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Global Health: Chronic Diseases and Other Emergent Issues in Global Health

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KEYWORDS

- Chronic disease • Injuries • Mental health
- Disaster risk reduction • Emergent issues

KEY MESSAGES

- The largest burden of noncommunicable diseases occurs in low-income and middle-income countries, making noncommunicable disease an urgent development issue
- The economic impact of noncommunicable diseases, such as cardiovascular disease and diabetes, places a significant burden on the development prospects for low-income and middle-income countries
- Approximately 1.3 million people die from road traffic injuries; 90% of these deaths occur in developing countries
- Rapid urbanization has a multiplier effect on many dimensions of existing disease and illness, and is introducing new health hazards
- Climate change is an emerging threat to global public health
- In the new millennium, global health decision makers and scientists must look beyond the traditional purview of public health regarding, for example, maternal and child health and communicable diseases.

Priority health issues are always a factor in country health policies that are shaped by global health discussions and initiatives, which in turn are influenced by existing risk factors and the interface with health systems. Priorities change quickly according to

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prevailing concerns and expected future trends, as seen clearly in the reemergence of tuberculosis and malaria as key health problems that have become global and individual country health priorities. Infectious diseases have always had a decisive and rapid impact on shaping and changing health policy with global pandemics such as severe acute respiratory syndrome (SARS) and H1N1, emerging without warning and challenging approved priorities within days if not hours.

However, it is important not to lose sight of other areas of health and to maintain a close and watchful eye on trends and developments in those diseases that do not generate the immediate impact that some infectious diseases have been able to do. Noncommunicable diseases fall into this group; they may not have garnered as much interest or importance over the past 10 or 20 years, but in fact have been affecting public health around the world in a very steady and critical way, becoming the leading cause of death in both developed and developing countries.¹

This article discusses emergent issues in global health related to noncommunicable diseases and conditions. Trying to offer an in-depth discussion on such a wide range of issues in just one article is clearly not possible, and therefore focus and emphasis is given to defining the unique epidemiologic features and relevant programmatic, health systems, and policy responses concerning noncommunicable chronic diseases (NCDs), mental health, accidents and injuries, urbanization, climate change, and disaster preparedness.

NONCOMMUNICABLE CHRONIC DISEASES

In the shadow of global efforts to achieve the Millennium Development Goals (MDGs), by far the largest killer on the planet has continued to advance in low-income and middle-income countries. NCDs cause 60% of all global deaths but receive just 2.3% of international development assistance for health. Approximately 80% of deaths caused by NCDs occur in developing countries, generally in a younger population than those in high-income countries.^{1,2} Over the next 10 years, the World Health Organization (WHO) predicts that NCD deaths will increase by 17% globally with the greatest increases in the African (27%) and the Eastern Mediterranean (25%) regions. In terms of the highest absolute number of deaths, the Western Pacific and South-East Asia are projected to lead the field.³

Noncommunicable diseases are a group of illnesses and include those conditions that have been identified as the leading causes of death around the world: heart disease, stroke, cancer, chronic respiratory diseases, and diabetes. These diseases are characterized by their long latency period often influenced by exposure to risk factors for extended periods over a patient's lifetime. The situation becomes more acute with the addition of the word "chronic," indicating that these diseases are mostly incurable and the duration of treatment may cover decades of a person's life.

Cardiovascular disease (mainly heart disease and stroke) is the biggest killer worldwide, contributing to 30% of global deaths each year.¹ The importance of such a high figure can be seen in the 47 countries that make up Latin America and the Caribbean, where cardiovascular disease alone accounts for 35% of the total mortality burden while AIDS, tuberculosis, malaria, and all other infectious diseases combined are responsible for only 10% of that burden.⁴ Globally, chronic disease deaths have been predicted to increase by 17% between 2005 and 2015.¹ Although research on multimorbidity has been based primarily on high-income countries, experts estimate that around 50% of the population living with chronic disease may actually be living with multiple chronic conditions.⁵

Sometimes erroneously referred to as "lifestyle diseases," NCDs are affected by a variety of risk factors that are often outside the control of the individual. There is

very little that can be done about some risk factors, such as age and genetic inheritance, and increasing evidence suggests that what happens before a person is born and during early childhood plays a key role in the onset of adult chronic disease, demonstrated by the proven association between low birth weight and increased rates of high blood pressure, heart disease, stroke, and diabetes.⁶

However, the most common chronic diseases share some of the same highly preventable or avoidable risk factors including physical inactivity, tobacco use, and obesity, leading researchers to study mortality for NCDs by risk factor. The WHO estimates that each year approximately 4.9 million people die from tobacco use, 2.6 million from being overweight or obese, 4.4 million as a result of raised cholesterol levels, and 7.1 million as a result of raised blood pressure.¹ Raised cholesterol and raised blood pressure (hypertension) are particularly dangerous risk factors because they can exist in an individual for a long time without presenting any obvious symptoms.

In its seminal book *Preventing Chronic Disease: A Vital Investment*, the WHO presents what it defines as effective and feasible interventions to reduce the threat of NCDs, with low-income and middle-income countries being specifically targeted.¹ The WHO seeks ideally to reduce the burden of NCD mortality by 2% per year through the implementation of the WHO Framework Convention on Tobacco Control (FCTC), which was the first global treaty negotiated by the WHO in 2003. As of 2010 it had been signed by 168 nations, although stages of ratification vary. The FCTC contains guidelines for implementing demand-reducing policies toward tobacco including health policies aimed at protecting the public with respect to commercial and other vested interests of the tobacco industry, protection from exposure to tobacco smoke, packaging and labeling of tobacco products; and limits or bans on tobacco advertising, promotion, and sponsorship.⁷ Tax increases for tobacco control are considered to be clinically effective and very cost-effective relative to other health interventions,⁸ while the implementation of smoking bans in public areas appears to reduce the risk of heart attacks significantly, particularly among younger individuals and nonsmokers, according to a study published in the *Journal of the American College of Cardiology* (September 29, 2009 issue). Researchers reported that smoking bans can reduce the number of heart attacks by as much as 26% per year.^{9,10}

Policy level programs are also being discussed for reducing salt and sugared beverages^{11,12} in the diet, consumer products, and food outlets. The WHO report also encourages screening for which there are clear public health benefits and cost benefit, and in situations in which the ability to treat the condition (such as raised blood pressure and cervical cancer) exists.¹ However, at present the quality and quantity of research investigating the actual benefits of different intervention programs to prevent noncommunicable diseases in developing countries is sparse and exists primarily as case studies.^{1,11}

Low-income and middle-income countries have developed their health provision and policies according to a primary care or Alma Ata model, focused on meeting the needs of pregnant women and children younger than 5 years, and developing services for a variety of high-impact communicable diseases such as human immunodeficiency virus (HIV)/AIDS, tuberculosis, and malaria. The health systems in these countries are unprepared to deal with risk-factor education and behavior modification for the prevention, diagnosis, and treatment of NCDs, or the long-term management of these conditions. Despite growing interest among the population and health system leadership, one high-ranking health official pointed out that

Currently, donor countries are operating a policy ban on funding NCDs, thereby starving low-income governments of the financial and technical assistance needed to turn around the NCD epidemic. This policy has to change, with overseas development assistance aligned to the priorities of recipient countries.³

This situation continues to be an issue for developing countries despite numerous calls for action in the area of NCDs and funding.^{4,11,13–15} Furthermore, there is a clear inequity inherent in noncommunicable diseases, as the poor and less educated are more likely to be exposed to several preventable risk factors including tobacco use, high-fat and energy-dense food consumption, physical inactivity, and obesity.¹⁶

There is no denying that noncommunicable diseases are linked to economic loss, and the WHO highlighted this in 2005, predicting that national income loss due to heart disease, stroke, and diabetes for China, India, and the United Kingdom are expected to be \$558 billion, \$237 billion, and \$33 billion, respectively, with part of the losses being the result of reduced economic productivity.¹

The Global Burden of Disease (GBD) project began in 1990 and since then chronic diseases have exceeded the burden of infectious diseases.¹⁷ Despite this, the international community has yet to display a sense of urgency toward reducing NCDs or supporting NCD-focused interventions in developing countries, even though they are threatening development and economic progress.³ Perhaps the situation will change in the near future with the participation of United Nations (UN) member states in a high-level summit on noncommunicable diseases scheduled to take place in New York in September 2011.

Although nothing can be guaranteed, similar UN summits have provided the catalyst for change, as seen following the summit on HIV/AIDS in 2001 that resulted in significant funding and political commitment to a coordinated action plan.³

MENTAL HEALTH

Since 1946, the WHO has defined health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”¹⁸ However, mental illness and related conditions have never received the same importance or consideration as other areas of health despite their enormous burden on the population. This fact is exemplified by the routine exclusion of mental health services from Primary Health Care (PHC) and the absence of any mental health–related objectives in the MDGs.^{19,20}

Mental illnesses, including behavioral, neurologic, and substance use disorders, affect a significant number of the world’s population. In 2002, the WHO estimated that globally 154 million people suffered from depression, 25 million from schizophrenia, and 15 million from substance use disorders, with around 877,000 people committing suicide every year.²¹ In the same year, unipolar depressive disorders were ranked as fourth in terms of burden of disease,²² well on the way to prove the 1990 prediction of the GBD analysis that estimated mental illness, specifically unipolar major depression, would become the second leading cause of burden of disease by 2020, second only to ischemic heart disease.¹⁷

Studies in PHC settings in Turkey, the United Arab Emirates, France, Vietnam, and Zimbabwe revealed that the prevalence of mental illness ranges between 10% and 60% among adults,^{23–30} with depression being the most common ranging from 5% to 20%, followed by generalized anxiety disorders (4%–15%) and dependency on addictive substances (5%–15%).^{31–33}

Children are not immune to mental health problems, with those aged between 6 and 14 years exhibiting a prevalence of mental illness of between 20% and 30%,^{34,35} the most common diagnoses being anxiety disorders, major depression, behavioral disorders, and attention-deficit/hyperactivity disorder.^{28,35} Mental illness has an effect on other family members, which is seen clearly in a study looking at growth rates of children with mothers suffering from mental illness. The study showed that 20% of these

children suffered from stunted growth, which could have been averted if interventions to treat the maternal depression had been performed.^{28,35}

Individuals suffering from severe form of depression are at increased risk of attempting suicide,³⁶ as are women who experience abuse.³⁷ Meanwhile, the prevalence of mental health problems among elderly people is 33%, the majority of whom suffer from depression.^{38,39}

Cost-effective treatment for most mental illnesses exists and, if correctly applied, most patients become functioning members of society, leading normal lives even in low-resource areas, and suicide risk is reduced.⁴⁰

Of interest, poverty indicators are related to mental disorders^{41–44} with low education level being the most influential determinant.⁴⁵ Extrapolating these data, it is feasible to suggest that developing countries with low education levels will tend to have a higher proportion of the population suffering from mental health problems. Despite this, however, most low-income and middle-income countries spend less than 1% of their health expenditure on mental health. Explicit mental health policy, legislation, mental health treatment facilities, and community care are all lacking.²¹

ACCIDENTS AND INJURIES

Injuries as a global health issue include many types that are routinely reported to and published by the WHO, such as poisoning, falls, drowning, burns, and intentional injuries including interpersonal violence such as elderly, partner, or child abuse, and collective violence such as war. However, two of the most important injuries that contribute to high global death rates are road traffic accidents and occupational injuries. In 2005, an estimated 9% of all global deaths were the result of an injury.⁴⁶ Injuries not only affect morbidity and mortality rates but also have a tremendous effect on the individual, the family, and the community. **Box 1** presents the scope of injuries and their importance as a national health issue.

Road Traffic Accidents

It is predicted that by 2030, road traffic injuries will be the fifth leading cause of death.⁴⁷ Already, approximately 1.3 million people die due to road traffic accidents each year, and an additional 20 to 50 million are injured or disabled.⁴⁷ Despite being home to fewer than 50% of the world's motor vehicles, low-income and middle-income countries have 90% of the mortality burden for road traffic accidents.⁴⁷ One

Box 1

Childhood injuries in Bangladesh

Injuries prove to be the largest killer of children between 1 and 17 years of age, accounting for 38% of all classifiable deaths. This means that 83 children per day die of injuries or 3 children per hour. The leading cause of injury-related deaths among children is drowning (59.3%) followed by road traffic accidents (12.3%), animal bites (9.3%), and suicide (8.0%). It is estimated that injuries permanently disable around 13,000 children per year in Bangladesh. Nonfatal injuries occur in approximately 1 million children per year or 2 per minute (Institute of Child and Mother Health, 2005). When injury-related deaths are broken down by type and by age group, children aged 1–4 and 5–9 years are most likely to die from drowning with a mortality rate of 86 per 100,000 and 26 per 100,000 child deaths, respectively. In the 10–14-year age group, road traffic accidents account for 8 per 100,000 child deaths, and in the 15–17-year age group, suicide accounts for 24 per 100,000 child deaths.

of the most important reasons for this apparent discrepancy is the high number of vulnerable road users in developing countries. Vulnerable road users include pedestrians, cyclists, and both the rider and passenger of motorcycles and scooters. Vulnerable road users account for 46% of deaths, and in low-income countries pedestrians account for nearly half of all road accident-related deaths.⁴⁸

There are proven interventions that can lead to a reduction in the amount of road traffic deaths and injuries. Such measures include controlling or reducing the speed of traffic with speed bumps or low-speed zones in urban areas, establishing and enforcing blood alcohol concentration limits, enforcing the use of helmets for both riders and passengers on motorcycles, and enforcing the use of seat belts, infant seats, and child booster seats.⁴⁷ The wearing of seatbelts in automobiles can reduce front-seat passenger deaths by 40% to 65% and rear-seat passenger deaths by 25% to 75%; however, only 57% of countries require the wearing of seat belts by all passengers.⁴⁷ The problem is that because of the high numbers of both people and different types of vehicles in developing countries and the lack of resources to police traffic effectively, traffic laws are not easily enforced, despite evidence showing the benefit of specific interventions in the reduction of traffic-related morbidity and mortality.⁴⁹

Occupational Injuries

Occupational injuries are a significant problem in global public health, contributing to between 312,000 and 334,000 deaths worldwide each year. With great shifts in industrialization from the developed to the developing countries, it is logical that the highest number of occupational injuries is shifting in the same way toward the developing world. However, it is very likely that published figures are underestimated, with numbers probably being 10% below the actual figure for the United States and as much as 85% for some locations such as rural Africa.^{50,51} Although several factors come into play when analyzing the causes of underreporting in developing countries, one of the main reasons is the lack of adequate data.⁵²

Determining the actual prevalence of occupational injury is critical for several reasons: (1) to provide accurate data to health providers, policy makers, nongovernmental organizations (NGOs), and the public; (2) to provide baseline data against which to measure interventions; (3) to aid priority setting and targeting for policy change and interventions; and (4) to estimate societal costs of rising occupational injuries. Tools to capture occupational injury have been designed and widely circulated by the UN's specialized agency, the International Labour Organization. However, field testing of the tools has been limited to small-scale surveys in diverse settings such as Vietnam, Ghana, and Bangladesh,^{53–56} and larger, nationally representative studies are needed.

In many developing countries, there is a lack of policy for or enforcement of safe working environments, which naturally means that wood cutting, mining, agriculture, construction, and manufacturing are more hazardous than in developed countries. The developed world has accepted that poor working conditions and practices are unacceptable and has legislated against them, leading to a reduction in occupational injuries over the past century. However, it seems that globally the same care has not been forthcoming, and developing countries have taken on the burden of heavy industry and poor working conditions that generate increases in occupational injuries. This trend is perfectly exemplified by the phrase "export of hazard" to describe when an outdated and dangerous technology is relocated from a high-income country to a developing country, despite the knowledge that the risk of injury with this technology is high.⁵⁷

Cost of production plays a key role in maintaining poor working conditions, and many industries in developing countries manage cost control through the use of manual labor, which is cheaper than the infrastructure and equipment needed to upgrade a process that produces the same amount of product at a much safer level. Manual labor is particularly exploited in the construction industry in developing countries, which have a disproportionate number of deaths from workers falling and injuries from falling objects. Working conditions at all levels of commerce are also full of risk factors to health, from the lack of ergonomically designed offices to avoid back injuries and repetitive stress disorders, to building materials used in construction, which may offer a long-term risk of health problems. The latter is of particular concern in many low-income and middle-income countries, with construction still making use of asbestos despite the documented links to lung cancer.^{58,59}

URBANIZATION

Urbanization is a major public health challenge for the twenty-first century, with significant changes in our living standards, lifestyles, social behavior, and health. Previously more of a phenomenon in developed countries; it is now taking hold and being seen at a greater level in developing countries.⁶⁰ The United Nations Population Fund (UNFPA) predicts that over the next 2 to 3 decades, almost all the world's population growth will be in urban areas in developing countries.⁶¹ WHO figures for the period 1995 to 2005 already show an alarming increase in urban population growth, with developing countries' urban areas growing at an average of 1.2 million people per week or around 165,000 people every day.⁶⁰

While urban settings offer many opportunities including access to better health care, they can affect existing health risks and introduce new health hazards. The living and working conditions of those living in rapidly expanding and poorly planned urban areas often experience risks to health in some of the most basic areas such as unsafe drinking water, unsanitary conditions, poor housing, overcrowding, hazardous locations, and exposure to extremes of temperature. These increases in health risks are particularly critical for those most vulnerable: children younger than 5 years, infants, and the elderly.^{60,62}

The rapid growth of urban settlements is often due to poor economic performance of the area in question and lack of urban planning and regulation, which has resulted in an increase in the number and size of informal settlements or slums in many cities. It is estimated that in the developing regions, more than 70% of urban residents live in slums.⁶¹

The Urban Health Situation

The current pattern of urban growth is expected to have a multiplier effect on many dimensions of illness and disease. Child mortality is already high in the urban areas of developing regions. In Nairobi, where 60% of the city's population lives in slums, child mortality in these slums is 2.5 times greater than in other areas of the city.⁶³ Evidence from various surveys and studies points to a heavier burden of diseases such as diarrheal diseases, acute respiratory diseases, malnutrition among children, HIV/AIDS, tuberculosis, malaria, diabetes, and obesity on the urban poor.^{60,61,64}

Migration, increased mobility, changes in the ecology of urban environment, high population density, poor housing, and poor provision of basic services all act as pathways for emerging and reemerging communicable diseases.^{61,62} The consequence of these changes is evident in the spread of multidrug-resistant strains of tuberculosis that is placing the urban poor of India, Indonesia, Myanmar, and Nepal at a higher

risk. Vector-borne diseases such as dengue and malaria are also increasing in many urban areas, due to migration, climate change, stagnant water, insufficient drainage, flooding, and improper disposal of solid waste.^{61,62}

Unhealthy lifestyles characterized by unhealthy nutrition, reduced physical activity, and tobacco consumption due to rapid and unplanned urbanization are associated with common modifiable risk factors for chronic diseases such as hypertension, diabetes mellitus, and obesity.⁶⁰ Urban environments tend to discourage physical activity and promote unhealthy food consumption. Overcrowding, heavy use of motorized transport, poor air quality, and lack of safe public spaces are some urban factors that restrict participation in physical activities. In the larger populated cities of Asia obesity is becoming a significant problem, and the rapid transition of diets in developing countries is typified by the coexistence of child malnutrition and maternal obesity in the same household. One of the main factors identified as causing an increase in diabetes worldwide is the change in traditional diets caused by urbanization.⁶⁵

Urbanization is exacerbating the health risks in terms of traffic accidents, injuries on the street or in the home, and mental health problems. The changes in climate and rising sea levels work toward increasing urbanization, with 600 million people living in the low-elevation coastal zones being at heightened risk of flooding, which will lead to migration to higher elevations and larger cities.⁶¹

Adopting preventive measures to control communicable diseases, upgrading the infrastructure of existing health facilities, increasing human resource capacity, and taking appropriate measures for providing equitable health services to all, especially the most vulnerable groups, are vital for improving urban health. Recently, the WHO identified 5 key areas of action for improving urban health:

1. Promote urban planning for healthy behaviors and safety
2. Improve urban living conditions, including access to adequate shelter and sanitation for all
3. Involve communities in local decision making
4. Ensure cities are accessible and age-friendly
5. Make urban areas resilient to emergencies and disasters.⁶⁰

However, these actions will only be effective if there is strong collaboration between health authorities, urban planning agencies, environmental agencies, energy providers, and the transportation systems.

CLIMATE CHANGE

Climate change is an emerging threat to global public health. It is now widely accepted that climate change is occurring as a result of emission of greenhouse gases, especially from fossil-fuel combustion.⁶⁶ Climate change is predicted to affect many natural systems and habitats, for example, increasing the frequency and intensity of heat waves, increasing the number of floods and droughts, altering the geographic range and seasonality of certain infectious diseases, and disturbing food-producing ecosystems,⁶⁷ which in turn will affect human health both directly and indirectly. Direct health effects include changes in mortality and morbidity, and changes in respiratory diseases from heat waves. In terms of indirect health effects, these are much more extensive and include changes in the distribution of vector-borne diseases, the nutritional and health consequences of regional changes in agricultural productivity, and the various consequences of rising sea levels, flooding, and droughts.^{66–68}

Climate change is highly inequitable, and the paradox is that those at greatest risk are the poorest populations in developing countries who have contributed least to

greenhouse gas emissions. However, the rapid economic development and concurrent pollution means that developing countries are now vulnerable to adverse health effects from climate change and, simultaneously, are becoming an increasing contributor to the problem.^{67,69}

Although the effects of climate change affect all levels and ages of any single population, the elderly and those with preexisting medical conditions are seen as being the most vulnerable. Conversely, major diseases that are most sensitive to climate change such as diarrhea, malaria, and infection associated with malnutrition are most serious in children living in poverty, making them highly vulnerable to the resulting disease burden.⁶⁷

Heat waves are expected to increase the occurrence of heat-related illnesses such as heat exhaustion and heat stroke, and aggravate existing conditions related to circulatory, respiratory, and nervous system problems, especially among the elderly.^{67,68} In 2003, a major heat wave affected most of Western Europe and caused 2000 additional deaths in England and Wales.⁶⁸ Another consequence of high temperatures is that they raise the levels of ozone and other air pollutants, which in turn aggravate respiratory diseases such as asthma.

Meanwhile, health impacts due to natural disasters, such as floods, droughts, and storms, range from immediate effects that include physical injury, mortality and morbidity, and communicable diseases, to possible long-term effects such as malnutrition and mental health disorders. From 1992 to 2001, flooding was the most frequent natural disaster (43%), killing almost 100,000 people and affecting over 1.2 billion people worldwide.⁷⁰ Droughts increase the risk of food shortages and malnutrition, and increase the risk of diseases spread by contaminated food and water, because viral load increases in water sources when levels drop dramatically.

Rising temperatures, irregular rainfall patterns, and increasing humidity affect the transmission of many vector-borne and water-borne diseases such as malaria, dengue, cholera, and other diarrheal diseases. Vector-borne diseases currently kill approximately 1.1 million people each year while 2.2 million die from diarrheal diseases.⁷¹ Studies suggest that by 2030, climate change may put 170 million people in Africa at risk of malaria,^{67,72} and by the 2080s the global population at risk of dengue is likely to increase to 2 billion.^{67,73} Recent published data provides evidence of an association between the El Niño and La Niña phenomena, which are major determinants of global weather patterns, and some infectious diseases. Evidence shows that there is an association between El Niño and malaria epidemics in parts of South Asia and South America, and with cholera in coastal areas of Bangladesh.^{68,74} Studies of malaria have already revealed the health impacts of climate variability associated with El Niño, including large epidemics on the Indian subcontinent, Colombia, Venezuela, and Uganda.⁷⁵

One of the most immediate problems related to changes in climate and climate patterns is that on food production and availability. Each year approximately 3.5 million people, mostly children from developing countries, die from malnutrition and related diseases. It is projected that climate change will decrease agricultural production in many tropical developing regions, thus putting tens of millions more people at risk of food insecurity and adverse health consequences of malnutrition.⁶⁷ Disasters in certain areas of high food production will also affect global prices, thereby affecting not only those people living in the affected region but others around the world who depend on food produced from that region.

The WHO GBD study in 1990 indicated that the climatic changes that have occurred since the mid-1970s would be having an effect by the year 2000, with 150,000 deaths (0.3% deaths globally each year) and 5.5 million lost disability-adjusted life years

(DALYs) per year (0.4% global DALYs lost per year). The estimated effects are predicted to be most severe in those regions that already have the greatest disease burden of climate-sensitive health outcomes, such as malnutrition, diarrhea, and malaria.^{17,67,71}

Many of the projected impacts on health are avoidable, and public health policy makers need to act to reduce or negate the impact caused by climate change through a combination of short-term public health interventions that aim to adapt measures in health-related sectors, such as agriculture and water management, and long-term strategy. The most effective responses are likely to be strengthening of the key functions of environmental management, surveillance and response to protect health from natural disasters and changes in infectious disease patterns, and strengthening of the existing public health systems.^{67,68} However, countries need to assess their main health vulnerabilities and prioritize adoptive action accordingly, keeping in mind the costs involved.

COMPLEX DISASTER PREPAREDNESS AND RESPONSE

Natural disasters know no boundaries, and any nation or population can be subject to a catastrophic disaster at any time. However, some nations and populations are more at risk of disasters than others due to geographic location, poverty, and several socio-political factors. This issue of disaster risk reduction (DRR) rose to global prominence in the aftermath of the tsunami in the Indian Ocean in December 2004.

Following a disaster, some populations suffer more acutely than others. It is worth considering the complex issues of how societies organize themselves in terms of risk and actual prevention and care, for access to clean water and sanitation, and how they communicate and initiate behavioral change among the displaced or fragile populations. At the forefront of most discussions when planning post-disaster management and action is the priority placed on certain elements of disaster relief, such as the building of embankments, the distance to clean water, or the time from incident to response. Recent examples of varying responses and outcomes were seen following the two cyclones in South Asia. There was a relative success in Bangladesh in terms of lives saved and response coordination after Cyclone Sidr in November 2007, compared with the devastating loss of more than 100,000 lives after Cyclone Nargis in Myanmar in May 2008, not to mention the loss of draft animals and dykes, and the flooding of fields during planting season.⁷⁶ Bangladesh reverted to its well-developed program for DRR that includes national-level coordination, whereas in Myanmar there was no national platform for disaster preparedness, and delays occurred in the coordination of international response to the disaster. In addition to the immediate and obvious impact of natural disasters, conditions often worsen in poorly coordinated settings, as evidenced in 2010 when *Vibrio cholerae* emerged in post-flood Pakistan, and for the first time since the 1960s in post-earthquake Haiti.⁷⁷

In general, there are 7 factors that can turn a natural disaster into a complex disaster regardless of the severity or magnitude of the initiating event such as a hurricane, earthquake, or tsunami. According to the UN Department of Humanitarian Affairs, the 7 factors are: poverty, ungoverned population growth, rapid urbanization and migration, transitional cultural practices, environmental degradation, lack of awareness and information, and war and civil strife.⁷⁸

Poverty is by far the single greatest factor that contributes to the vulnerability of a population to complex disasters. In addition to lacking financial resources to prepare for or recover from a disaster, impoverished people are also more likely to have low levels of education and low amounts of political influence to properly deal with

a disaster situation. In addition to increases in birth rates, rapid population growth can be the consequence of urbanization or migration. Population growth without limits produces a population that is more likely to settle in areas that are unsuitable or at risk for natural disasters, meaning that more people are at risk of disease and, most importantly, are more likely to undergo civil strife while competing for scarce resources.

As mentioned previously, rapid urbanization and migration lead to impoverishment. Former rural populations make themselves more vulnerable to disaster by settling in less developed or high-risk city environs, often leading to homelessness or living in urban slums that have circumvented any planning controls or regulations. Such populations therefore are made more vulnerable to floods, landslides, and the destruction of their dwelling during a hurricane or earthquake.

Transition of cultural, economic, or government practices such as the increase in migration from rural to urban areas, economic advancements, families moving away from traditional support networks and to unfamiliar surroundings, and the shift from an agrarian to an industrialized society leave certain societies vulnerable to natural disasters.

Environmental degradation can play a role by either causing or exacerbating a disaster. For example, deforestation can work in two ways: firstly enabling runoff or secondly, making landscapes vulnerable to storms, due to lack of natural wind breaks. Everyone is aware of the natural conditions that provoke droughts, but through the construction of dams, unchecked urbanization, implementation of poor cropping patterns, and the depletion of water supplies, man-made droughts are becoming more widespread.

It is clearly of utmost importance to ensure that populations are informed about what to do to prepare in advance of a natural disaster such as a hurricane, and also are able to fend for themselves following the event. A lack of awareness and the dissemination of accurate information is a major factor that can turn one disaster into a multiple or complex disaster involving, for example, subsequent outbreaks of cholera, malnutrition, and physical injury.

War and civil strife are extreme events that can both produce disasters or be caused by disasters, normally as a result of the preceding 6 factors.⁷⁸ The phrase for disasters that specifically strike war-torn populations is Complex Humanitarian Emergencies.⁷⁹

Global efforts to address and capture the importance of disaster risk and poverty have been hampered by a lack of data, especially from Asia, Latin America, and the Caribbean. Empirical evidence linking disaster risk to poverty tends to come from microstudies within one community, making it impossible to generate generalized findings across regions or entire countries.⁸⁰

Prompted by the devastation that followed the tsunami on 26 December, 2004, there was widespread acceptance that an early-warning system should be installed and other actions taken to prevent loss of life where possible. The World Conference on Disaster Reduction was held in Japan in January 2005, and resulted in the creation of the Hyogo Framework for Action 2005-2015 (HFA), which was endorsed by 168 UN member states and urges all countries to make major efforts to reduce their disaster risk by 2015. The HFA outlines the need to increase awareness and understanding about DRR, the importance of knowing the real and potential risks, and taking action against them. Specific recommendations included the need to create or enhance early-warning systems, build DRR into education, and reduce risk factors such as deforestation, unstable housing, and the location of communities in risk-prone areas.

Although different areas of the planet experience different risks, the one common factor is that DRR “concerns everyone, from villagers to heads of state, from bankers

and lawyers to farmers and foresters, from meteorologists to media chiefs.”⁸¹ To support common needs within regions, associations and networks have been established to support DRR, such as the South Asian SAARC Disaster Management Center and the Caribbean Disaster Emergency Response Agency.

Types of activities that can feature in a national or regional DRR program can include: establishing early-warning systems; using local knowledge of events; building an awareness of risk and risk preparedness through community activities; building flood-resistant buildings and safe homes; developing contingency plans; helping communities and individuals develop alternative sources of income; and establishing insurance or microfinance programs to help transfer the risk of loss and provide additional resources to the community.⁸²

SUMMARY

In addition to chronic diseases, mental health problems, injuries, and complex disasters, communities should consider increasing risks from more than 30 new or re-emerging diseases that have appeared since the 1970s: liver disease due to the hepatitis C virus; Lyme disease; food-borne illnesses caused by *Escherichia coli* O157:H7; *Cyclospora*, a water-borne disease caused by *Cryptosporidium*; hantavirus pulmonary syndrome; and human disease caused by the avian H5N1 influenza virus.⁸³ The increasing number of new and reemerging diseases is not the only risk factor that should be added to the planning processes for developing a DRR program. Drug resistance in treating many diseases and illnesses is a major concern, as witnessed in malaria and tuberculosis, and with a highly mobile world population, global pandemics such as SARS, H5N1, and H1N1, for which treatments either are not available or levels of suitable drug are clearly not sufficient for a worldwide epidemic, are proving to be very challenging. This clear inability to predict and maintain sufficient levels of treatment for potential threats makes health risk reduction extremely difficult, and in developing countries where resources are already stretched to cope with existing health issues, creating effective programs will require intervention from social partners, global support organizations, and aid from the developed world. An ever quickening pace of globalization means that public health-related problems in one area of the world will have an impact on those living in another area and therefore, it is in everyone's interest to ensure that all countries, irrespective of their economic development and available resources, are sufficiently supported to maintain and review strategies that will effectively reduce morbidity and mortality rates in all spheres of public health.

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