[226] Diagne, Khady (2007) "Governance and natural disasters: addressing flooding in Saint Louis, Senegal", *Environment and Urbanization* 19(2), pp 552-562.

[227] Center for Disaster Preparedness (CDP) (2007) *Philippines: Mainstreaming Community-based Mitigation in City Governance, Community-based Disaster Risk Management and Local Governance,* Center for Disaster Preparedness (CDP) (in partnership with ADPC), http://www.prevention.net/files/736_Philippines-good-practices.pdf.

families having an awareness of potential disasters, with common medicines and important documents to hand. Some of their ideas link to environmental sustainability and the reduction of risk through appropriate construction methods, planting of trees and protecting the mangroves. Children's consideration of protection includes older people, younger children, disabled people and minority groups; and their ideas about saving to be prepared for future disasters suggest a natural resilience that should be encouraged."[228]

Plan notes that the full potential of children's constructive involvement in risk reduction measures is seldom explored:

"*The theory … that disaster risk reduction strategies must be based on participatory principles is well established. We are concerned, however, based on our research into the response to the tsunami, that the mind-set of those who will put this theory into practice does not yet extend to a genuine integration of children and young people into plans for disaster response, recovery and risk reduction*."[229]

Rather than adding to stress, an appropriate level of involvement can help reduce it, giving children a sense of competence and control where they might otherwise feel helpless.

4.4 Responding to the immediate losses, costs and threats following extreme weather events

Extreme weather events, whether on a larger or smaller scale, can result in substantial losses, costs and disruptions in all areas of life, as well as threats to health and safety. Rebuilding can be a long-term process, and interim responses are needed to help families and communities cope with the immediate aftermath – whatever the scale of the event. Most of the discussion below relates to emergency responses after higher-magnitude disasters, because these tend to be better documented. The needs following smaller-scale events are also important – and as with larger events, there must be an assessment of the damages and immediate needs.

4.4.1 Health, safety, nutrition after extreme events

Maternal and child health care and nutritional supplementation may be among the first supports set up in the immediate aftermath of disaster, and in this sense young children and the caregivers may be comparatively well served, especially after larger events. But health goes beyond the availability of health services, and the level of safety and environmental health in post-disaster situations is often appalling. The protection of child health must be more broadly defined in these situations, as in poor urban communities generally, to ensure environments that do not call for superhuman efforts on the part of caregivers. Relatively simple measures can make a big difference in helping caregivers protect their children's health. In a Malawi refugee camp, for instance, the provision of covered pails with spouts reduced faecal coliform levels in stored water by 69 per cent.[230] However, it is critical to pay attention to local perceptions of workable solutions. In this same camp, a less expensive option would have been the use of chlorination. But because this was unpopular among residents, it did not become a useful solution.

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[228] 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*, Plan International, Bangkok, p 29.
[229] 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*, Plan International, Bangkok p 7.
[230] Roberts, L, Y Chartier et al. (2001) "Keeping water clean in a Malawi refugee camp: a randomized intervention trial", *Bulletin of the World Health Organization* 79(4), pp 280–287.

After an extreme event, it is important to be aware of the heightened potential for injury, especially for children. A careful assessment of the post-disaster area can help reduce cuts, falls, electric shocks and other injuries from unfamiliar hazards. Adequate reproductive health services for women and young girls may also be a critical component of protection in the somewhat longer term, in the often dysfunctional and violent aftermath of disasters.[231]

Mental health is another important component. Although trauma may be overstressed as an outcome of disasters, this does not mean that it does not exist. It is important to look at the often considerable hardships that accompany events, and to determine within the local context how both children and adults can be helped to cope with them. Given the risks related to some of the psychological supports for children that are offered in the context of emergencies, the Bernard van Leer foundation, which focuses on early childhood, offers additional practical guidelines to organizations seeking to provide psychosocial support programmes (Box 8).

Box 8: Support for children after a disaster: advice from the Bernard van Leer Foundation
"As a general rule, the following should be avoided:

- *responses which label children as 'traumatized' or 'mentally ill' may have an unhelpful or stigmatizing effect. It is often more helpful to convey the idea that distressed children may be responding normally to abnormal events.*
- *responses which isolate children from the many others who may have had similar experiences. Programmes which 'treat' children away from their own environment (such as in 'trauma centres') are to be avoided, and treating children in institutional settings has the potential to be particularly damaging.*
- *programmes which use methods that transgress cultural norms – for example, encouraging children to discuss and express their feelings in cultures which do not sanction such behaviour.*
- *allowing children to be interviewed, to 'tell their story', to researchers and journalists should be avoided: insensitive interviewing can easily cause secondary distress. The child's best interest should be a guiding principle in all situations."*

Source: Mc Callinn, Margaret (2005) "Guest editorial: responses to young children in post-emergency situations", Early Childhood Matters 104, Bernard van Leer Foundation, p 7.

Also very useful in this context are the standards presented by the Sphere Handbook, a basic humanitarian aid text on emergency responses, which now include attention to the mental and social aspects of health following disasters.[232] A child-focused review of the available evidence on the interventions described by the Sphere minimum standards provides a number of recommendations, which make it clear that support for the mental health of children involves, critically, support for a stable and functioning adult society and the maintenance of accustomed routines (Box 9). [233]

[231] Goodyear, L and M Hynes (2001) "Integrating reproductive health into emergency response assessments and primary health care", *Prehospital and Disaster Medicine* 16(4), pp 223-230.
[232] Sphere Project (2004) *Humanitarian Charter and Minimum Standards in Disaster Response*, Sphere Project, Geneva. Earlier versions of this handbook did not include attention to mental health because of the lack of expert consensus on this area.
[233] 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), pp 1853-1864.

Box 9: Recommendations for mental and social health following disasters, based on the Sphere minimum standards

1. People have access to an ongoing, reliable flow of credible information on the disaster and associated relief efforts.
2. Normal cultural and religious events are maintained or re-established (including grieving rituals conducted by relevant spiritual and religious practitioners). People are able to conduct funeral ceremonies.
3. As soon as resources permit, children and adolescents have access to formal or informal schooling and to normal recreational activities.
4. Adults and adolescents are able to participate in concrete, purposeful, common interest activities, such as emergency relief activities.
5. Isolated persons, such as separated or orphaned children, child combatants, widows and widowers, older people or others without their families, have access to activities that facilitate inclusion in social networks.
6. When necessary, a tracing service is established to reunite people and families.
7. Where people are displaced, shelter is organized with the aim of keeping family members and communities together.
8. The community is consulted regarding decisions on where to locate religious places, schools, water points and sanitation facilities. The design of settlements for displaced people includes recreational and cultural space.
9. Professional treatment should be available for urgent psychiatric complaints, including pre-existing mental illness, as well as non-intrusive "first aid" support for those in acute distress. For protracted disasters a system of community-based psychological support should be established.

Source: 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), pp 1853-1864.

The following diagram, drawn from a review of the mental health needs of children in crisis, illustrates the distribution of the kinds of services that are most likely to be supportive of children's psychological well-being (and that of their families) (Figure 3). This pyramid makes clear that in most cases, it is the more general community-based interventions that will be useful to the greatest number of people, and that specialized mental health services are likely to be a priority for relatively few.

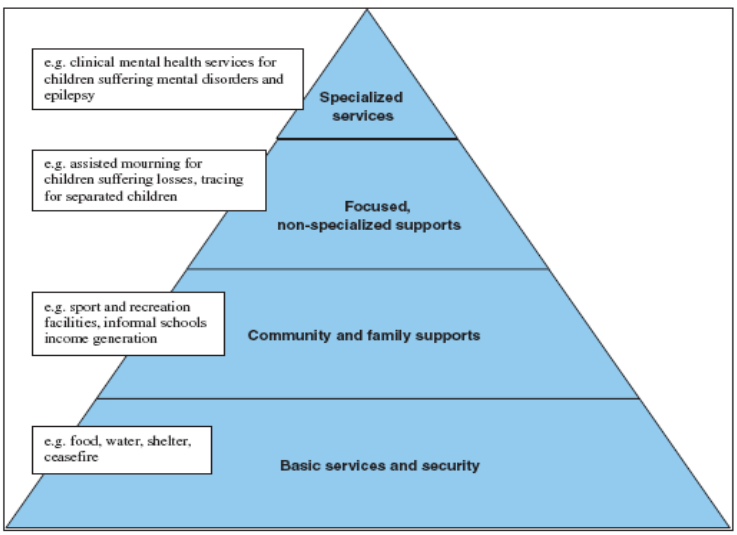

Figure 3: Interventions for psychosocial needs after an emergency

Source: Jones, Lynne (2008) "Responding to the needs of children in crisis", *International Review of Psychiatry*, 20(3), page 299.

4.4.2 Strengthening families' immediate capacity to cope

Many of the problems experienced after disasters are related to the way emergency and transitional assistance is delivered, and to the fact that people may feel little or no control over their lives. Not only do survivors generally have no role in decisions that affect them; much of the time they do not even know what decisions have been made. The resources, skills and strengths of communities are often overlooked in the rush to assess risks and needs. An array of NGOs can deliver various supports – in the emergency barracks described in Box 6 (Aceh), one organization provided water and another brought in food, another staffed a safe play area for children and another picked up waste. Residents were apparently reluctant to do anything for themselves for fear they would jeopardize some potential assistance. They were unwilling, for example, to repair shoddy and even dangerous construction because they saw it as the responsibility of the organization that had provided it. There appeared to be no coordination on the part of the various organizations with any resident group – no one even seemed clear whether any such group existed. A sense of helplessness and demoralization was pervasive. The fact that this was a "temporary" situation made it appear pointless to deal with the problems. This temporary situation, however, would end up being home to children for more than two critical years of their lives.

In sharp contrast was an emergency camp in Thailand set up by the highly regarded Community Organizations Development Institute (CODI), an independent public organization that carries out a number of government programmes. From the very day after the disaster, when this camp was first opened, residents were encouraged to organize themselves, with each alley providing a representative to a resident committee, which then served as the gatekeeper for all NGOs coming to provide services. Camp residents negotiated with NGOs and determined how best to make use of the available assistance. Here too, residents waited many months for final relocation, but the mood was very different and people had taken a constructive role in improving and maintaining the camp.[234] The difference for children is clear – not only in terms of their health and safety but also in terms of the level of reassurance and stability provided by the presence of adults who are active, engaged and in charge.

Approaches that encourage active engagement and community control in the aftermath of disaster have huge implications for children – as well as for more general recovery. Psychosocial support sessions, however effective, cannot replace functioning families and communities. But the genuine involvement of those affected in the aftermath of a disaster, children or adults, is surprisingly rare given the rhetoric on the value of such participation. In part, this is because of the push to accomplish a great deal in a short time, and the sense that involving people will undermine efficiency. As is clear from the Thai example, efficiency can actually be enhanced when people are engaged in practical ways. But participation is too often perceived by organizations as just one more thing to do in an already overwhelming situation. It is viewed, in other words, as an additional project to burden staff, rather than a way of getting things done. The superficial consultation that sometimes occurs may have more to do with donor requirements for participation than with the intent of actually sharing control with communities and drawing on their knowledge and strengths. In defence of over-burdened organizations, it must be acknowledged that facilitating and supporting truly constructive community engagement, especially with communities that may have little practice with joint decision making, can take skill and experience as well as genuine commitment. In many cases, those working in the field in this setting, hired suddenly in the aftermath of disaster, may have little or no understanding of this approach, let alone any experience of it.

Although the same level of organization will not be necessary in the case of smaller-scale events, the same principle applies – involving those affected as soon as possible in making decisions about their needs and priorities is a critical way of ensuring that adults regain control of their own lives and, by extension, are better able to provide the care and support their children need.

[234] Field visits by author in Indonesia and Thailand, and discussions with CODI and Save then Children staff.

4.4.3 Restoring children's activities and routines

In the aftermath of both large and small disasters, one critical response is to ensure that schools and early childhood centres are up and running as soon as possible. Supportive institutions at community level, for children whose households and communities are disorganized and overwhelmed, have well-documented benefits. Early childhood programmes can help reduce parental stress as well as provide young children with a safe, structured daily routine and valuable contact with other children.[235] Schools can provide the same kind of routine, sanctuary and interest for older children – providing them with an identity as students and a chance to maintain and develop their skills with an eye to the future, as well as the contact with peers that is so critical to them.[236] It should be kept in mind, however, that the internationally accepted minimal standards for education in the context of emergency and disaster[237] may exceed the standards that are met in most low-income countries at the best of times. If emergency response efforts can include work to strengthen local school systems, so much the better. Every effort should be made to use this opportunity to involve children and communities in considering how schools can become more welcoming, vital centres for local learning. A related issue is adequate space for homework. In overcrowded emergency and transitional housing especially, it may be hard for children to find a quiet, well-lit place where they can focus on their studies. Provision of a shared place that meets these requirements can help ensure that children remain in school.

Other helpful responses, especially for older girls, involve working with them on ways to ensure they feel safe from harassment or abuse. This may involve lighting the way to the toilets, or finding people who are willing to monitor the route or accompany children and adolescents. It can also mean finding ways to ensure their privacy while they are bathing or dressing. This would be welcome for women as well.

An increasingly common NGO response for children after emergencies is the provision of "safe play areas" or "child-friendly spaces", especially for younger children.[238] The rationale is excellent: in efforts to shelter people and provide basic amenities, obstructions to play are unlikely to be seen as a priority concern. In the chaos following a disaster, it can be critical to provide some safe place for children, and especially to ensure that they have a chance to relieve distress and anxiety through play with other children. "Safe play areas" are generally raised, covered platforms, quickly erected, with a lockable room for storing toys and other materials; they may also be large tents or other structures. Generally, they are open for set hours during the day, with a staff member available to work with the children. Although these safe spaces fill an important need in the chaos of an emergency, they are less useful as a longer-term solution, as the post-disaster scenario drags on. When adults feel their children's needs are being met in this way, it can remove an important incentive for addressing the often appalling conditions within the larger local environment. It's an illusion to assume, however, that a few supervised hours a day within these small covered spaces is any kind of substitute for a safe, varied, stimulating neighbourhood. Care should be taken to ensure that safe play areas are seen as a short-term solution – or else that they become just one component of the necessary attention to the local environment for children. Ideally, the organizations that support these interventions could also encourage and facilitate community meetings on how best to make the more general common space safe and pleasant for children's use.

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[235] Williams, JRA, Tina Hyder and Susan Nicolai (2005) "Save the Children's experience: ECD in emergencies", Responses to Young Children in Post-emergency Situations, *Early Childhood Matters* 104, pp 16-21, Bernard van Leer Foundation.

[236] Nicolai, S and C Triplehorn (2003) *The Role of Education in Protecting Children in Conflict*, HPN Network Paper #42, ODI, London.

[237] Interagency Network for Education in Emergencies (2004) *Minimum Standards for Education in Emergencies, Chronic Crises and Early Reconstruction*, www.ineesite.org/standards/MSEE_report.pdf.

[238] The criteria for these are described, for instance, in Prabhu, Nina (2007) *International Donor Agencies Guidelines for Responding to Children in Emergencies*, Ryerson University, http://www.ineesite.org/ineedownloads/viewall.asp?pid=1387&cp=21.

Especially where older children are concerned, the aftermath of disaster may involve the loss of the kinds of routine activities that make them feel like competent useful people. Gillian Mann has pointed out that in refugee situations, for instance, restoring a sense of normalcy may depend in part on recreating the daily chores and responsibilities that are an integral part of the lives of children in many low-income communities.[239] Children's desire and capacity to play an active, competent role is especially relevant in the post-disaster context, as is discussed next.

4.4.4 Respecting children's capacity for active involvement in the aftermath of crisis

Because of the rights orientation of most child-focused organizations, children may have more opportunity for participation than adults – at least in the context of large-scale disasters. But this, again, is little guarantee of the kind of genuine engagement that many older children in particular are likely to want. Not all opportunities for "participation" are equally worthwhile. Many children have noted their impatience, for instance, with having endlessly to share their disaster stories. As a child from a group of seven to 12-year-olds in Thailand noted:

> "*People very frequently asked children the same questions. These people were many and came from many organizations. We felt bored and did not want to answer. But for the school's sake, and fame, we had to answer*."[240]

On the other hand, authentic engagement can be valuable to all. Scholars from the refugee studies centre at the University of Oxford have made a real contribution to understanding the potential role of children in these situations, where adult roles and structures have become fractured. Guyot, for instance, describes how, in refugee camps in Africa, the involvement of young people

> "*…can transform the experience of displacement, as entire communities benefit from the unique competencies young people carry with them, including effective coping mechanisms, adaptability, resourcefulness and their abilities to institute and secure positive change and self-protection. Active decisions made by children – how they organize themselves, the priorities they identify, the habits they maintain or choose to leave behind when entering the camp environment – have a major impact on the future development of the entire community*."[241]

Although children have the capacity to function independently, there can be practical advantages to encouraging the integration of children's involvement with that of adults, and this can be especially relevant in the context of a disaster response. The post-disaster "dependency syndrome" is familiar to all who work in that world. Being among helpless, depressed adults is uncomfortable and disturbing for most children. In this context, for a project to call on children alone to make plans and decisions can be a reversal of the normal order – and at a time when people are especially anxious for things to return to normal. In the haste to set up psychosocial interventions for children, it can be easy to forget how important it is for children to see their parents and neighbours as competent people who can take an active role in planning their lives and making decisions. Involving children and bypassing adults is not a healthy way to support strong family and community relationships. This does not mean that all discussions and activities need to involve all age groups – but it can be helpful to ensure that there are plenty of chances to share perspectives and decide together on things that may affect everyone.[242] This will be discussed further below in the context of rebuilding.

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[239] Mann, G (2000) "Networks of support: a literature review of care issues for separated children" unpublished paper.

[240] 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*, Plan International, Bangkok, p 11.

[241] Guyot, Julie (2007) "Participation: children and youth in protracted refugee situations", *Children, Youth and Environments* 17(3), pp 159-178, p 162.

[242] Bartlett, Sheridan and Iltus Selim (2007) *Making Space for Children; Planning for Post-disaster Reconstruction with Children and their Families*, Save the Children India, Chennai.

Access to relevant information is vital to a sense of control over life. In the days after a major disaster, information can be critical for accessing available support and materials. The Sphere standards require that relief information be readily available to affected people after a disaster, but also that this information be understandable to a local 12-year-old.[243] This requirement – both the availability of information and its accessibility to those who need it – should be respected not only in the immediate relief period, but also in preparation efforts and throughout the rebuilding process.

4.5 Adapting to impacts and losses, and rebuilding to reduce future risks

Although the reconstruction process is a precious opportunity for addressing both short-term concerns and longer-term development issues, it can often just replace old problems with new ones. There tends to be little understanding of how reconstruction affects children, or how it could potentially be turned to better advantage in providing social as well as physical benefits. Although new housing may be a vast improvement over conditions in emergency camps and transitional shelter, it can fail to meet the needs of both younger and older children in some critical ways. The issues that arise may be relevant not only for reconstructed settlements following major disasters, but also for much smaller-scale reconstruction and for upgrading undertaken to reduce risks from potential climate-related extremes.

"Rebuilding" of course means lives as well as infrastructure, housing and neighbourhood space. The need for attention to livelihoods is well recognized. But social capital generally can use support especially in situations where people have been displaced and resettled. Active involvement and collaboration in the creation of physical conditions that are truly responsive to social needs can go a long way in supporting these critical aspects of people's lives.

4.5.1 Rebuilding with children's health and safety in mind

The creation of new or reconstructed settlements or neighbourhoods can be a good opportunity for addressing the basic infrastructure that is so critical not only to protection from future weather events but also to children's health. Piped water supplies to houses, in-house latrines and adequate drainage systems can all be more economically installed at this stage. There are many practical precedents for low-cost infrastructure installed with community involvement in cooperation with local government.[244] Even when there are not the resources for in-house plumbing, local involvement in designing community level solutions can result in a huge improvement over a lack of such infrastructure, or the often inadequate and unmaintained municipal provision.[245]

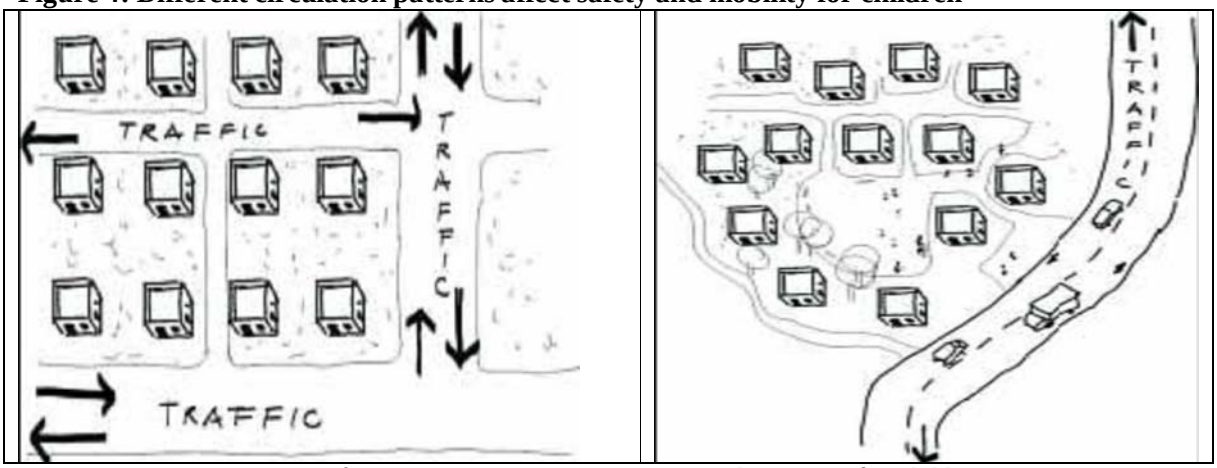
Safety is also a major concern, and a neighbourhood designed and built with children in mind will make this a priority, ensuring that play and mobility are possible with minimal risk. A major concern in this regard is the circulation routes through a community. In existing poor urban settlements, the narrowness and poor quality of many streets and alleys may actually serve as protective factors for children, making street play relatively safe. But reconstruction (or upgrading) efforts may include ensuring that streets are wide and durable enough to allow traffic to pass through easily – an important consideration especially for emergency access in case of fire or illness. But if vehicles can move through at even moderate speed, children will be more limited in their ability to move around freely and safely. In completely rebuilt areas, a distinction between access roads and a circulation network of small, safe pedestrian lanes can encourage

[243] Sphere Project (2004) *Humanitarian Charter and Minimum Standards in Disaster Response*, Sphere Project, Geneva.
[244] See, for instance, Hasan, Arif (2007), "The Urban Resource Centre, Karachi", *Environment and Urbanization* 19(1), pp 275–292; Boonyabancha, Somsook (2005) "Baan Mankong; going to scale with 'slum' and squatter upgrading in Thailand", *Environment and Urbanization* 17(1), pp 21-46.
[245] Burra, S, S Patel and T Kerr (2003) "Community-designed, built and managed toilet blocks in Indian cities", *Environment and Urbanization* 15(2), pp 11-32.

social interaction and child mobility instead of inhibiting it, as well as increasing the amount of common community space. This holds true whether it applies to high-rise buildings or smaller units.

Figure 4 reflects surroundings that are less dense than is common in most urban areas, but the principle is the same. In upgraded areas, wherever streets are improved and paved, it makes sense to include speed bumps or other devices to slow down traffic, so that children's play is safe and pedestrian needs take priority. Sidewalks are an important component of children's safe mobility. Reaching school or running errands will be far safer if children do not have to walk in traffic. Adequate planning of common space can also help to ensure safe places for children to play. This will be discussed further below. The following section also discusses household modifications that can help protect young children from injury and poisoning.

Figure 4: Different circulation patterns affect safety and mobility for children



Source: Sketch by Selim Iltus, from Bartlett, S and S Iltus (2007) *Making Space for Children*, Save the Children, Chennai.

4.5.2 Rebuilding in ways that strengthen family and community

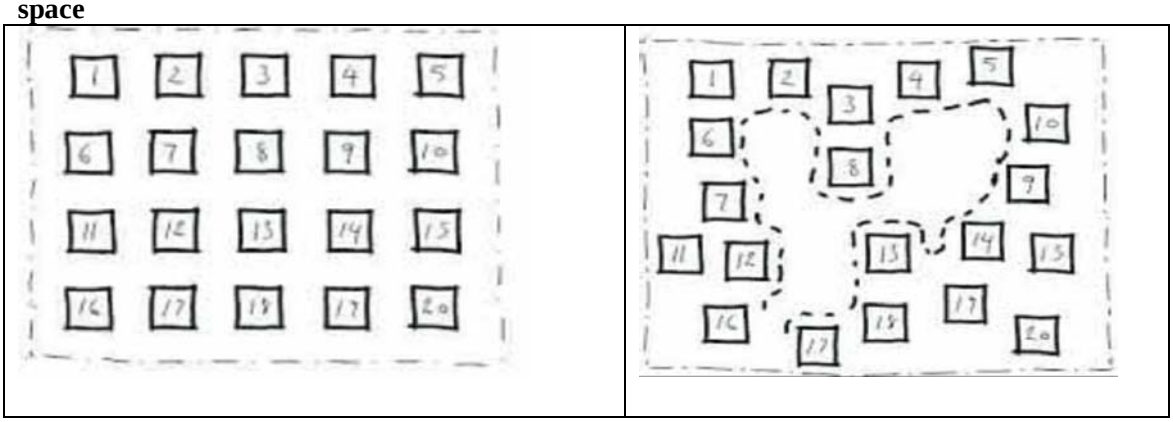
Location: The location of rebuilt settlements has implications for livelihoods and for access to such amenities as schools, markets and health facilities, with implications for all. In Tamil Nadu after the tsunami, many large resettlement areas remained empty after they were completed, in part because of their location. People in the town of Nagapattinam, for instance, refused to move two kilometres away to a site that separated them from jobs and other supports, even though this meant staying in their hot, crowded, rundown emergency barracks. Genuine consultation in advance of such major decisions, and throughout the rebuilding process, far from being a factor that slows down the process, is the only approach likely to ensure its practicality and efficiency.

Women's ownership: It has frequently been noted that women are more likely to make children's concerns a priority than are men. Jayaraj, in a discussion of rebuilding experiences in Andra Pradesh following on cyclones and other disasters over recent decades, notes that in the rebuilding process, when issues related to women are adequately addressed, children's needs are far more likely to be taken care of. She stresses the importance of registering new house sites in women's names or, when houses are being repaired or rebuilt in situ, ensuring that ownership by men be converted to joint ownership as a condition of the subsidized construction of permanent housing. She also stresses that there be at least 50 per cent

representation of women in all decision-making bodies, and that measures be taken to support and sustain women's leadership.[246]

Layout: Often, new housing in less dense urban areas is built in a grid pattern on land levelled and stripped of vegetation – an arrangement that is efficient for engineers but that fails to make optimal use of space from a social perspective. Housing that is clustered to reflect and support social ties can encourage local interaction and mutual support, at the same time that it allows for children's play (Figure 5).

Figure 5: Different ways of using the same space: traditional grid layout versus more positive open space



Source: Sketch by Selim Iltus, from Bartlett, S and S Iltus (2007) *Making Space for Children*, Save the Children, Chennai.

Priorities in this regard can be very locally specific, however. In a participatory site design process in Delhi, for instance, young girls objected to a courtyard arrangement for new housing, arguing in favour of a street layout that would leave them less likely to be cornered by drunken men.[247]

In more dense urban areas, high-rise housing is the most practical response, but it has long been recognized in a number of settings (primarily in high-income countries) to raise significant issues especially for younger children and their caregivers.[248] Anecdotal evidence from low-income countries points to the same concerns.[249] Efforts must be made in these cases to consider internal layouts that promote social interaction as well as make it easier for caregivers to allow small children out of their apartments for play.[250] Outdoor space can also be arranged, even around high-rise housing, in ways that maximize safety and opportunity for children who are old enough not to need an adult in the vicinity.

Housing: Minor adaptations to housing design can also make a considerable difference to family dynamics and to caregivers feeling they can deal adequately with their children's needs. It is often assumed, for instance, that one- or two-room living is adequate for those with low incomes. Conversations

[246] Jayaraj, Annie (2003) "Post-disaster reconstruction experiences in Andra Pradesh, India," PreventionWeb document DRR8040, http://www.preventionweb.net/english/professional/publications/v.php?id=554.
[247] Chatterjee, Sudeshna (2007) "Children's role in humanizing forced evictions and resettlements in Delhi", *Children, Youth and Environments* 17(1), pp 198-221.
[248] See, for instance, Saegert, S (1982) "Environment and children's mental health: residential density and low-income children", in Baum, A and JE Singer (eds) *Handbook of Psychology and Health*, Erlbaum, Hillsdale NJ; Oda, M, K Taniguchi et al. (1989) "Effects of high-rise housing on physical and mental development of children", *Journal of Human Ergology* 18(2), pp 231-235.
[249] For instance, discussions with resettled women and children in Mumbai.
[250] In Mumbai again, efforts have been made by the NGO SPARC to change building regulations to permit wider hallways and common spaces on each floor.

with numerous families, however, both in the context of disaster rebuilding and other re-housing efforts, make it clear that privacy is an issue that is too seldom addressed, and that an extra partition wall, even in a small housing unit, can relieve tensions within households. Other adaptations eagerly sought by caregivers include shelving to keep possessions off the floor and hazardous items such as medicines, pesticides and kerosene out of the reach of small children.[251]

Another consideration, especially in newly planned areas, is ensuring space is flexible enough to allow for small enterprises, both home-based and within the neighbourhood, making it easier to earn without going long distances. It is also important to consider the role of common space in allowing for social interaction and community meetings. An excellent example, unlikely as it may seem, is the community toilets built by poor urban slum dwellers and grassroots women's cooperatives in India (Box 10).

Box 10: Community toilets as common space

In Indian cities, what little provision there is for sanitation in slum settlements has usually taken the form of public toilet blocks. These are most often shoddily constructed buildings with no provision for maintenance or repair. The toilets frequently become blocked and unusable, so the open area around is used for defaecation and often for dumping garbage. The area becomes a health hazard even at the best of times, especially for small children, but during heavy rains the waste can be spread around even more widely.

When the women of the grassroots collective, Mahila Milan, started building their own community toilets in the l990s with the support of the Mumbai-based NGO SPARC, they focused on better quality construction, with large tanks to store sufficient water for regular maintenance and hand washing. They also built special children's toilets, with smaller squat plates, handles for holding onto and a lot of natural light. Young children are generally afraid of the dark and of falling into the large openings of adult latrines. Waiting in line for long periods is also difficult for them and they often get pushed out of the way by adults in a rush. These pleasant cheerful toilets encouraged them not to defaecate in the open as they almost always did before. The privacy and security concerns of women and older girls were taken into account as well, by providing separate toilets with separate entrances. Small fees, charged to families for the use of these spaces, helped to cover maintenance costs of the toilets.

The toilet blocks were built in central locations intentionally, and not isolated on the periphery of the settlement as the old municipal toilets had been. This helped ensure that the sites were informally monitored and kept clean. In some cases, where there was sufficient space, a community hall was built adjoining the toilets; in others, a meeting space was created on a terrace on top. Sometimes, this space was also used as a child care centre. Although this linking of toilets and community space may seem a strange solution, in fact it works very well. In dense settlements, this may be the only available meeting place. The social interaction that takes place here begins to transform the way people relate to the toilets. Instead of seeing the toilet block as a humiliating, filthy place to be avoided as much as possible, people are proud of it and want to keep it clean. For older children in particular, the chance to have this basic human function treated with dignity and acceptance is an important component of their own self-respect. This change in attitude is supported by the celebration of a toilet festival as each block opens, where the contribution of all can be acknowledged – both people from government agencies and from communities. The management committees gradually formalize the maintenance and management of the toilets which, in turn, helps to develop formal structures within the community.

Source: Burra, Sundar, Sheela Patel and Thomas Kerr (2003) "Community-designed, built and managed toilet blocks in Indian cities", Environment and Urbanization 15(2), pp 11-32.

[251] Conversations with rehoused families in Tamil Nadu, Mumbai, Sri Lanka.

4.5.3 Considering children's routines and activities

The quality of common space is also critical to children's needs. In most resettlement areas, the emphasis is on housing units and infrastructure, with little attention to common space. Shared space and facilities in any neighbourhood can help to make up for limitations in housing and can contribute to creating the safe vital local environments that make a huge difference to the social needs of growing children. Solutions may involve formal recreational facilities or space for community meetings and gatherings, or just places where people can sit and talk while children play. Whatever the scale and the level of formality, any space that encourages positive social interaction will make it easier for children to engage in the world outside of home – a need which increases the older they get. A neighbourhood that provides varied opportunities within secure local space allows children to test and develop their competence in all kinds of important ways, and to feel a sense of belonging within a community.

When space is allocated for common use, it will ideally be as central as possible, as with the Mumbai toilet blocks described above, or scattered throughout a community. Too often, if this kind of space is thought about at all, it tends to be given a peripheral location. Larger recreational facilities, such as space for cricket or football, may be more reasonably placed at the edge of things. But space for social interaction and play for small children works much better if there are small informal pockets here and there, easily accessible to all, rather than a formal fenced playground at the edge of things.

Vegetation is a factor often overlooked in both resettlement efforts and upgrading. Robust research from poor urban neighbourhoods in the USA has shown that children are significantly more likely to engage in creative play when they have access to pleasant green surroundings; they also interact better with adults, and have even been found to do better in school. It has also been found that adults are more likely to spend time outdoors when there are trees and vegetation, more likely to get to know their neighbours, less likely to experience domestic violence, and better able to cope with life problems.[252] While this research comes from the USA, qualitative research from a number of countries, several in low-income countries and communities in the South, highlights the emphasis children give to the importance of trees and pleasant outdoor environments.[253] Anecdotal evidence from post-tsunami areas points in the same direction. After the tsunami, the landscape was devastated and stripped bare of vegetation in many places. While adult priorities were shelter and livelihoods, children spoke repeatedly of their desire for trees and shade. In one community, where replacement housing was slowly going up on a typically barren desolate stretch of land, children asked if they could start a nursery so that there would be something to plant when the construction was over.[254] (By the same token, children in areas prone to crime or violence will also frequently point to the need to trim back vegetation in places that are known to be unsafe, and to install adequate lighting.)[255]

4.5.4 Children's active involvement in planning – along with adults

Adequate responses to construction and upgrading require a close understanding of local realities, and this has long been acknowledged to come most fruitfully from those who are affected. The values of community participation, and even more of community-driven processes, are well established. People are

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[252] Wells, NM (2000) "At home with nature: effects of 'greenness' on children's cognitive functioning", *Environment and Behavior* 32(6), pp 775-795; Kuo, FE, WC Sullivan et al. (1998) "Fertile ground for community: inner-city neighborhood common spaces", *American Journal of Community Psychology* 26, pp 823-851.

[253] Chawla, L (ed) (2001) *Growing Up in an Urbanizing World*, Earthscan/UNESCO, London; Swart Kruger, Jill and Louise Chawla (2005) "'We know something someone doesn't know'; children speak out on local conditions in Johannesburg", *Children, Youth and Environments* 15(2), pp 89-104.

[254] Author's field visits.

[255] Swart Kruger, Jill and Louise Chawla (2005) "'We know something someone doesn't know'; children speak out on local conditions in Johannesburg" *Children, Youth and Environments* 15(2), pp 89-104.

the experts in their own lives. Where solutions are called for that affect children's lives, or that can draw productively on their knowledge, the same principle applies. (Box 11)

Box 11: Children bring their perspective to tough decisions on a practical house design
Serious flooding in the last few years in Tamil Nadu, India, has displaced even more people than the tsunami did – and especially the extremely poor dalit (untouchable caste) communities who live in mud shacks in the low-lying land that no one else wants. Save the Children secured the funds to build flood-proof housing in eight dalit villages, and decided to work in partnership with these communities to come up with the best solutions. Most of the available resources would have to go to solid foundations that would withstand flooding and get the houses up off the ground. Other than that, the tentative plan was for one-roomed houses, 11'x 17', with a tiled roof.

A group of children and adults in one village raised concerns about the plan, however. "It makes no sense for us to have a tiled roof," pointed out a 12-year-old boy. "We have cyclones here and things fly around. Tiles can get smashed easily by falling coconuts. And we have no money, so we'll never be able to replace the broken tiles. We'll just have to cover the damage with palm thatch and then we'll be right back to leaking roofs again." People agreed that a flat reinforced concrete roof would fit their needs better. It would provide a place to escape to during especially high floods, like those of the last few years, and somewhere to stay and keep belongings safe until the waters receded. (In some villages, it took a month last year for the waters to recede, and people spent the time camped on a road nearby.)

A flat roof had been considered earlier by Save the Children. But it would cost about 80 per cent more, for both the extra materials and for the stronger foundation to carry the extra weight. The women in the group decided they would be willing to compromise with a much smaller flat-roofed house to reduce the costs. But when they drew up a full-scale floor plan with chalk, they were taken aback by how small their houses would actually have to be to fit the budget. They decided they needed to think about this a little longer, but that they would probably go for the tiled roof plan. The children who were present pleaded with them. One boy agreed that the smaller house would be "too small to breathe in", but all the others were adamant – it would be much better, they felt, to have a smaller house if it meant they would be safe from rushing floodwater. They recalled how fast the last flood had risen, and how frightened they were of being washed away by the chin-high waters. "What if it came at night next time?" they asked. The women sitting and listening nearby nodded their heads in recognition of the children's fears and decided to negotiate further with the organization and determine what they would need to find for added funds in order to have the security of a flat roof, and still allow for a house a little bit larger than 10' x10'.

Source: Author's field visit, February 2007.

Unfortunately, involving even adults in the aftermath of disaster is surprisingly rare, as already discussed. Despite the established value of this approach, there is a tendency to see it as inefficient in the context of emergency rebuilding measures. The centralized, top-down nature of post-disaster reconstruction, along with the pressure to provide immediate responses (in part because of donor timeframes) generally gets in the way of a more process-driven, integrated approach. Ironically, the "quick, efficient" approach is often not that quick; nor does it result in solutions that people are happy with. Involving children may in fact be more acceptable, in part because it is not seen as serious enough to pose any kind of threat to the status quo. The standard approach within child-focused organizations is to conduct child participation projects as separate events for children, giving them a chance to identify local issues that concern them, and sometimes to take action. These projects are valued for their capacity to educate children in active citizenship, and to give them a chance to articulate their ideas. But they too seldom become embedded into

wider community initiatives.[256] As a result they can be quite short lived, ending when the support organization leaves. When children's concerns are dealt with outside the context of more general community aspirations and efforts, they may remain split off from the very processes and people that should sustain them. For instance, children's concerns about drainage or waste removal are unlikely to result in more than a few clean-up days if they do not become incorporated into wider community efforts to negotiate a solution. When adults are also engaged in identifying and debating the issues, the results are more likely to put down roots, and a serious engagement with local authorities is more likely to follow. Karen Malone of the Growing Up in Cities network, which has worked in many countries to provide children and young people with ways to address the local issues that affect them, has noted that child- or youth-specific projects are generally taken less seriously by local governments than projects that involve the entire community.[257] Roger Hart, with his "ladder" of children's participation, also places children's work alongside adults at a higher level than projects where children make decisions in isolation.[258]

This shared process can also change the way adults see their children. Many adults are surprised by the thoughtful perspective and practical common sense that children can bring to a discussion of local concerns, and this can become a routine part of the local decision-making culture.[259]

This is not to suggest that children and young people should not have their own projects and aspirations, or negotiate with local authorities on behalf of their own specific interests, which may not always be part of a wider community effort. Nor does it mean that a short-lived project is by definition without value. Louise Chawla, long involved with the Growing Up in Cities programme, has this to say about the way this network operates:

> "*As the project moves into a site, it is meant to be used as a tool to help community leaders and government agencies understand the issues that young people face and to see ways to integrate young people into community development as constructive, insightful partners. If institutions see ways to include the methods that they learn into ongoing operations, that is great. But if the project is just used to help solve a particular problem, that is okay too. What we hope it will leave behind is a new configuration of better, more equal relationships between adults and young people, and a public that sees young people in a more accurate and more hopeful light – as partners in collaborative processes to create more livable cities for everyone*."[260]

The implications for local efforts to adapt to climate change are clear.

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[256] Varney, Darcy and Willem van Vliet (2005) "Local environmental initiatives oriented to children and youth: a review of UN-Habitat best practices", *Children, Youth and Environments* 15(2), pp 41-52.

[257] Malone's comment is part of a "conversation" presented in Chawla, Louise, Natasha Blanchet-Cohen, Nilda Cosco, David Driskell, Jill Kruger, Karen Malone, Robin Moore and Barry Percy-Smith (2005) "Don't just listen - do something! Lessons learned about governance from the Growing Up in Cities project", *Children, Youth and Environments* 15(2), pp 53-88.

[258] Hart, Roger (1992) "Children's participation: from tokenism to citizenship", UNICEF Innocenti Essays #4, UNICEF/International Child Development Centre, Florence, Italy.

[259] For a description of such a process, see Bartlett, Sheridan and Selim Iltus (2007) *Making Space for Children; Planning for Post-disaster Reconstruction with Children and their Families*, Save the Children, Chennai, India.

[260] Chawla, Louise, Natasha Blanchet-Cohen, Nilda Cosco, David Driskell, Jill Kruger, Karen Malone, Robin Moore and Barry Percy-Smith (2005) "Don't just listen - do something! Lessons learned about governance from the Growing Up in Cities project" *Children, Youth and Environments* 15(2), pp 53-88.

5 Conclusion

There are many vulnerable populations in the context of climate change – the poor, the elderly, pregnant women, those in particular locations. Children are not unique in this sense. However, they constitute an extremely large percentage of those who are most vulnerable, and the implications, especially for the youngest children, can be long term. If speculation about the impacts of climate change fails to take into account the particular vulnerabilities (as well as capacities) of children at different ages, measures for prevention and adaptation may prove to be inadequate in critical ways, and may even result in additional stresses for young minds and bodies.

Addressing these concerns for children may appear to be an unrealistic burden, adding unduly to the need for time and resources in the face of so many other compelling priorities. Fortunately, this is not a zero sum game. As stressed in this paper, there are strong synergies between what children need and the adaptations required to reduce or respond to more general risks. The most useful measures to protect children's health are also fundamental in reducing risks from potential disasters – such as adequate drainage, waste removal and proper sanitation. Supporting adults so that they are better able to address their children's needs also leaves them better equipped to work collaboratively on reducing risks, preparing for disasters and rebuilding their lives after a crisis. Ensuring that children continue to have opportunities to play, learn and to take an active role in finding solutions will prepare them to be the citizens we need to continue addressing the problems faced by their communities and by the planet. It has generally been found that neighbourhoods and cities that work better for children tend to work better for everyone, and this principle also undoubtedly applies to the adaptations that are being called for by climate change.

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