# Global Megatrend 3:
# Disease burdens and the risk of new pandemics

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## Summary

The world is amid a major shift in health conditions, as the burden of communicable disease continues to fall, while the level and impacts of non-communicable disease (NCD) such as heart diseases, cancer and diabetes rise. These trends are expected to continue in coming decades. In this shift, many developing countries face a 'double burden', as communicable diseases persist while NCDs become more common. At the same time, the risk of new pandemics remains a global concern. Moreover, health conditions vary significantly across the globe and also within countries, with both communicable and non-communicable disease more severe for the disadvantaged: without new initiatives across policy sectors and geographical boundaries, these health inequalities are likely to continue.

A broad range of global trends will influence future global health outcomes, including: economic growth and living conditions; demographic changes including migration and ageing populations; environmental conditions, including air pollution and climate change, as well as access to clean drinking water and exposure to chemicals; and technological developments. Global and national health care actions as well as economic, social and environmental policies can play a significant role in preventing NCDs, combating communicable disease and preparing for future pandemics.

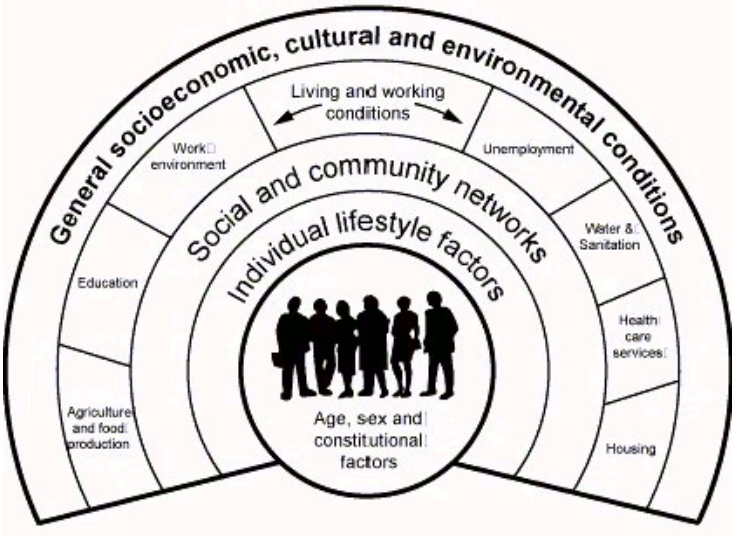
The Millennium Ecosystem Assessment underlined that human health depends on healthy ecosystems, and there are synergies between efforts to address health issues and those to protect the environment, both in Europe and worldwide.

# 1. Introduction

In its Constitution, the World Health Organization (WHO) defines health 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'. Moreover, the Constitution affirms that the 'enjoyment of the highest attainable standard of health' is a fundamental human right (WHO, 1946 and 2005).

A broad range of social, economic, environmental and cultural factors influence human health (see Figure 1 below). These factors are mediated by social and community networks. They affect our health in several ways, including via our lifestyles, and interact with innate factors, such as individual age, sex and genetic makeup.

**Figure 1: Social Determinants of Health**




*Source: Office of Health Economics, UK*

Section 2 of this report focuses on the social, economic, environmental and cultural factors that affect human health. In particular, its review of such drivers looks at how global megatrends are trends changing demography and living and working conditions: these will directly influence global health, as will changes in environmental burdens.

The world's population is now undergoing a major shift in health problems, related to economic development and changes in lifestyle: the burden of disease from non-communicable diseases (NCDs) such as diabetes or stroke has since 2000 outweighed the burden from communicable diseases; NCDs are also the most important cause of death in the world. Figure 2 presents an overview of this shift in terms of the factors influencing human health – it elaborates on the elements noted in the outer circles in Figure 1. Figure 3 then shows the quantitative trends in disease and death from 1990 to 2010.

Despite their ongoing decline, communicable diseases still pose a significant burden, in particular in developing countries, where 94% of all deaths due to communicable diseases occur (WHO 2011b). Moreover, the risk of new pandemics remains a global threat. In addition, major inequalities in health outcomes persist across the countries of the world as well as within them, related to factors including income, education and health care.

Section 3 of this report describes the major health trends for communicable diseases and NCDs, as well as the ongoing risk of pandemics and the persistence of health inequalities. Section 4 then reviews global policy responses to these issues. Health drivers and trends in Europe cannot be separately easily from those at global scale. For this reason, issues for Europe are described in boxes that place them in context of broader global drivers and trends.

**Figure 2: Various human health risks in relation to development and economic growth**

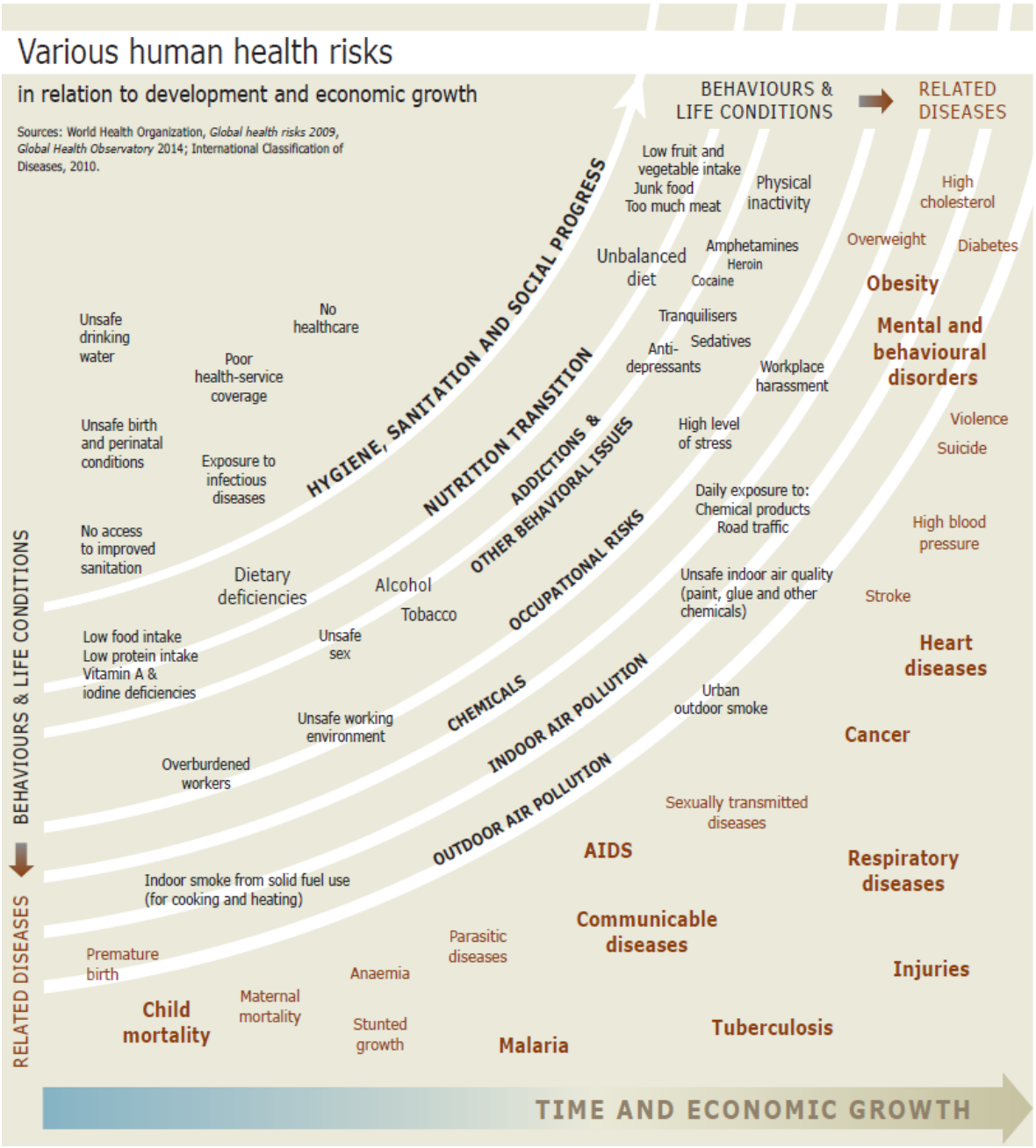
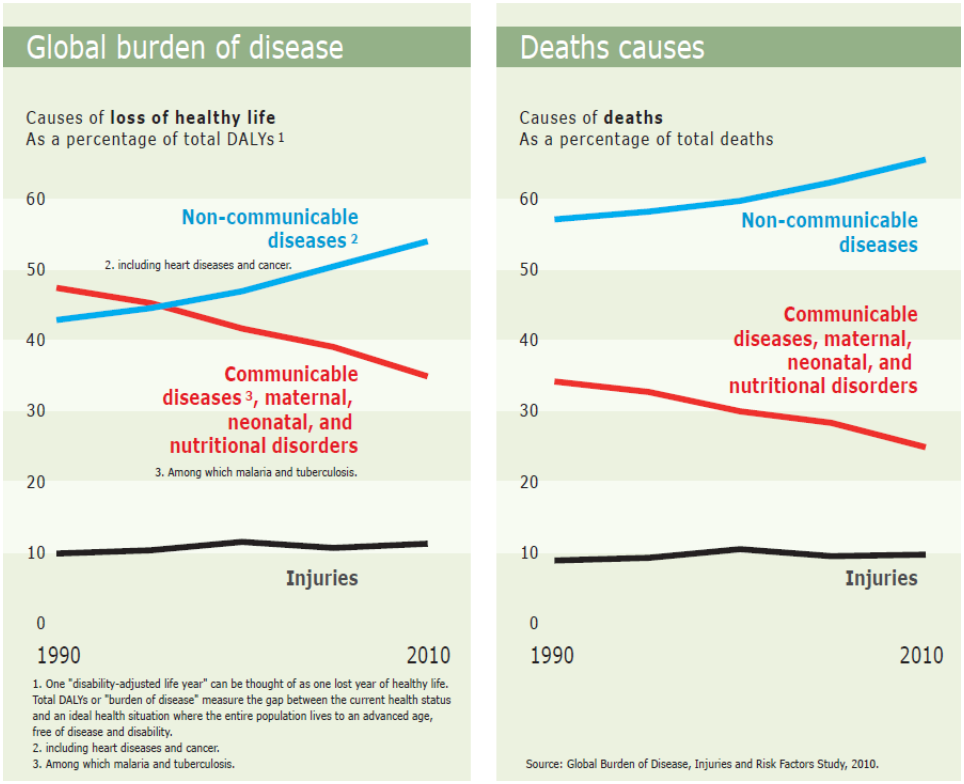


**Figure 3. Trends in the global burden of disease and death from communicable and non-communicable disease and injuries**




## 2. Drivers

This section reviews several factors that are influencing global health trends. Changing economic and social conditions play a key role: these are discussed in section 2.1. Closely tied to these are demographic factors, including changing life expectancies, migration and travel, the topic of section 2.2. Environmental factors are also key drivers for health outcomes; projected changes in air pollution, water quality and climate change are considered in section 2.3. In coming decades, changes in technology, the topic of section 2.4, are expected to play a key role in health care.

### 2.1 Economic growth, urbanisation and changing lifestyles

The coming decades should see ongoing economic growth, in particular in developing countries: current projections suggest that global output will almost triple over the period from 2010 to 2050; in 2050 China and India together will account for almost half of global output. As a result, global poverty is project to fall significantly, as will disparities in average income across countries. Current trends suggest that per capita GDP in China will reach about half of the US level and about two-thirds of the EU level in 2050. These projections are based on recent trends and are uncertain. (See GMT5 for sources and further details on economic growth as a megatrend.)

These trends will affect global health in several important ways. Economic growth will provide resources that can be tapped for health research, health care and improved sanitation. Moreover, economic growth will lift more people out of poverty. This will reduce undernourishment, which has fallen around the world but remains an important concern: The UN reports that the 2001 Millennium Development Goal to halve the share of the world's population facing hunger in 2015 (compared to 1990) is 'within reach' – but is not certain[1].

[1] Source: http://www.un.org/millenniumgoals/poverty.shtml

Economic growth and urbanisation are linked to improving education levels, which in turn are an influence on health outcomes: this is the case in particular for girls' education.

Not all the changes will be positive. WHO has identified four main lifestyle risk factors for non-communicable disease: tobacco consumption, insufficient physical activity, unhealthy diets, and harmful use of alcohol. Wealth and urbanisation can promote lifestyles that exacerbate these risk factors. For example, as people move to service sector jobs and, in cities lacking sustainable transit policies, increasingly travel by private car, their physical inactivity is likely to grow. Growing food consumption will reduce undernourishment but has led to higher levels of obesity. The consumption of alcohol, tobacco and drug consumption are also major concerns (for further information see chapter 3).

***Lifestyles and health: food consumption***

Among the most important lifestyle aspects for health is food consumption. FAO notes that 'Good nutrition is the foundation for human health and well-being, physical and cognitive development, and economic productivity' (FAO, 2013).

According to WHO, about 842 million people worldwide, 12% of the world's population, suffered from undernourishment, in the period 2011-2013 (FAO, IFAD and WFP, 2013).[2] The great majority are found in developing countries, and South Asia and Sub-Saharan Africa are the regions of the world with the greatest number of undernourished people. In nearly all developing countries, the levels of hunger are higher in rural than urban areas (FAO, 2013).

Both the share and the total number of people suffering from undernourishment have been falling in recent years (see Figure 4). This reflects a long-term trend: in 1947, about half of the world's population suffered from undernourishment (FAO, IFAD and WFP, 2013). The UN reports that the 2001 Millennium Development Goal to halve the share of the world's population facing hunger in 2015 (compared to 1990) is 'within reach' – but is not certain[3]. However, the more ambitious target to reduce the total number of hungry people in the world to about 500 million in 2015 (set at the 1996 World Food Summit) will not be met (FAO, 2013).

In addition to undernourishment, an even larger share of the world's population, however, faces deficiencies in micronutrients such as vitamins: FAO estimates about 2 billion people. Among some poor populations, including in developed countries, over-nutrition can coincide with micronutrient deficiency; i.e. deficiency in one or more vitamins and minerals of importance for human health, stemming from inappropriate dietary composition and disease (FAO 2013).

In many cities across the world, there is a move towards 'Western' diets with high levels of fat, sugar, salt and carbohydrate. A key factor is the replacement of small shops and city market sellers by large distribution chains that sell processed foods. Today, many developing countries face a dual nutrition crisis, with ongoing malnutrition together with obesity; some individuals in both developing and developed countries consume too many calories but lack key micro-nutrients. In coming decades, malnutrition is forecast to continue falling, while obesity is projected to grow.

The trends are of course as varied as the cities across the world. Many poor residents, in particular in slum areas, struggle to afford sufficient food and suffer malnutrition. In high-income countries, wealthier inhabitants now increasingly seek out high-quality, often organic foods (Dixon et al, 2007). In contrast, poor neighbourhoods in the United States and other high-income countries often lack stores that sell healthy food, including good quality fruit and vegetables: a study in Baltimore for example, found such 'food deserts' in low-income parts of the city, whose residents also had high levels of diabetes, obesity and hypertension (JHU, 2010).

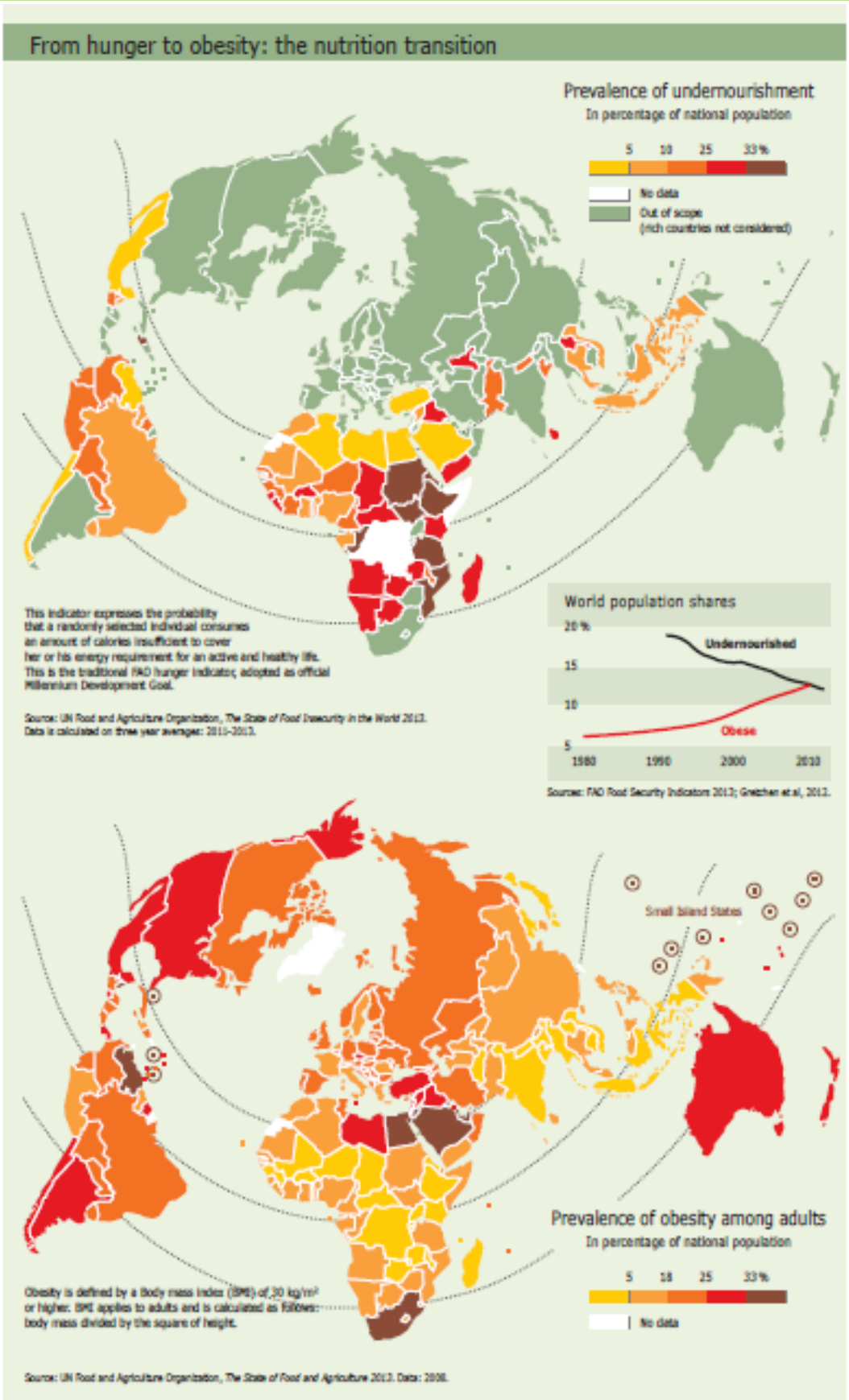
Food consumption will also change: while growing personal income will help overcome undernourishment, the consumption of meat, sugar and other 'rich' foods is expected to increase. These lifestyle trends are linked to

[2] Undernourishment is defined by FAO as a level of food intake over at least a year insufficient to meet dietary needs, i.e. chronic hunger

[3] Source: http://www.un.org/millenniumgoals/poverty.shtml

the increase in non-communicable disease, described in section 3. They will also change agricultural systems, such as livestock raising, which in turn can will affect human health.

**Figure 4: Current levels of undernourishment**



***Changing agricultural systems: intensive livestock raising***

The growing demand for meat by middle class populations around the world has led to an increase in livestock raising. This in turn creates a series of risks for human health. One of the most important arises due to the potential for intensive cattle and poultry raising to act as an incubator for disease.

Humans share many infectious diseases, including influenza, with other animals: by one estimate, three quarters of human communicable diseases have a zoonotic origin, i.e. are transmitted by another species. Examples include avian influenza (H5N1), severe acute respiratory syndrome (SARS) and Ebola virus (section 2.3 discusses these disease). The most recent influenza pandemic, the H1N1 pandemic in 2009, originated in intensive pig raising. Diseases can be transmitted by human contact with domestic livestock, human contact with wild animals, and also from contact between livestock and wild animals then to humans (Liverani et al, 2013).

In coming decades, intensive livestock raising is expected to increase around the globe to meet the demands of a growing population and, in particular, the world's growing urban middle class (see Figure 5). By one estimate, intensive methods already supply about 70% of the world's poultry and egg supplies. Intensive production is already dominant in developed countries. Many developing countries, where small-scale livestock production has been common, are projected to see a sharp growth in large-scale, intensive livestock raising, often near urban areas.

Intensive livestock raising poses a series of risks for the emergence and spread of zoonotic disease: large numbers of animals are concentrated in confined units can providing 'incubators' for existing and new diseases; most intensive operations use antibiotics against these threats and also to boost production – a practice that can lead to drug resistance; and the transport of large numbers of livestock from industrial systems can spread disease (Liverani et al, 2013).

Antibiotics are used in intensive livestock raising, both against disease and also to boost growth. In the United States, about four times as many antibiotics by mass are consumed by livestock than humans. Consumption remains high in Europe, despite EU legislation to regulate use (see section 4). Farmers use antibiotics to prevent disease in crowded conditions which allow rapid spread of disease; in many parts of the world, they are also used to increase and speed growth. While the high use of antibiotics in intensive livestock raising is an advantage for production, over the long-term it speeds resistance – including resistance for diseases that affect both livestock and humans (Böll and FoEE, 2014).

A major report in the US asserted that 'the present system of producing food animals in the United States is not sustainable and presents an unacceptable level of risk to public health and damage to the environment, as well as unnecessary harm to the animals we raise for food'. Recent tests by the US government found high levels of E. Coli and Salmonella bacteria in retail meat that were resistant to three or more antimicrobial drugs (JHU, 2013).

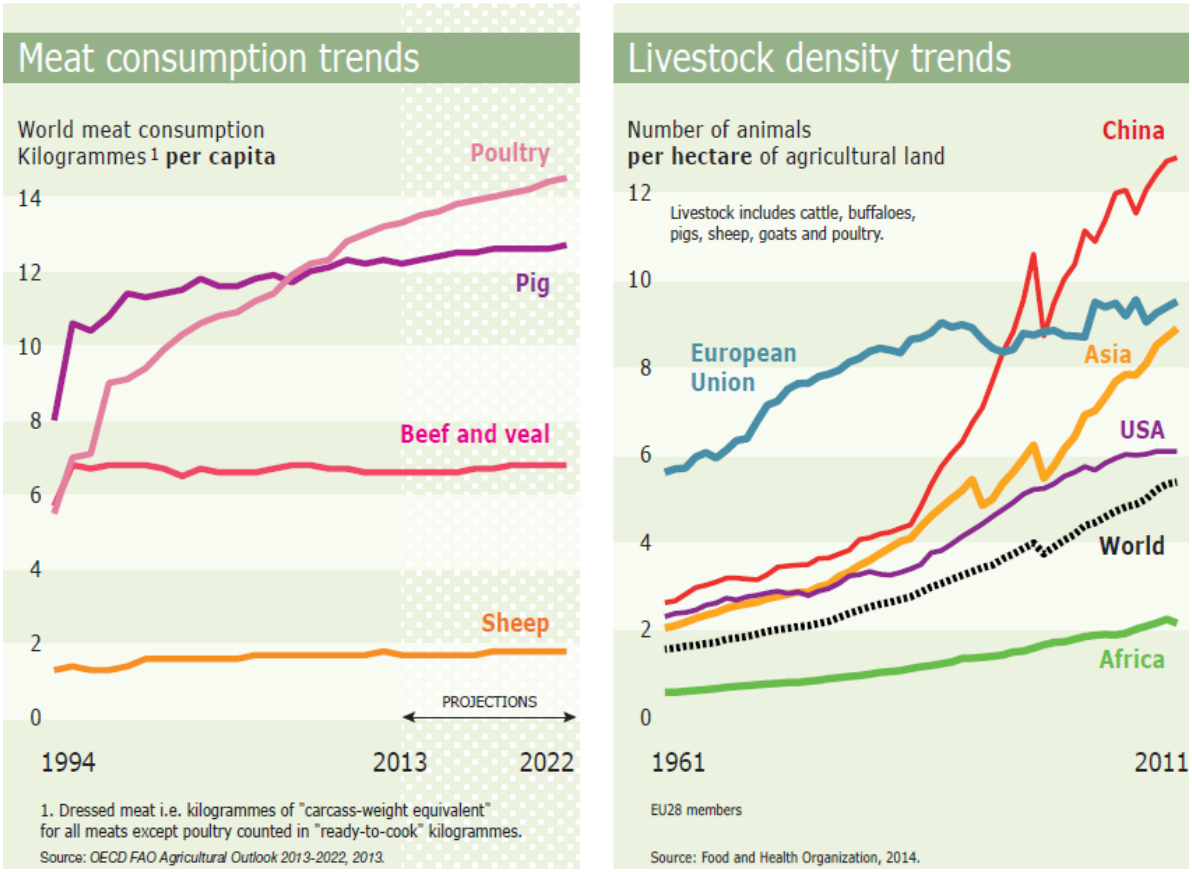
Around the world, however, global meat production is projected to continue rising. Intensive producers are driving out smaller ones, not only in developed but also in developing countries: in China already, intensive production supplies half of the nation's pork. Moreover, global trade in both meat and livestock feed has grown rapidly: poultry imports in Africa, for example, increased by about 60% from 2005 to 2012, as low-priced chicken wings unwanted in developed country markets such as Europe undercut meat from small local producers in Africa. (Böll and FoEE, 2014).

The co-existence of both small-scale, traditional methods and industrial production in developing countries may exacerbate these problems. With habitat destruction, humans and livestock in rural areas may come into greater contact with wildlife. Both internal livestock and food markets within countries as well as international trade may also pose risks of disease. In general, however, the influence of these factors is poorly understood (IOM, 2013b).

In addition to the risks of new human pandemics arising from intensive livestock farming, plant and animal pandemics also remain a major concern: these could affect human health via upheavals to farming and food systems (UK GOS, 2011).

The most important path for animal to human disease transmission is likely to be from livestock to agricultural workers. However, wastes from livestock are also an important concern. Already, according to WHO, the world's poultry generate as much faecal pollution in tonnes as humans; cattle produce four times as much. Livestock faeces pollute water bodies and are a potential source of disease transmission. In most parts of the world, however, drinking water treatment systems have focused on bacteria from human rather than animal sources. With growing livestock raising around the world, their waste will need greater attention (Dufour et al, 2012).

**Figure 5: Meat production, trends and forecast, in million tonnes**




In addressing these problems, the 'one health' perspective that looks at agricultural systems, ecosystems and human health together can provide an approach to address these growing problems (see Box 1).

**Box 1: One Health**

The 'One Health' approach addresses the connections between human health, animal health and the environment, including ecosystem health. The approach is used to identify, analyse and manage health risks arising from human-animal-ecosystem interactions, including risks of infectious disease[4]. This is an important step, as *'...the convergence of people, animals, and our environment has created a new dynamic in which the health of each group is inextricably interconnected.'* (AVMA, 2008)

Activities such as the US One Health Initiative and the One Health Commission have sought to strengthen medical and veterinary collaboration around the world to improve animal and human health; strengthen collaboration with social sciences and with wildlife health experts; improve understanding of cross-species disease transmission; and establish new methods, medicines and partnerships (One Health Initiative, 2008).

[4] http://www.cdc.gov/ONEHEALTH/

***Inequality, poverty and health***

Inequality is a key factor for health and social problems (Ortiz and Cummins, 2011). Around the world, inequality is linked to a range of health determinants, including education, nutrition and access to health care.

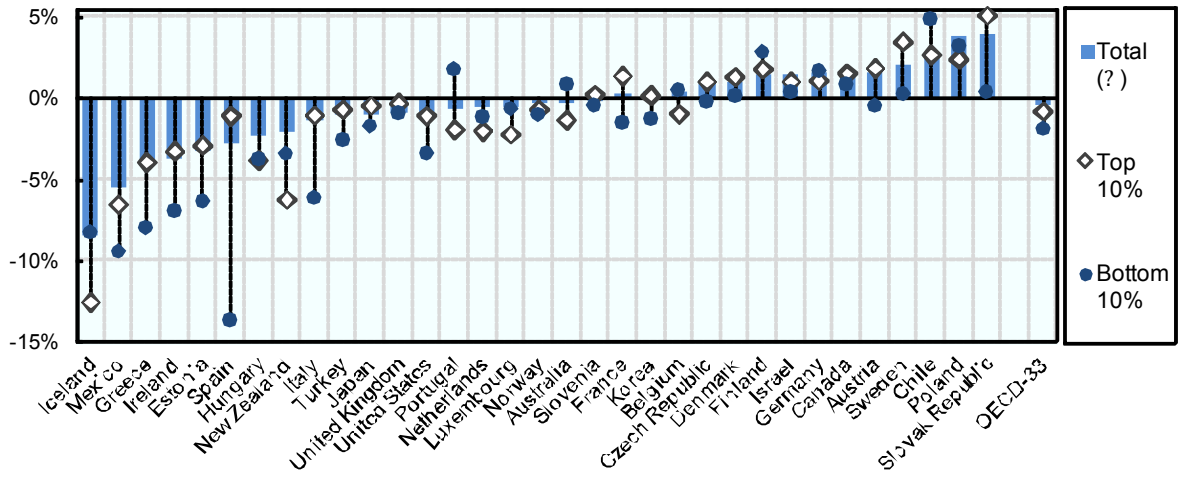
For the world as a whole, the differences between rich and poor are striking. The top one-fifth of the global population enjoyed almost 70% of world income in 2008; in contrast, the bottom one-fifth received only 2%.[5] Global inequality has fallen slightly in recent decades: in 1990, for example, the top one-fifth received about 75% of total income. However, in a longer-term perspective, global inequalities have grown: by one estimate, the world Gini coefficient of income distribution rose about 60% from 1820 to 2002 (Ortiz and Cummins, 2011).

Inequalities within countries also vary significantly, with the highest differences between rich and poor seen in developing countries; at the same time, many developing countries including Thailand, Brazil and Nigeria, saw their income inequalities fall from 2000 to 2008 (Ortiz and Cummins, 2011).

**Box 2. The economic crisis in Europe and other developed countries**

Among developed countries, it appears that inequality has risen since the 1980s. Moreover, the recent economic crisis has disproportionately hit poorer families, despite social transfers that cushion impacts such as rising unemployment (see Figure 6). (OECD, 2013)

**Figure 6: Annual percentage changes in disposable income between 2007-2010, by income group**




*Source: OECD income Distribution Database (www.oecd.org/social/income-distribution-database.htm)*

Of particular concern are those who live in extreme poverty. The UN Millennium Development Goal target in this area – to halve, from 1990 to 2015, the share of people in the world with an income under one US dollar a day – was met by 2010. Over the past few decades, the level of extreme poverty has fallen: notably, the share of developing country residents living below $1.25 a day[6] fell from 47% in 1990 to 22% in 2010. The total number of people living in extreme poverty fell by 700 million. In the least developed countries, however, the improvement has been less rapid: in these countries, many of which are found in Africa, extreme poverty fell from 65% in 1990 to 46% in 2010, and thus still affects almost half of their population (UN, 2013b).

In coming decades, global poverty is expected to continue falling with economic growth, in particular in developing countries. This process, however, is not certain nor smooth, as the recent health crisis has shown.

[5] Based on purchasing power parity exchange rates. Inequality indicators are often based on income; estimates suggest that wealth inequalities – where holdings of financial assets and real estate come into play – are greater than income inequalities (Ortiz and Cummins).

[6] Based on purchasing power parity exchange rates

Around the world, this crisis has hit many low-income households, with direct impacts on their healthcare; moreover, unemployment has driven many middle-income households into lower income groups. A common "coping mechanism" of those impacted by low employment and poverty caused by the jobs crisis is reduced expenditure on healthcare (UNICEF, 2012): *"in a number of developing countries, in particular, households have consistently reported lower healthcare spending and service utilization, which has exposed many people to a higher risk of sickness, disability or even death".* The same report indicates that *"there is also ample evidence that unemployment can cause serious physical and mental impacts. In general, unemployment has been shown to increase susceptibility to physical illness, mental stress and loss of self-esteem, and ultimately lead to severe depression"*.

The economic crisis has hit young people especially hard. After 2008, youth unemployment rose around the world; despite a small decrease in 2011, global youth unemployment stood at 12.6% in 2013. In the EU and other developed economies, youth unemployment rose by one-quarter from 2008 to 2012. In Greece and Spain, youth unemployment exceeded 50% in 2013. The lack of jobs has even broader impacts, as about as many others are estimated to not be looking. A further one-quarter of young people around the world have very low-paying and precarious jobs. The effects can be long lasting, as unemployment in early years can affect earnings and health up to two decades later. (ILO, 2013)

A further problem is that great numbers of young people are entering job markets – an estimated 120 million a year – as many developing countries experience a 'youth bulge'. In the longer term, there is a concern that economic growth around the world is creating fewer stable jobs for skilled workers; in areas of job growth, such as in information and other technology sectors, many young people face a mismatch with the skills acquired through traditional education (WEF, 2014). If these trends persist, economic inequalities within and also possibly across countries could widen.

More information on health inequalities can be found in section 3.4.

***Urban development and slums***

A closely related trend is the growth in cities, in particular in developing countries. Already by 2010, more than half of the world population lived in urban areas; this share is expected to grow to two-thirds by 2050. Asia and Africa will account for most of the increase: the UN estimates that by 2050, almost 80% of China's population will live in cities.

Urban areas concentrate economic and social opportunities, including better education and higher-paid jobs. Health care opportunities are often better in urban areas. Moreover, good provision of health care for all residents is one of the factors supporting urban prosperity and growth prospects, 'Cities with healthier, better-educated workforces are more likely to be productive and competitive' (UN Habitat, 2013).

The world's fast-growing cities can also concentrate health risks. These include air and noise pollution. Urban lifestyles bring stress and sedentary habits that contribute to non-communicable disease such as stroke and diabetes. The concentration of human inhabitants in cities can spread communicable disease quickly; so can the many animals found in cities – which can include mosquitoes, chickens raised for food and animals that thrive in urban systems such as rats. Traffic and other urban infrastructure bring higher risks for injuries.

In many countries, health inequalities are high in urban areas, which bring together the very rich and the very poor. The health of urban residents varies sharply by income, as the wealthy have access to better food, health and living areas. Many cities in developing countries are growing faster than governments can provide sanitation or health services: the poor in particular suffer from the lack of these services (WHO, 2010c).

Urban health problems are most acute in slum areas. UN Habitat describes a slum as a 'heavily populated urban area characterised by substandard housing and squalor'. Key characteristics include poor access to sanitation and safe drinking water, overcrowding, insecure residence and poor housing structures (UN Habitat, 2013). Slum conditions vary greatly across the world. Poor housing can range from high-rise tenement buildings to shacks to makeshift quarters alongside roads. Many slums are found on steep hillsides subject to landslides, along rivers and other areas subject to flooding or close to industrial areas, exposing their residents to a range of health risks.

In 2012, an estimated 863 million people lived in slum conditions – of which more than 90% in developing countries. In sub-Saharan Africa, 62% of urban residents lived in slum conditions in 2012. The share of slum population in developing cities, however, has fallen – from 33% in 1990 to 46% in 2012. This decline is seen in all world regions, and most rapidly in Asia. Nonetheless, due to the growing world population, the absolute number of slum inhabitants has risen from 650 million in 1990 (UN Habitat, 2013).

One target under the Millennium Development Goals called to 'achieve, by 2020, a significant improvement in the lives of at least 100 million slum dwellers', by providing improved water sources and sanitation facilities, more durable housing or sufficient living space. This target has been met. Countries including China, India and Indonesia in particular have improved the lives of slum dwellers (UN, 2013b; UN, 2014).

Slum dwellers face a range of adverse health conditions. For example, mortality of children under five is roughly twice as high for the 20% for urban residents with the lowest incomes, compared with the 20% with the highest incomes, across in Africa, Asia and the Americas. These differences can be even greater for slum residents: in Nairobi, under-five death rates were more than 10 times higher in slum areas (WHO, 2010c).

**Box 3: Addressing health urban inequities**

WHO and UN Habitat have called for action to address health inequities in the world's growing cities. They indicate that the best approach involves: developing a good evidence base on health problems in each city across all population and income groups, using the best available evidence when rigorous data are not available so as not to slow action; addressing health inequities across the entire urban population, including disadvantaged groups but also middle-class residents; and identifying interventions across policy areas, including the natural and built environment, food security and quality, and health and social services. Examples of the many possible initiatives include the training of women community health workers in poor urban areas in Pakistan; improving access to safe drinking water and improved sanitation in the Lake Victoria region in Africa; and community action against violence in São Paulo, Brazil.

## 2.2 Demographic change: rising life expectancies, increasing migration and travel

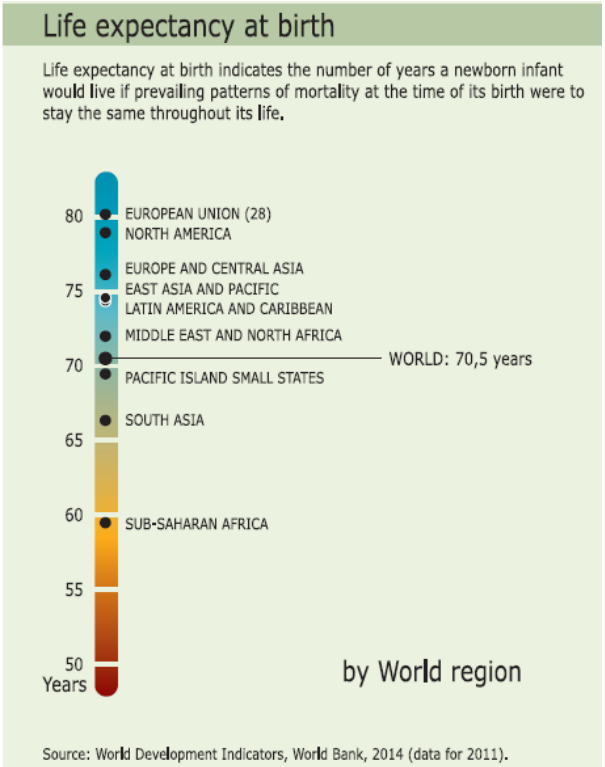
***Life expectancy***

One major success of economic development and health care has been the increase in life expectancy around the world. The global average life expectancy at birth rose to 70 in 2011, an increase by six years since 1990. This increase reflects improved economic and social conditions, better health care and the decrease in births. The rise has not, however, been steady in all parts of the world: in Africa, average life expectancy declined in the 1990s due in part to the HIV/AIDS pandemic, though it has since improved (WHO, 2014f). At the same time, life expectancy varies greatly across regions though it is projected to converge slowly in coming decades (see Figure 7).

In 2015, humanity will pass a major watershed: for the first time, the overall human population over 65 will be greater than the population under 5 (see figure 8). In some developed regions of the world, such as Europe, the proportion of older people already exceeds that of children (23% compared to 16%) (UN, 2012). This development will further fuel the increase in prevalence of non-communicable diseases, as these mostly disproportionately affect elderly populations.

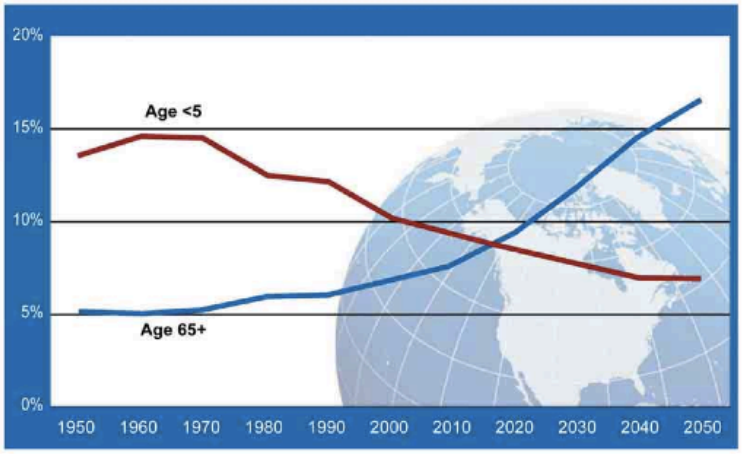
The number of older people is projected to grow from an estimated 524 million (8% of the global population) in 2010 to nearly 1.5 billion (16% of the population) in 2050, with most of the acceleration taking place in developing countries (WHO, 2011c). WHO predicts that in 2050, 80% of the world's older people will be living in a country that is currently defined as 'low- and middle-income' (WHO, 2013l). This means that countries such as Chile and Iran will have a greater proportion of older people in 2050 than the United States of America (WHO, 2013l).

**Figure 7. Life expectancy across world regions**




A consequence of ageing populations and higher life expectancies is that health care for the elderly is a growing social and policy issue in many countries, including Europe. The impacts of an ageing population on health are significant now, and are likely to increase over time. The WHO report on global health and ageing (WHO, 2011c) portrays a rapidly ageing world in which social and demographic changes will mean fewer older people will have the support of families and *"with declining support from families, society will need better information and tools to ensure the well-being of the world's growing number of older citizens"*. In addition, the increasing number of older people "*is placing upward pressure on overall health care spending in the developed world, although other factors such as income growth and advances in the technological capabilities of medicine generally play a much larger role*" (WHO, 2011c), although the same report states that little is known about ageing and health care costs in the developing world.

**Figure 8: Young Children and Older People as a Percentage of Global Population (1950-2050)**




*Source: WHO (2011c), Global Health and Aging: [http://www.who.int/ageing/publications/global_health/en/index.html](http://www.who.int/ageing/publications/global_health/en/index.html)*

One issue is that older populations are more likely to be susceptible to environmental hazards, e.g. air pollution, heat waves and floods (WHO 2011c) which could become increasingly significant in the context of a changing climate. Shrinking populations are often associated with ageing populations (WHO 2002), which will bring additional health risks as immigration becomes necessary to maintain economic output and support the non-working population. Recent work by the European Environment Agency and the EC Joint Research Council (EEA and JRC, 2013) also affirms that ageing populations are more susceptible to environmental hazards. The elderly (as well as economically and socially deprived people) are among the most vulnerable to the health effects of climate change (ECDC, 2010).

As the global population ages there is likely to be increasing recognition of the need for assistive technologies (WHO 2011c) and wider planning for active older life, for example as seen in the WHO initiative the Global Network of Age-friendly Cities and Communities.[7]

***Migration***

Most migration principally occurs within countries, in particular from rural to urban areas. Data, however, are often poor and incomplete. Within China alone, an estimated 220 million people have moved to a location where they are not resident, about 17% of the population; about 150 million of these moved from rural areas (ECOSOC, 2013).

The number of migrants between countries of the world has increased from 155 million in 1990 to 214 million in 2010; in terms of shares of the world population, however, the increase has been relatively low – from 2.9% to 3.1%. Since 1990, however, migration flows have become increasingly diverse: many countries – including for example – Malaysia, Nigeria and Thailand – are both a source of emigrants and a home for immigrants. Indeed, 24 countries around the world are both the source of more than 1 million emigrants and the home for more than 1 million migrants from other countries. Three regions of the world provide the home for about 85% of international migrants: Europe, which hosted almost 70 million in 2010, followed by Asia (61 million) and North America (50 million) (ECOSOC, 2013).

Migration from developing to developed countries has grown quickly and by some measures has doubled over the past 20 years; at the same time, movements from one developing to another developing countries are not always recorded (IOM, 2013).

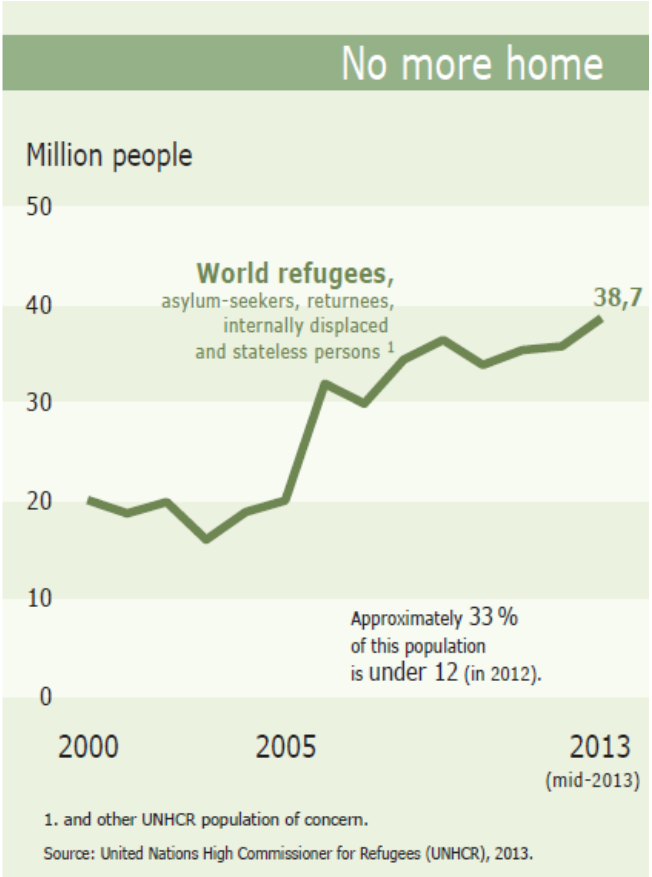
Migration includes people who have been forcibly displaced due to war and disaster: in 2013, almost 40 million had been forcibly displaced. Over the past decade, the global number of refugees and others fleeing conflict has increased steadily (see figure 7). Environmental factors such as climate change can play a role in migration, via events such as droughts, which spur rural to urban movements (IPCC, 2007), and potentially natural disasters as well (see also section 1.3).

All types of migration can increase risks of increased transfer of some infectious diseases; this is the case especially where migrant groups have poorer access to health care, poor initial health status (e.g. malnutrition) or more difficult living conditions (e.g. crowding, poor housing quality, poorer working conditions etc). Migration can result in the re-introduction of infectious diseases to areas where they had been eradicated (or significantly reduced) from. For example, Tuberculosis (TB) has re-emerged to become more common in some developed countries where it had historically been reduced to very low levels, in many cases linked to migrants from areas of high health inequality. The International Organization on Migration and other international agencies have developed programmes to identify and address TB and other serious health threats among migrant populations (IOM, 2013). More information about TB can be found in chapter 3.

On the other hand, migration can also lead to higher incomes, better health care and improved health outcomes. In polls conducted for the UN, migrants from developing to developed countries report some difficulties initially receiving adequate health care, but over time have the same perception of access to and quality of health care as native-born populations, and better than people in their native country. In contrast, migrants between developing countries report a higher level of health problems than those to developed countries; many report worse health outcomes (IOM, 2013).

[7] http://www.who.int/ageing/age_friendly_cities_network/en/index.html

**Figure 9: World refugees, asylum-seekers, returnees, internally displaced and stateless persons**




A further concern is that many health professionals migrate to take advantage of opportunities in higher income countries, and in doing so create difficulties for the health care systems in their home countries; international organisations have undertaken a number of programmes to address this issue and also to support migrants in bringing training to their home countries (IOM, 2012).

Migration also leads to demographic changes. Migrants tend to be younger and healthier than their home country average (ECOSOC, 2013). For developed countries in particular, migrants are typically younger than the native-born population.

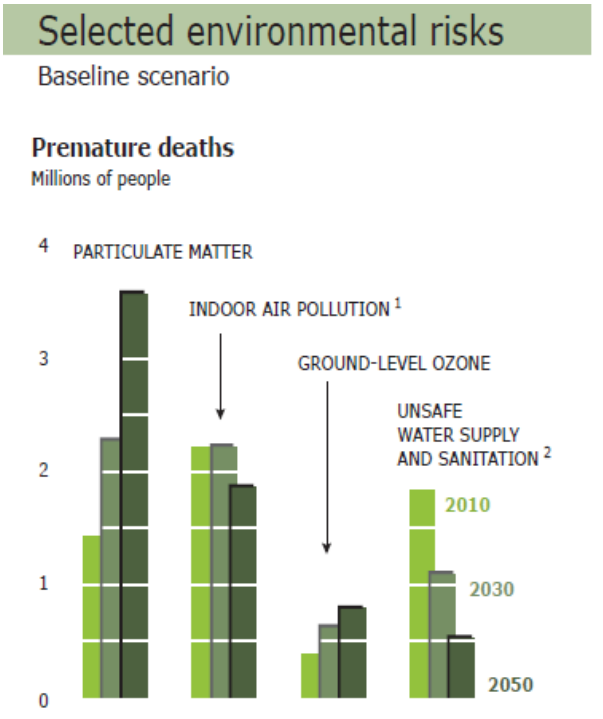
**Box 4. Migration in Europe**

The European Commission's 2012 Ageing Report (EC, 2012) shows that Europe's net immigration flows peaked in the 2000s and has dropped off in recent years; while continued inward net migration is predicted to 2060, this will be at a decelerating rate. The UN World Migration Report (IOM, 2013) supports this conclusion, noting that migration from developed to developing countries has slowed; instead, migration among developing countries has grown.

## 2.3 Growing environmental problems that affect health

A range of environmental problems can affect human health. This section reviews several key environmental issues, including: urban air pollution; indoor air pollution; poor sanitation and drinking water; toxic chemicals; and the impacts of climate change (see Figure 10). Other environmental risks for health include: noise levels that contribute to hypertension; naturally occurring radon released from the ground, linked to lung cancer; and contamination due to poor solid waste management. Many of these problems, including air pollution and climate impacts, are particularly acute in urban areas. Moreover, environmental issues often have the greatest health impacts on vulnerable populations, including children, the elderly and low-income groups.

**Figure 10: Global premature deaths from selected environmental risks: Baseline, 2010 to 2050**




Is it the note you were referring to Anita?

***Urban air pollution***

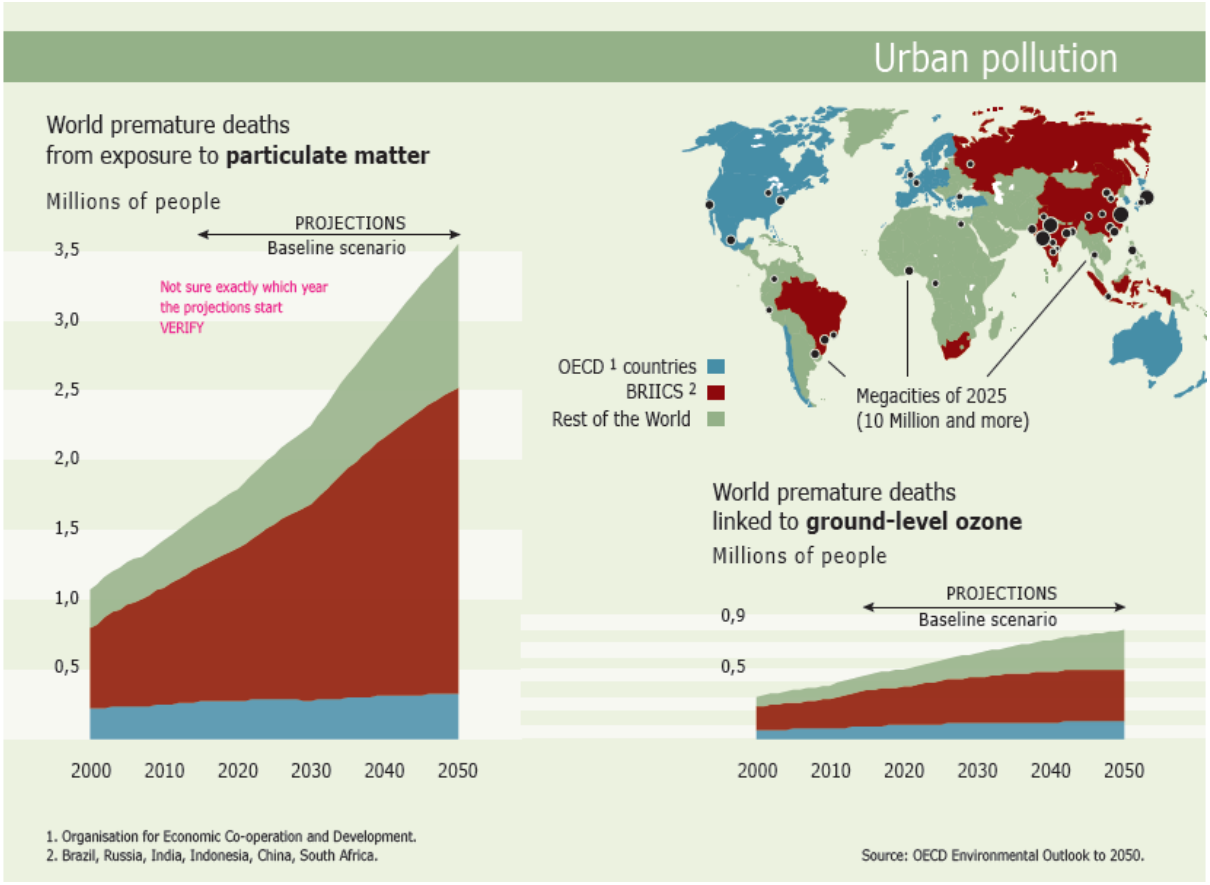
Among these problems, urban air pollution is one of the most important. Fine particulate matter – $PM_{10}$ and $PM_{2.5}$ – is the most serious threat to health, as the small particles go deep into the lungs. OECD has predicted that if current trends continue, the number of global deaths per year from particulate matter will more than double to over 3.5 million in 2050, and deaths from ground-level ozone will also rise quickly in coming decades (see Figure 11). Already, the great majority of deaths occur in developing countries, and levels of ambient air pollution are projected to continue rising in the coming decades in large cities in the developing world. In OECD countries as well, however, the number of deaths per population will rise (OECD, 2012).

Ground-level ozone, formed by a chemical reaction by in the atmosphere by pollutants such as NOx, VOCs and methane, also has significant human health impacts. Motor vehicle emissions are an important source. As sunlight is a catalyst for the reaction, ground-level ozone can reach high levels in tropical countries; in Europe, it reaches high levels in particular in summer months. Ozone levels are already at high levels in India and are predicted to increase rapidly in China (OECD, 2012).

Recent WHO work suggests that current health impacts from air pollution are higher than previous estimates, including the OECD projects provided above: WHO indicates that 3.7 million deaths were attributable to ambient air pollution in 2012: the higher estimates are due to several factors, including new evidence on the links between exposure and health (WHO, 2014b).[8]

[8] OECD's forecasts are based on modelling and thus depend on a range of assumptions about current and future air pollution and its interaction with other determinants of health, including the potential gains from air and climate policies. Notably, these forecasts predict rising health impacts from air pollution in OECD countries, while separate EEA projections foresee a decline in European countries, which make up close to half of the OECD population.

**Figure 11: Ground-level ozone concentration for major cities: Baseline, 2010-2050**




With increasing air pollution emissions in many parts of the world, the hemispheric transport or air pollutants is of growing concern. For example, ozone in particular from fast-growing Asian cities reaches Europe, North America and also the Arctic. This transport also leads to health impacts, implying that emissions reductions will have benefits outside the source area. Modelling for UN ECE indicates that emissions reductions in Europe and North America will have greater impacts outside the source regions than within them (UNECE, 2010)

***Indoor air pollution***

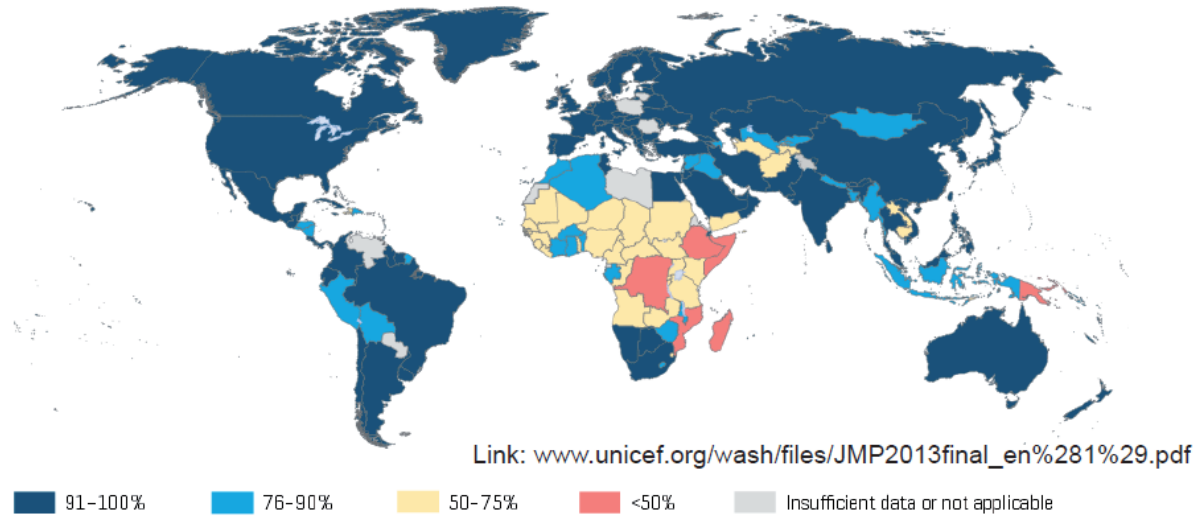
Current levels of indoor air pollution are estimated to result in just over 2 million deaths per year due to the combustion of coal, wood, dung and other biomass. About half of these deaths are children, in particular in low-income countries in Southeast Asia and Africa, as well as China. OECD projects that this level will decline slowly in coming decades: as people move out of poverty, they switch to cleaner fuels such as natural gas and live in homes with ventilated stoves. More recent WHO work, however, indicates that global mortality due to indoor air pollution is significantly higher than the OECD calculations: WHO estimates about 4.3 million deaths in 2012 (WHO, 2014b).

In developed countries, indoor air pollution from chemicals in cleaning fluids, carpets and other products are a concern. (OECD, 2012)

***Water***

Unsafe water supply and sanitation is another major source of health problems – and moreover, the deaths it causes mainly take children. The impacts are seen almost entirely in developing countries, in particular in sub-Saharan Africa and India (see Figures 12 and 13).

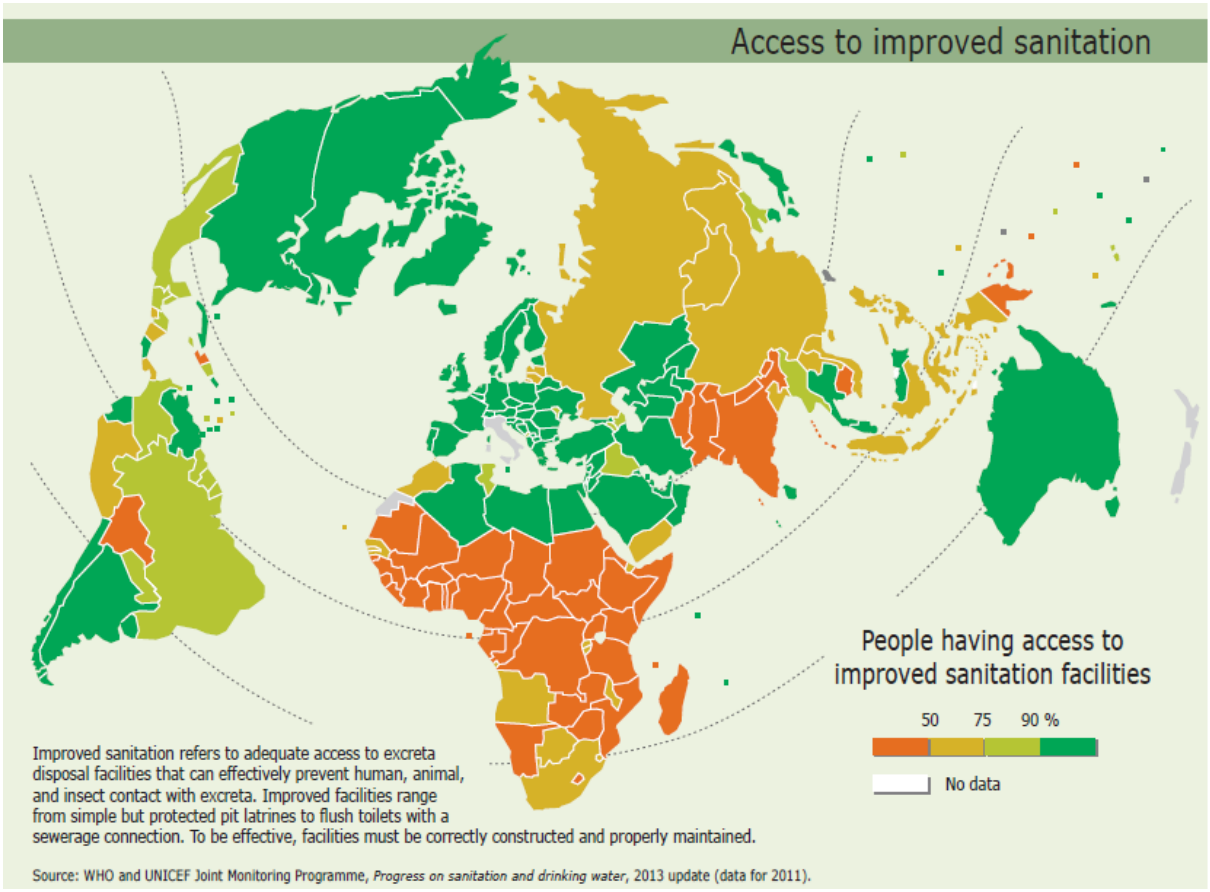
**Figure 12: Proportion of the population using improved sources of drinking water (2011)**




*Source: WHO and UNICEF*

In recent years, access to improved sources of drinking water has improved significantly, rising from 76% in 1990 to 89% in 2010. As a result, the Millennium Development Goal in this area – to halve those without this access from 1990 to 2015 – has been met, according to official reporting. Poor access remains a problem in particular in low-income countries and among disadvantaged groups, in particular in rural areas, where more than four-fifths of those without access live. Moreover, the UN reports that there are concerns about the quality of many improved water sources – it is possible that the number of those without access is much higher than official estimates. Moreover, many have access only to public water points, rather than piped water at home (UN, 2013b).

**Figure 13: Proportion of the population using improved sanitation (2011)**



In contrast, the MDG target to reduce the number of people without access to improved sanitation by half has not yet been met, and may be achieved by 2015. Coverage rose to 64% in 2011, but would need to reach 75% to meet the target. The greatest improvements were seen in Eastern Asia, where access rose from 27% in 1990 to 67% in 2011.

Despite these improvements, about half of those without access – approximately one billion people – lack any sanitation facilities and use open defecation, a practice that has strong risks to spread disease, in particular in villages and urban areas.

**Box 5: Sustainable Sanitation**

Traditional sanitation methods – in particular sewer systems and large wastewater treatment plants – are costly to build and operate, require extensive water and still contribute to water pollution. In response, the 'sustainable sanitation' approach focuses on the reuse of wastewater as a valuable fertiliser or as a renewable energy fuel; treatment only to the level necessary for reuse; and decentralised systems (Lüthi et al, 2011). The Gates Foundation has supported research into new toilets that follow such principles (Gates Foundation, 2013).

Across developing countries, largely untreated human sewage is used as fertiliser: this creates an important health risk by spreading microbes and creating diseases such as diarrhoea. Proponents argue, however, that the sewage can provide a substitute for expensive mineral fertilisers, and the solution is to ensure proper treatment (Pearce, 2013).

In the EU, the Sewage Sludge Directive regulates the use of this material resulting from wastewater treatment, for example prohibiting its use for fruit and vegetable crops.

***Chemicals and nanomaterials***

Around the world, people are exposed to an increasing range of chemicals. According to WHO, impacts from acute poisoning, workplace exposure to chemicals and exposure to lead reached about one million deaths per year in 2004. The effects of other exposure routes – including to chemicals used in consumer products as well as accidental and other industrial releases – have not been estimated by WHO. Chemical sales have increased steadily in recent years, in particular in developing countries. However, understanding of the health impacts of exposure to chemicals remains limited (EEA and JRC, 2013).

Chemicals can affect health also through the waste cycle. Notably, the dismantling of electronic waste has led to high levels of heavy metals, dioxins and other chemicals, documented at and nearby sites in China, India, Ghana and Vietnam. At present, a high share of electronic waste is shipped from developed countries, often illegally, for recycling in developing countries. The EU's Directive on Waste Electrical and Electronic Equipment (WEEE) seeks to counter illegal trade by increasing domestic recycling. In coming decades, however, a growing share of this type of waste will come from developing countries: by 2030, it is estimated that developing countries will generate twice the number of obsolete computers as developed countries (Riederer et al, 2013).

Pesticides are used in agriculture and also as an important public health tool against vector-borne diseases such as malaria and dengue fever. Exposure to pesticides, however, can also bring health impacts, in particular when they are used without appropriate precautions (WHO, 2013i).

Chemicals used in mining have brought acute exposure to local areas in developing countries (see Box 6). In addition, children and adults around the world are affected by low levels of lead contamination. WHO has estimated that overall, lead poisoning of children accounts for 0.6% of the world's global disease burden, due to long-term mental retardation and heart risks. About half of the world's children have blood lead levels over 5 µg/dl, a threshold at which impacts on intelligence are seen; 16% of children and 13% of adults have blood lead levels over 10 µg/dl, a threshold for further health impacts. Although the worst problems are seen in developing countries, lead poisoning has been estimated to cost US$ 43 billion in the United States (WHO, 2010a).

Key pathways include lead in paint and in gasoline, both are now banned in the EU (WHO, 2010a). WHO and UNEP have launched the Global Alliance to Eliminate Lead Paint. At the time of the World Summit on Sustainable Development in 2002, about half of the world's countries still used leaded gasoline; since then, through efforts such as UNEP's Partnership for Clean Fuels and Vehicles, nearly all countries of the world have phased it out.

**Box 6: Gold mining and lead poisoning in Nigeria**

In and near the village of Bagega, Nigeria, an estimated 400 children have died from lead poisoning and over 2000 have been treated since the problem was identified. The results deaths, illness and permanent disability – blindness is a potential consequence of lead poisoning – are linked to local gold mining: the ore, containing high levels of lead, is extracted by small-scale miners who crush the rock, often using simple mortars and pestles and releasing high levels of dust. This work is done near and also within the village, exposing local children (Grossman, 2012).

In this case, discovered in 2010, experts from Médecins Sans Frontières, WHO and aid agencies provided surviving children with chelation therapy against their lead poisoning. Around the world, a boom in gold mining has brought heavy metal poisoning. Mercury is often used to extract gold from ore, and small-scale mining operations have led to cases of mercury poisoning of miners in Colombia and other countries. Gold mining is estimated to be the source of 30% of global mercury releases, affecting the environment and human health around mines (Siegel, 2011).

Moreover, cases of child heavy metal poisoning have been seen in dozens of other local, 'hot spots' in the developing world. A recent literature review identified 57 locations where lead poisoning has affected about 8000 children (Clune et al, 2011); an even larger number of cases were excluded due to poor data.

In order to better understand the impacts of chemicals on health around the world, WHO launched a Chemical Risk Assessment Network in 2013.

Nanomaterials, made of particles in the range of 1 to 100 nm, are of growing concern due to their widespread use in consumer and industrial products (see GMT4). Little systematic information is available, however, on human exposure and health impacts of nanoparticles. The issue has been studied by the European Commission and OECD (EEA and JRC, 2013). Nanomaterials are also used in medical devices, and organisations have called for greater restrictions in this to protect human health (Noharm, 2014).

***Climate change and health***

Climate change can have a range of direct and indirect effects on human health.

One important area is the risk of more frequent and more severe occurrences of extreme weather events. IPCC has found some evidence that heat waves, floods and droughts have increased in parts of the world since 1950. Climate models predict a continuation of these trends in the coming century: in many parts of the world, flooding, storms and cyclone risks are expected to increase; heat waves may also become more common and more severe in many parts of the world, and the effects will be strongest in cities, due to their 'heat island' effect. Droughts are also expected to increase (IPCC, 2012).

Climate change, in particular rising temperatures, can exacerbate air quality: higher temperatures can increase concentrations of ground-level ozone, and dryer conditions mean that particulate matter remains in the air for longer (EEA and JRC, 2013).

Climate change can also affect the range of communicable diseases spread by vectors such as mosquitoes, as well as those carried via water and food. The range of mosquitoes bearing malaria and dengue fever, for example, has shifted in recent years, with small, local outbreaks of these and other tropical diseases experienced also in Europe (EEA and JRC, 2013). Higher temperatures could increase levels of food-borne diseases such as salmonellosis. In terms of waterborne disease, extreme weather events can overwhelm wastewater treatment plants, leading to higher risks of waterborne disease; higher temperatures can reduce water quality and increase microbes in surface waters, including bathing water (IPCC, 2007).

In addition, climate change is expected to put increasing pressure on global food supplies, a factor that good lead to higher prices and greater levels of undernourishment (IPCC, 2007). Other impacts include the potential for greater exposure to allergens, notably pollen.

The impacts of these trends are difficult to estimate, due in part to the uncertainty related to climate models and, in particular, regional and local impacts. Moreover, many of the higher risks can be addressed through better preparedness, early warning systems and adaptation policies, as well as strong health policies (IPCC, 2007).

***Green space***

Studies have shown that health and well-being appears to be better for people living near forests, grasslands, agricultural areas and urban green spaces. In cities, parks and community gardens provide areas for recreation and can strengthen a sense of the community and connections to the environment (EEAand JRC, 2013; UN Habitat, 2013). In many cities, however, people living in low-income and slum districts have little contact to green space.

Most environmental problems disproportionately affect lower-income groups who have less access to drinking water and sanitation or to electricity and natural gas that can replace smoke indoor fuels. These problems are particularly severe in urban slum areas. In Europe, low-income populations more often live near industrial areas, landfills and noisy roads (EEA and JRC, 2013).

## 2.4 Medical research and technology

***Accelerating innovation***

The pace of technological innovation is accelerating, and healthcare is one of the key areas expected to benefit from fast-changing fields of nano, bio and information technologies (see GMT4 on Technology). A broad range of new products and healthcare methods are in development, in areas including drug development, genetic engineering and the use of sensors and artificial intelligence.

The growing links between nanotechnology and information technology are producing miniature sensors that can be used for healthcare. One area of research is in wearable and ingestible sensors to monitor the health of chronic patients at home, with results connected via Internet to medical centres (MGI, 2013). Athletes and others are already using wearable sensors to monitor their health and improve performance, and their use is expected to grow rapidly in developed countries.

**Box 7: The 'tricorder' competition**

The X Prize Foundation in the US has launched a competition for a hand-held, non-invasive medical diagnostic tool that can detect 15 diseases and conditions, including pneumonia, hepatitis A and stroke, along with five vital signs (body temperature, blood pressure, blood oxygen level, heart rate and respiratory rate): the goal is to develop a device that individuals can use to monitor their own conditions. The competition refers to the 'tricorder' medical device featured in the 'Star Trek' TV and film programmes (X Prize Foundation, 2014).

The initiative raises a series of legal and ethical questions, such as the potential legal liability for a manufacturer when a device gives either a false positive result (erroneous confirmations of a condition) or a false negative one (not accurately diagnosing a condition). Individuals may need help in interpreting the results; an artificial intelligence database accessed by Internet could be valuable (McKenna, 2013). The goal is improve health care and make it more efficient – for example, such a device could be valuable for health care workers in developing countries.

One example is the 'tricorder' competition underway in the US (see Box 7). This initiative reflects a wider trend in medicine, shifting expertise and some decisions away from highly trained doctors to individuals who directly access information technology. Already, many individuals with Internet access regularly seek information on their medical conditions on the worldwide web. Sensors and artificial intelligence are expected to take the role of IT in medicine to a new stage.

In healthcare systems as well, artificial intelligence will increasingly be able to support doctors in diagnoses – and increasingly, replace this area of work. Another growing area is the use of crowd-sourced information via cell phones to monitor disease outbreaks. (MGI, 2013). Genomic sequencing is being used for drug discovery (MGI, 2013).

A range of techniques are being developed to deliver drugs more precisely to the parts of the body where they are needed, such as tumours, in order to increase efficacy and reduce undesired side effects. Examples include 'nanocapsules' that delay release of the active molecule, 'cloaks' to hide from the human immune system, which often attacks and removes drugs, and capsules with chemical properties that geared to a specific tissue, such as a tumour, following the approach of natural antibodies (Mitchell Crow, 2013).

The growth of new human organs to replace or enhance existing ones is another example of a new research area. The goal is to use cells from a human patient to grow a new organ, thus eliminating the risk of organ rejection. The process uses stem cells grown on either an artificial scaffold or a structure taken from an animal organ. The first organ entirely grown in the laboratory, a rat kidney, has been successfully transplanted and work is underway on growing lungs and other organs (Coghlan, 2013; Murphy and Atala, 2012).

***Gaps in medical research***

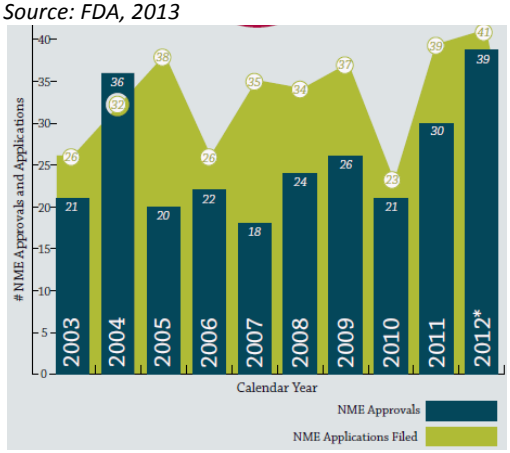
While new technologies promise future advances in medicine, in recent years researchers have warned about a long-term slowdown in the development of new drugs. This has been attributed to several causes: perhaps 'easy' discoveries have largely been made; another is that returns in 'traditional' sectors have declined, pushing drug companies to focus on new health issues and neglect ongoing areas (Pammolli et al, 2011).

Drug research and discovery has slowed in particular in the area of antibiotics, a topic discussed further in section 2.3. Reportedly, pharmaceutical companies have been reluctant to fund expensive final trials for newly developed antibiotics, as the returns are low (McKenzie, 2013). New financing approaches have sought to address the problem: the European Commission (via its FP7 research programme) and the European Federation of Pharmaceutical Industries and Associations have jointly funded the Innovative Medicines Initiative to develop new medicines: among its work, the Initiative has launched a programme called 'new drugs for bad bugs' to develop new antimicrobials (IMI, 2014).

Reports of a broader crisis in drug discovery may be exaggerated. In the US, while new drug approvals slowed significantly in the first decade of this century, 2011 and 2012 saw an increase in the total number of new molecular entities approved and applications filed.

**Figure 14: Number of NME Approvals and Applications**

*Source: FDA, 2013*




The concern remains that medical research focuses on 'profitable' topics, in particular non-communicable diseases that occur in developed countries. A number of international initiatives have been launched to address 'neglected' tropical diseases found mainly in developing countries (see section 2.3). Similarly, several initiatives have sought solutions to health care issues for the developing world. In addition to work on sustainable toilets and sanitation (see section 1.3), research has looked at better refrigerators for vaccines, to ensure that they remain in good condition when taken to remote areas.

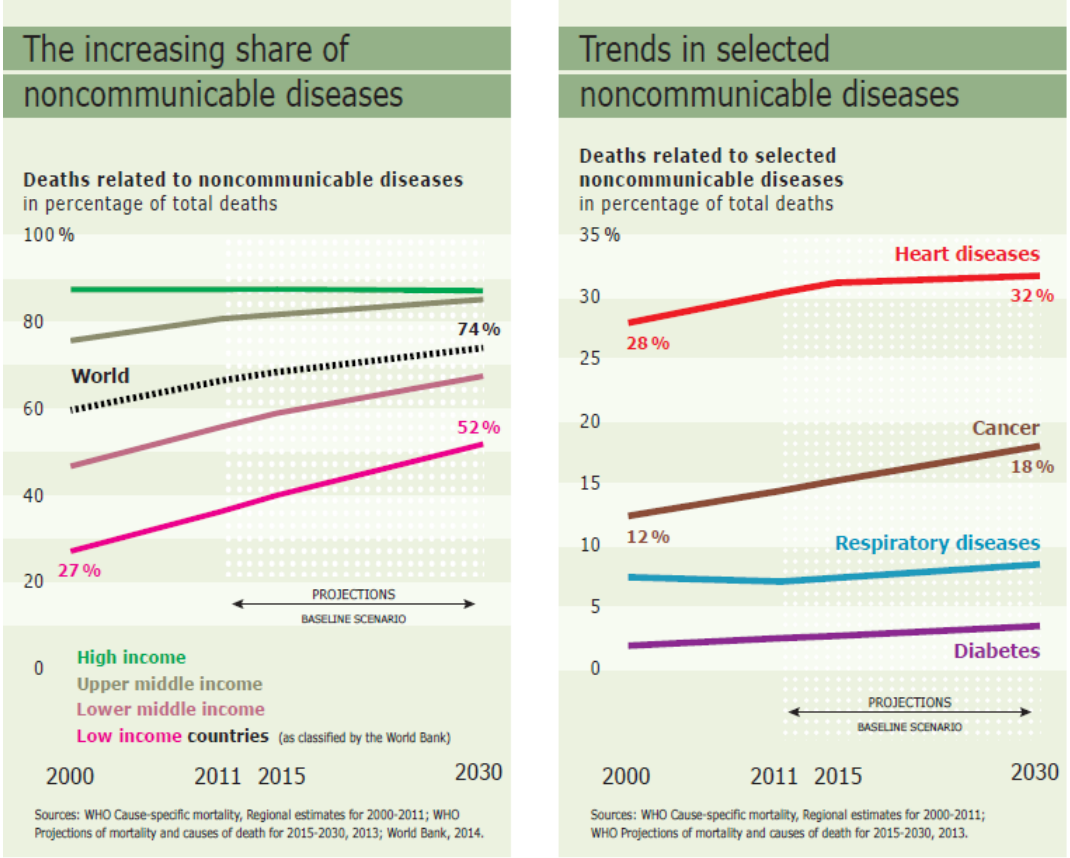
# 3. Trends

## 3.1 Growing levels of non-communicable diseases

Non-communicable diseases (NCDs) constitute one of the major challenges for development in the twenty-first century, as they are responsible for 36 million deaths each year (this is 63% of all global deaths). Many NCDs are largely preventable by enabling health systems to respond more effectively and equitably and by influencing public policies across sectors and governments to tackle risk factors such as alcohol and tobacco use, high blood pressure, unhealthy diets and physical inactivity. These in turn are linked to income, housing, employment, transport, agricultural and education policies, which themselves are influenced by patterns of e.g. international trade, finance and culture. According to projections by the World Health Organization, the total annual number of deaths from non-communicable diseases will increase to 55 million by 2030 if "*business as usual*" continues (WHO, 2013f).

While infectious, communicable diseases used to be the main burden of disease and cause of death around the world for centuries, the situation changed in developed countries after the second World War due to improved living conditions and medical achievements such as vaccination and antibiotics. The prevalence of non-communicable diseases started to rise and conditions such as heart diseases and cancer became associated with economic development. This changed around the start of the new millennium, when NCDs started to appear increasingly in developing countries too (see Figure 3).

**Figure 15: Burden of chronic non-communicable diseases (2008-2030)**




This development can be attributed to shifts from traditional health risks such as inadequate nutrition or unsafe water and sanitation to modern risk such as overweight and obesity. The Global Burden of Diseases, Injuries and Risk Factors Study 2010 (GBD 2010) assessed and compared risk factors of disease burdens and injuries between 1990 and 2010 (Lim et al, 2012; Lozano et al, 2012). The study found that indeed the contribution of different risk factors has changed substantially, with a shift away from risks for communicable diseases in children towards those for non-communicable diseases in adults. These changes are related to the

ageing population, decreased mortality among children younger than 5 years, changes in cause-of-death composition, and changes in risk factor exposures. However, the extent to which the epidemiological shift has occurred and what the leading risks currently are varies greatly across regions (Lim et al, 2012; Lozano et al, 2012).

Data of 2011 from WHO also dispels the myth that NCDs are mainly a problem of affluent societies; two-thirds of all deaths due to NCDs occurred in developing countries (WHO, 2011b). The study also showed that the probability of dying from any of the major non-communicable diseases ranges from 87% in developed countries to 58% in developing countries (table 1)..

**Table 1: Total death rates and shares of deaths of the three main causes in developing and developed countries**

*Source: Global Burden of Diseases, Injuries and Risk Factors Study, 2010 (GBD 2010)*

| | Number of deaths due to NCDs | Number of deaths due to communicable diseases | Number of deaths due to injuries | TOTAL | Share of deaths due to NCDs | Share of deaths due to communicable diseases | Share of deaths due to injuries |
|---|---|---|---|---|---|---|---|
| Developed countries | 11,323,700 | 760,374 | 874,938 | **12,959,012** | **87%** of all deaths in developed countries are due to NCDs | **6%** of all deaths in developed countries are due to communicable diseases | **7%** of all deaths in developed countries are due to injuries |
| Developing countries | 23,216,200 | 12,396,100 | 4,198,380 | **39,810,680** | **58%** of all deaths in developing countries are due to NCDs | **31%** of all deaths in developing countries are due to communicable diseases | **11%** of all deaths in developed countries are due to injuries |
| **TOTAL** | **34,539,900** | **13,156,474** | **5,073,318** | **52,769,692** | | | |
| *Shares in developed countries (compared to total)* | **33%** of all deaths due to NCDs happen in developed countries | **6%** of all deaths due to communicable diseases happen in developed countries | **17%** of all deaths due to injuries happen in developed countries | | | | |
| *Shares in developing countries (compared to total)* | **67%** of all deaths due to NCDs happen in developing countries | **94%** of all deaths due to communicable diseases happen in developing countries | **83%** of all deaths due to injuries happen in developing countries | | | | |

The prevalence of non-communicable diseases is expected to further increase in developing countries and to continue to accompany socioeconomic development. This has been called an "epidemiologic transition" in which there is a waning of infectious and acute diseases and an emerging importance of chronic and degenerative diseases (WHO, 2011b) – see Figure 16.

However, despite the success of vaccination and prevention programmes, communicable diseases are a persisting problem that can't be dismissed, and developing countries are now thus facing a "double burden" of disease. On the one hand they have to continue with their efforts to tackle diseases such as malaria and HIV/AIDS, while at the same time they have to deal with a rapid upsurge in non-communicable diseases (particularly cardiovascular disease, diabetes, cancer and chronic pulmonary disease) and obesity rates. In addition to this, this development is inextricably linked to poverty, as premature deaths from NCDs reduce productivity, limit economic growth and increase poverty rates and inequalities. A report from the African Union in April 2013 underscored the fact that "*the exorbitant costs of NCDs, including often lengthy and expensive treatment, where coupled with the loss of breadwinners, is likely to force millions of people into poverty in Africa, stifling development*" (African Union, 2013).

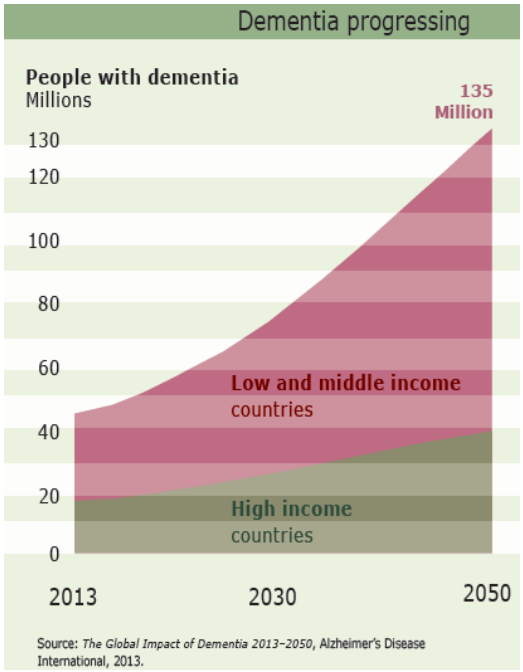
Figure 15 shows that by 2030, non-communicable diseases are projected to account for more than 50% of the disease burden in low-income countries and more than 75% in middle-income countries. Communicable

diseases on the other hand will account for 30% in low-income countries and 10% in middle-income countries. Countries are grouped according to the World Bank Atlas Method: low-income groups have a GNI per capita of $1,035 or less**;** lower middle income, $1,036 - $4,085; upper middle income, $4,086 - $12,615; and high income, $12,616 or more.

***Ageing populations***

As described in section 2.2, due to longer life expectancy and declining fertility rates, the proportion of people aged over 60 years in virtually all countries worldwide is growing faster than any other age group (see Figure 16). Older populations thus mean higher rates of certain diseases such as Alzheimer's, Parkinson's, cardiovascular diseases, arthritis and cancers (UN, 2012). WHO cites projections from Alzheimer's Disease International that suggest that 115 million people worldwide will be living with AD/dementia in 2050, with a markedly increasing proportion of this total in less developed countries (WHO, 2011c). The scale of this change is illustrated in Figure 15, showing how much faster growth in the number of people with dementia is expected to be in low- and middle-income countries compared to high-income countries.

**Figure 16: Growth in number of people with dementia (2010-205)**




***The four main NCDs and four main risk factors***

The four main non-communicable diseases - cardiovascular diseases, chronic respiratory diseases, cancer and diabetes - kill three in five people worldwide and are all four intrinsically linked to four shared risk factors: increased levels of exposure to tobacco use, unhealthy diets, physical inactivity and the harmful use of alcohol.

***Cardiovascular diseases***, which are diseases such as coronary heart disease (heart attacks), raised blood pressure (hypertension) and heart failure, are largely preventable. They are however the number one cause of death in the world, with over 17 million people dying from cardiovascular diseases (CVDs) in 2008 – this was nearly a third of the total. The magnitude of CVDs continues to accelerate globally, and it is estimated that by 2030, 23.3 million people will die each year from CVDs (mainly heart attacks and strokes). The increasing prevalence of cardiovascular diseases can be attributed to population growth, ageing, and behavioural risk factors such as tobacco use, unhealthy diets, exposure to persistent stress, and physical inactivity (WHO, 2014c).

An alarming development is that over the past two decades, while deaths from CVDs have actually been declining in high-income countries, they have been increasing at very fast rates in low- and middle-income countries. In 2008, more than 80% of all deaths that occurred due to cardiovascular diseases took place in low- and middle-income countries. Moreover, the percentage of premature deaths from CVDs ranges from 4% in high-income countries to 42% in low-income countries, leading to growing inequalities in the occurrence and outcome of CVDs between countries and populations (WHO, 2011a).

In 2012, there were 32.6 million people living with ***cancer*** and 8.2 million people worldwide died that year from this disease - mostly lung (1.6 million deaths) liver (745 000 deaths), stomach (723 000 deaths), colorectal (694 000 deaths) and breast cancer (521 000 deaths) (GLOBOCAN, 2012). By changing or avoiding the main cancer risk factors such as tobacco and alcohol use, unhealthy diets and physical inactivity are the main cancer risk factors, 30% of all cancer deaths could have been prevented (WHO, 2014b). Especially tobacco use is an important risk factor, as it caused about 22% of all global cancer deaths in 2012 and over 70% of global lung cancer deaths. Another fundamental factor for the development of cancer is ageing, as the incidence of the diseases rises dramatically with age.

Of all new cancer cases, 60% occur in Africa, Asia and Central and South America and these regions together account for 70% of all deaths globally (GLOBOCAN, 2012). In many low-income countries, up to 20% of cancer deaths are due to infection by the hepatitis B virus (HBV), which causes liver cancer, and the human papillomavirus (HPV), which causes cervical cancer. In developing countries, up to 20% of cancer deaths could be prevented by immunization against the infection of HBV and HPV. It is expected that annual cancer cases will rise from 14 million in 2012 to 22 within the next two decades (GLOBOCAN, 2012).

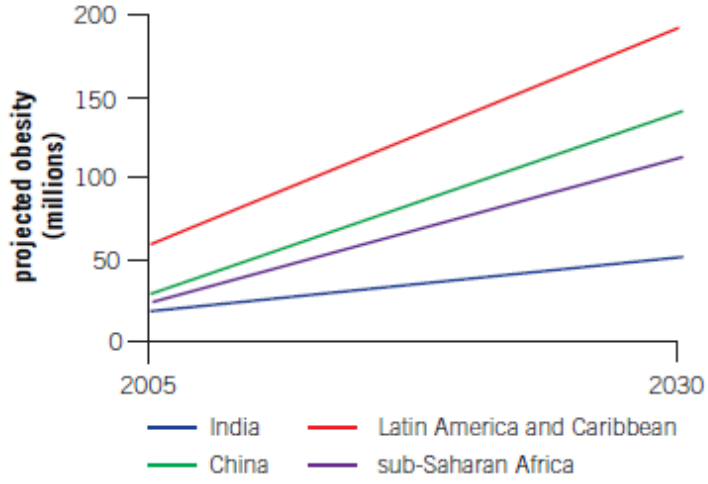
***Chronic Respiratory Diseases*** (CRDs) are diseases of the airways and lungs and include asthma and respiratory allergies, chronic obstructive pulmonary disease (COPD), occupational lung diseases, sleep apnoea and pulmonary hypertension (WHO, 2009). CRDs are responsible for four million deaths each year and 235 million people worldwide are currently suffering from asthma (WHO, 2013a). Measured in DALYs, in 2005 the burden of chronic respiratory diseases was projected to account for 4% of the global burden and over 8% of the burden of chronic diseases (WHO, 2007). Preventable CRDs are expected to increase in prevalence, particularly among children and elderly people.

COPD is a life-threatening disease that killed around 3 million people in 2005 (around 5% of all deaths globally). Almost 90% of COPD deaths occur in low- and middle-income countries, due to tobacco smoke (primary cause) but also indoor and outdoor air pollution, occupational dusts and chemicals and frequent lower respiratory infections during childhood (WHO, 2013c). The total deaths from COPD are expected to increase by more than 30% in the next 10 years.

There are currently 347 million people worldwide who have ***diabetes***, and more than 80% of these people live in low- and middle-income countries (WHO, 2014e). Diabetes is a chronic disease that occurs as a result of the pancreas not producing enough insulin (type 1 diabetes), or when the body cannot effectively use the insulin it produces (type 2 diabetes). This latter type of diabetes, which accounts for 90% of all diabetes cases worldwide, is often the result from excess body weight and physical inactivity. It is predicted that the total deaths from diabetes will rise by more than 50% in the next 10 years, and that diabetes will become the seventh leading cause of death in the world by the year 2030 (WHO, 2014e).

The development of type 2 diabetes can be prevented or delayed by maintaining a normal body weight, having a healthy diet, regular physical activity and avoiding tobacco use. Data shows however, that in 2008, about 35% of the global population over 20 years old – 1.5 billion people – was overweight. Of these, over 200 million men and almost 300 million women were obese (about 11% of the population over 20) (WHO, 2013h). The share of people who are obese and overweight has been rising steadily, including among children: the number of children under 5 who are overweight was estimated at 40 million globally in 2011. In 2008, Central and South America, North Africa and the Middle East, Northern America and Southern Africa were the subregions with the highest prevalence of obesity (ranging from 27% to 31%) (FAO, 2013). In coming decades, obesity is expected to rise across the world; recent projections used by the World Bank indicate sharp increases in areas including Latin America, China and India (Figure 17).

**Figure 17: Projected obesity rates in selected areas**




*Source: World Bank, Food Price Watch, March 2013, p5*

More information on the key risk factors such as alcohol, tobacco and drug consumption can be found below in Box 8.

**Box 8: Alcohol, tobacco and drug consumption**

WHO estimates that **alcohol consumption** is responsible for about 4.5% of the world's global disease burden and 4% of mortality: it is thus one of the leading risk factors.[9] Alcohol consumption is linked to cirrhosis of the liver, several types of cancer as well as traffic accidents and other injuries. High levels of consumption are an important health threat; so are episodes of 'binge drinking', a concern in particular for young people (WHO, 2011e).

Europe is the world region with the highest per capita alcohol consumption, followed by North America. In a few countries, such as Russia, alcohol consumption is a major health problem. While global consumption has been more or less stable, it has increased in Africa and South East Asia. Moreover, under-age drinking (13 to 15 years old) also appears to be rising.

**Tobacco** is even more important, accounting for an estimated 6 million deaths per year, of which more than 10% result from second-hand smoke. Tobacco use is linked to 12% of all deaths, including communicable disease such as tuberculosis and other respiratory disease, as well as a range of non-communicable disease such as cancers. Smoking is particularly important among European men, where it is linked to 25% of all deaths (WHO, 2012a).

Countries around the world have put in place policy measures to control tobacco use: WHO reports that 2.3 billion people now live in countries that have put in place at least one effective control measures, such as increased prices, bans or restrictions on advertising and graphic warnings, compared to 1 billion people ten years ago. WHO reports that research results identify six types of effective measures, such measures include warnings of health impacts and taxes on tobacco products. The 2003 WHO Framework Convention on Tobacco Control identifies such measures and calls on Parties to implement them; it has been ratified by over 170 countries around the world (WHO, 2013n).[10] In developing countries such as India, tobacco control is projected to be among the most effective and efficient measures to reduce levels of mortality from heart disease and stroke (Basu et al, 2013).

**Psychoactive drugs** such as cocaine and heroin are a further health threat, along with a range of other substances including synthetic drugs and non-prescription uses of medicines such as tranquilizers. Statistics

[9] It should be noted that many types of disease, and in particular non-communicable diseases, have multifactorial backgrounds (EEA, 2013h&e)

[10] See also: http://www.who.int/fctc/en/index.html

are uncertain, however, as drugs are illegal in most countries. The UN estimates that 3.4% to 6.6% of the world's adult population used illegal substances at least once between 2005 and 2010, with one in ten users suffering dependence and disorders, and drug use kills between 100,000 and 250,000 people a year worldwide. Violence and corruption related to illegal drug trafficking bring further deaths and economic and social costs.

In coming decades, the UN suggests that drug use will increase in developing countries due to factors include rising populations and urbanisation as well as the ongoing global spread of western youth culture. Moves to legalise drugs such as cannabis in the US and other countries may also lead to higher consumption, as prices are expected to fall. However, WHO underlines that long-term trends and their impacts are very unpredictable and are open to a range of factors, including cultural changes (UNODC, 2012).

***Economics of non-communicable diseases***

This double burden of disease in developing countries is threatening to overwhelm the health systems in many low- and middle-income countries, resulting in economic losses of US$7.3 trillion over the next 15 years (see table 2) (WEF, 2011).

This loss is equivalent to approximately 4% of these countries' current annual output. On a per-person basis, the annual losses amount to an average of US $25 in low-income countries, US$ 50 in lower middle-income countries and US$ 139 in upper middle-income countries. The lost outputs for the four main NCDs are 51% for cardiovascular diseases, 27% for respiratory diseases, 21% for cancer and 6% for diabetes (WEF, 2011).

**Table 2: Economic burden of NCDs, 2011-2025 (trillions of US$ in 2008)**

*Source: World Economic Forum*
*http://www3.weforum.org/docs/WEF_WHO_HE_ReducingNonCommunicableDiseases_2011.pdf*

| Country income group | Diabetes | Cardiovascular diseases | Respiratory diseases | Cancer | Total |
|---|---|---|---|---|---|
| Upper middle | 0.31 | 2.52 | 1.09 | 1.20 | 5.12 |
| Lower middle | 0.09 | 1.07 | 0.44 | 0.26 | 1.85 |
| Low income | 0.02 | 0.17 | 0.06 | 0.05 | 0.31 |
| **Total of low and middle** | **0.42** | **3.76** | **1.59** | **1.51** | **7.28** |

But also in developed countries the estimated costs are significant. The approximate cost of cardiovascular disease in 169 billion Euros per year to the EU economy, and the estimated cost of respiratory diseases to the EU's economy amounts to 102 billion Euros per year (EuroHealthNet, 2006). When looking at the national level, 2.8 million people had diabetes in the UK and the estimated economic cost of treating this disease was estimated to be £1 million an hour (2010 data) (Novo Nordisk, 2011). The personal costs for people with diabetes were estimated to be £500 million a year, due to absence at work, cost of travel for medical treatment, and loss of employment or early retirement due to ill health. Additionally, one in 20 people with diabetes need assistance from social services at a cost of £230 million per year. The cost to the national economy of lost working time and early death as a result of diabetes was estimated for the UK to be £531 million in 2006 and rising to £780 million in 2026.

## 3.2 Persistence of communicable diseases

While non-communicable diseases like diabetes, cancer and cardiovascular disease are sweeping the globe, communicable diseases are still posing a significant threat to human health and international health security, especially in developing countries.

***Maternal and child health***

Communicable, maternal, neonatal and nutritional causes remain the dominant causes of years of life lost due to premature mortality (Lozano et al, 2012). An estimated 6.6 million children under the age of five died in 2012, and 44% of all child deaths occur within the first month of life (WHO, 2014b). Diarrhoeal diseases are a major cause of death among children under five in developing countries. There are nearly 1.7 billion cases of diarrhoeal disease every year; killing around 760.000 children (WHO, 2013d). These are caused by bacterial, viral and parasitic infections (such as rotavirus and *Escherichia coli)*, which are often spread by faeces-contaminated water.

A disease that causes an even higher mortality rate among children under five is lower respiratory infections such as pneumonia. Almost 2 million children die each year, of which 99% live in developing countries. Nearly half of the deaths among children under five years old from acute lower respiratory infections are due to air pollution, particularly indoor air pollution. For example, nearly 50% of pneumonia deaths among children under five are due to particulate matter inhaled from indoor air pollution (WHO, 2011f).

Children in sub-Saharan Africa are about over 16 times more likely to die before the age of five than children in developed regions (WHO, 2014b). Overall, substantial progress has been made towards achieving Millennium Development Goal (MDG) 4. Since 1990 the global under-five mortality rate has dropped from 90 deaths per 1 000 live births in 1990 to 48 in 2012. But the rate of this reduction in under-five mortality is still insufficient to reach the MDG target of a two-thirds reduction of 1990 mortality levels by the year 2015.

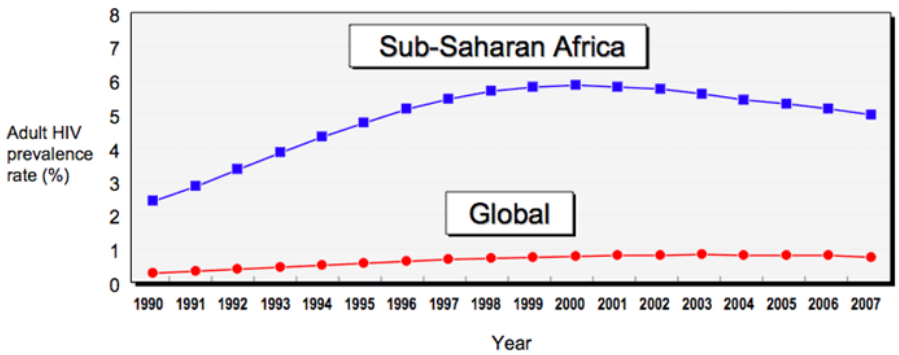
UNICEF and the World Health Organization recently published a Global Action Plan for the Prevention and Control of Pneumonia and Diarrhoea (GAPPD) - together these diseases are accountable for 29% of all deaths of children less than 5 years of age. The GAPPD aims to reduce mortality from pneumonia in children under 5 by 2025 to less than 3 per 1000 live births, and mortality from diarrhoea among children the same age group to less than 1 per 1000 live births (UNICEF, 2013).

***HIV/AIDS***

At the end of 2012, there were 35.3 million people living with HIV/AIDS in worldwide - this was a global prevalence (the percent of people aged 15-49 who are infected) of 0.8% (WHO, 2014f). Of those people, 2.3 million were newly infected cases, which equal 50 young women being newly infected with HIV every hour (UNAIDS, 2013). In 2012, 1.7 million people died of AIDS-related illnesses, including 230.000 children. The burden of this disease varies considerably between countries and regions; Sub-Saharan Africa being the region that is most affected with nearly 1 in every 20 adults living with HIV today (around 5% of the population). Of all people living with HIV/AIDS, 69% are living in Sub-Saharan Africa – see figure 18 (WHO, 2014f).

**Figure 18: Estimated adult (15-49 years) HIV prevalence rate globally and in Sub-Saharan Africa, 1990-2007**

*Source: WHO, UNAIDS: http://web.mit.edu/cis/fpi_disease.html*




Due to a 40-fold increase in access to antiretroviral therapy, there has been a 33% decrease in overall new HIV infections since 2001 and a 52% decrease in new HIV infections in children. AIDS related deaths have

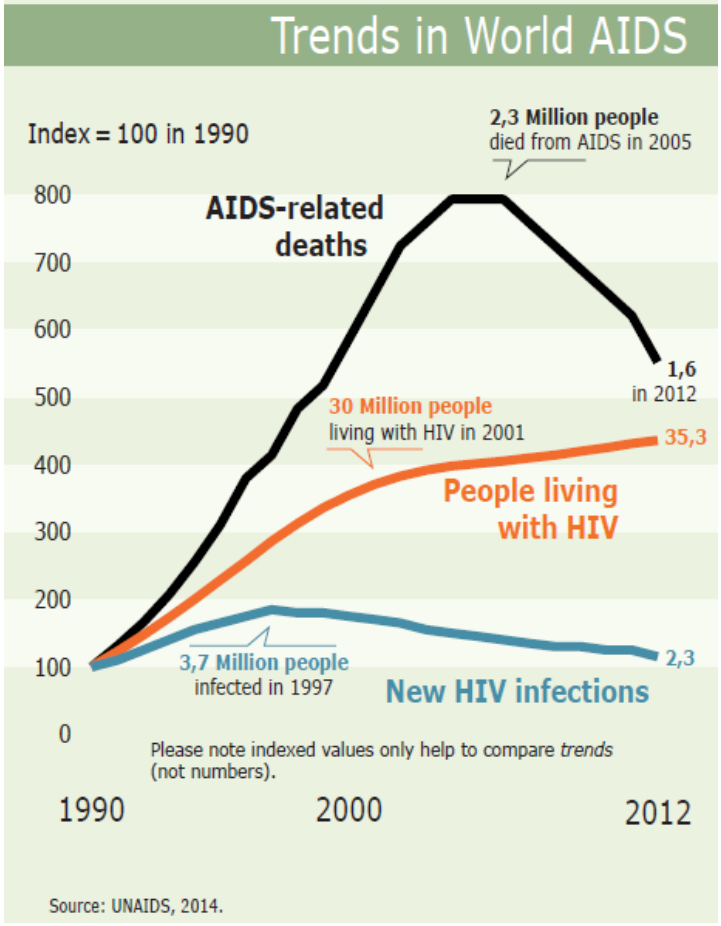
decreased by 29% since 2005 (UNAIDS, 2013). Nearly 10 million people in low- and middle-income countries received antiretroviral therapy in 2012 and the incidence of HIV is currently declining in most regions (UN, 2013a). Efforts are being made by governments and international organisations such as the United Nations and the World Health Organization to further decrease the prevalence of HIV/AIDS and to reverse its spread – one of the UN Millennium Development Goals. As shown in figure 19, the number of new HIV infections and deaths due to AIDS globally is decreasing, while the number of people living with HIV is increasing due to better access to antiviral therapy.

HIV transmission among people who inject drugs is however not decreasing, and evidence suggests little change in the HIV burden in this population (UNAIDS, 2013). Studies show that in countries from Eastern Europe, Central Asia and South Asia, HIV incidence among this group is even growing, mainly due to low coverage of sterile syringes for people who inject drugs. HIV prevalence among people who inject drugs in Asia is around 28% (World Bank, 2013).

***Tuberculosis***

After HIV, tuberculosis (TB) is the greatest infectious killer due to a single infectious agent, such as bacteria, viruses or prions, in the world today. In 2012, 8.6 million people developed TB, of which 1.3 million people died from tuberculosis. Additionally, the risk of developing tuberculosis is estimated to be between 12-20 times greater in people living with HIV. Studies suggest that around one third of the HIV-positive people in the world are co-infected with this disease (Red Cross, 2014). TB is the leading cause of illness and death among people living with HIV in Africa and a major cause of death in HIV-positive people living elsewhere. In 2011, there were 8.7 million new cases of TB, of which 1.1 million were among people living with HIV (WHO, 2013m). However, due to increased efforts and scaling up of HIV/TB programmes, rates have declined by 36% worldwide since 2004 (UNAIDS, 2013).

**Figure 19: New HIV infections, AIDS deaths and people living with HIV – Global, 2001-2012**



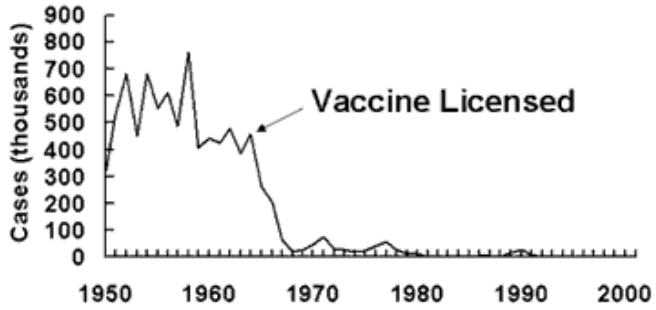
One in three of the global population have latent TB infection, which means they don't feel sick, they are not contagious and don't have any symptoms, but only about 10% of them will go on to develop the disease. If the disease goes untreated, each person with an active infection by *Mycobacterium tuberculosis* infects, on average, 10-15 other people each year. Mortality rates due to this disease have fallen by 41% since 1990, but tuberculosis has re-emerged to become more common in some developed countries where it had historically been reduced to very low levels. This is in many cases linked to migrants from areas with high levels of health inequalities. The International Organization on Migration and other international agencies have developed programmes to identify and address TB and other serious health threats among migrant populations (IOM, 2013). The Global Plan to Stop TB 2011-2015 of the World Health Organization is a roadmap of the Stop TB Partnership that was established in 2000 as a global movement to accelerate social and political action to stop the spread of TB around the world.

Of growing concern is the resistance to antimicrobial medicines, as multi-drug resistant TB is virtually present in all countries. Further details about multi-drug resistant TB can be found in section 3.3.

***Measles***

Despite the availability of an effective vaccine, this highly contagious disease caused by a virus remains one of the leading causes of death among young children. In 2012, more than 20 million people were affected by measles, of whom 122,000 people died (mostly children under five) – this is about 14 deaths an hour (WHO, 2013g). While global measles deaths have dropped from 562,400 deaths in 2000 to 122,000 in 2012 – this is a decrease of 78% - it is still a common disease in developing countries, particularly parts of Africa and Asia. The measles vaccine has been on the market for 50 years and has been very effective in the elimination of the disease - the impact of the introduction of the first measles vaccine in the US in the early 1960s is shown in figure 20.

**Figure 20: Measles, United States (1950-2001)**




*Source: CDC, http://www.cdc.gov/vaccines/vac-gen/6mishome.htm*

## 3.3 Growing risks of pandemics

Populations around the world have always been under constant threat from emerging and re-emerging infectious diseases. While monitoring and alert systems within and between countries have been put in place and medicine and technology are advancing to meet new diseases with the right treatments, significant risks still exist. Pandemics such as SARS and the H1N1 influenza virus have shown us that viruses can rapidly mutate and jump from between species – the interface between humans and animals is now the source of 75% of new diseases - , and that infections can quickly spread due to high levels of international movement. A report by the World Health Organization in 2011 described the world as "*ill-prepared to respond to severe pandemics or any other similar global, sustained and threatening public health emergency*"[11].

[11] http://apps.who.int/gb/ebwha/pdf_files/WHA64/A64_10-en.pdf

A recent WHO report on antimicrobial resistance highlights several key trends (WHO, 2014a):

- High rates of resistance for bacteria that commonly cause infections, including in hospitals
- Malarial resistance to artemisinin in several locations, a development that could endanger recent gains in malaria control
- Increasing levels of resistance to anti-HIV drugs
- Significant gaps in surveillance of antimicrobial resistance.

**Table 3: The outbreaks of SARS, Avian influenza and Swine flue**

| | | | Origin | Countries infected | People infected globally | Deaths globally |
|---|---|---|---|---|---|---|
| ***Nov 2002 - July 2003*** | **Severe Acute Respiratory Syndrome (SARS)[12]** | **Coronavirus** | Hong Kong | 29 | 8 096 | 774 |
| ***Feb 2003 - ongoing*** | **Avian influenza[13,14]** | **Bird-origin H5N1 virus** | Hong Kong | 16 | 650 | 386 |
| ***April 2009 – Aug 2010*** | **Swine flu[15,16]** | **Swine-origin H1N1 virus** | Mexico | 190 | >500 000 | 18 036 |

*Source: World Economic Forum*
*http://www3.weforum.org/docs/WEF_WHO_HE_ReducingNonCommunicableDiseases_2011.pdf*

***Viral pandemics***

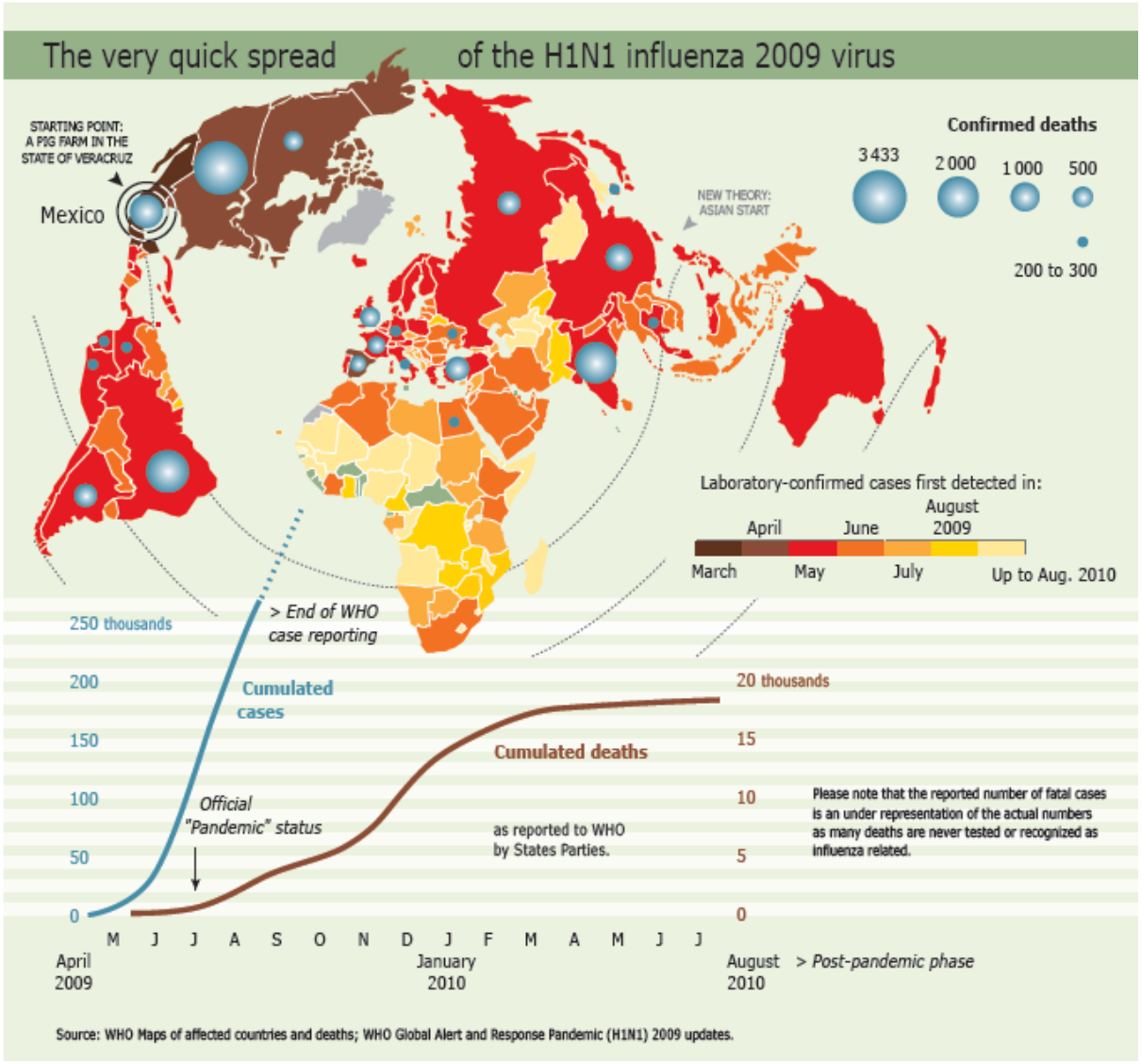
The spread of viruses, such as influenza, occur regularly and while they are unpredictable they can have significant consequences on human health and economic well-being worldwide. During the past decade, there have been various global outbreaks of viruses (see Table 3) such as the Severe Acute Respiratory Syndrome (SARS) in 2003 caused by the coronavirus, avian influenza, which was caused by the H5N1 virus adapted to birds and which spread throughout Asia and the Middle East in 2003 and reached Europe in 2005, and the 'Swine flu' pandemic in 2009, which was a new strain of swine-origin H1N1. During November 20002 through July 2003, a total of nearly 8100 people worldwide became sick due to SARS and of these, 774 died.[17] Since 2003, nearly 600 human infections of H5N1 have been reported from 15 countries, and about 60% of these people died from their illness.[18]

The H1N1 virus has been the most severe viral pandemic since the beginning of the twenty-first century, as it killed more than 18,000 people from over 214 countries since it first appeared in April 2009.[19] The World Health Organization announced in August 2010 that the H1N1 influenza virus had officially moved into the post-pandemic period. However, localized outbreaks of various magnitudes still continued. Figure 21 shows the rapid outbreak of the H1N1 virus around the world within a few months' time, causing many people to fall ill or to die as a result of their infection.

A range of factors is fuelling the risks of such outbreaks; among these are migration and the growing trade and travel connections in an increasingly interconnected world. More information on the health risks as a result of migration and international travel can be found in chapter 2.

[12] http://www.who.int/csr/sars/country/table2004_04_21/en/index.html
[13] http://www.who.int/influenza/H5N1_avian_influenza_update_20121217b.pdf
[14] http://www.who.int/influenza/human_animal_interface/EN_GIP_20140124CumulativeNumberH5N1cases.pdf
[15] http://kff.org/global-indicator/h1n1-influenza-swine-flu-cases/
[16] http://www.who.int/csr/disease/swineflu/laboratory14_05_2010/en/index.html
[17] http://www.cdc.gov/sars/about/faq.html
[18] http://www.flu.gov/about_the_flu/h5n1/
[19] http://www.who.int/csr/don/2010_05_14/en/index.html

**Figure 21: Outbreak and spread of the H1N1 influenza virus in 2009**




***Resistance to antibiotics***

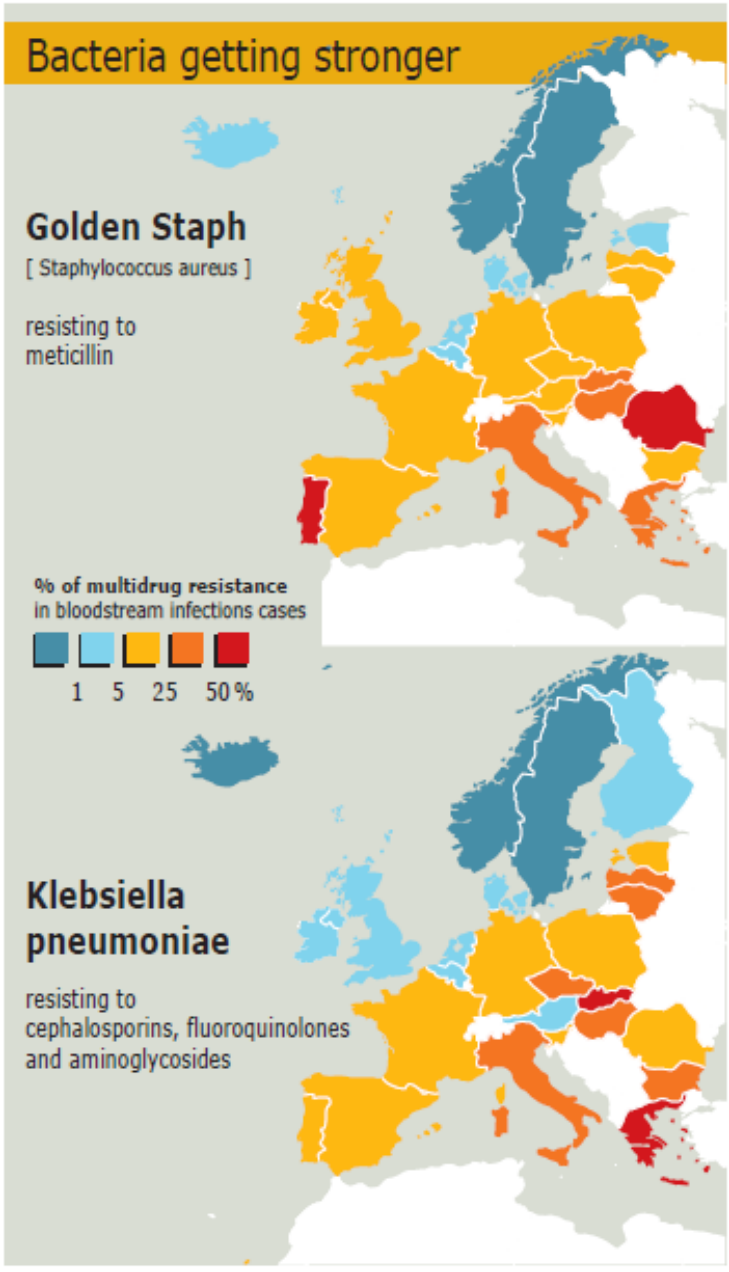
Another factor that can contribute or cause the outbreak of a range of infectious diseases is the development of resistance to, for example, antibiotics. While the use of antibacterial and antimicrobial compounds has been one of the most effective and common means to protect human health, it may no longer be readily available in the near future. Evidence suggests that medical research and innovation are not able to keep up with and stay ahead of the genetic mutation curve of bacteria, and new antibiotics developed often turn out to be ineffective. For example, none of the drugs that are currently in the development pipeline are effective against certain bacteria that have developed an emerging resistance to our strongest antibiotics and that have fatality rates of up to 50%.[20]

Worrying projections are starting to appear of antibiotic-resistant bacteria. The meticillin-resistant *Staphylococcus aureus*, better known as MRSA and a source of infection in particular in hospitals, is stabilizing and possibly decreasing, but not as sharply as had previously been projected. A strain of *Enterobacteriaceae*, a source of bladder, lung and blood infections, has become resistant to all antibiotics (McKenna, 2013). In the USA, it is estimated that two million people a year become infected with bacteria that are resistant to at least one antibiotic; direct deaths are estimated at over 20,000 a year (CDC, 2013). Additionally, as shown in

[20] Borer, A., Lisa Saidel-Odes, M. D., Riesenberg, K., et al. Attributable Mortality Rate for Carbapenem-resistant Klebsiella Pneumoniae Bacteremia. *Infection Control and Hospital Epidemiology*, 2009, 30:972-6.

figure 22, in Europe there is a widespread increasing trend for *Klebsiella pneumonia.* Experts are therefore starting to prepare for situations in which all antibiotics will be ineffective, even for treating the most common infections. It is likely that such scenarios will result in a significant spread of antibiotic-resistant bacteria with high mortality rates globally.[21]

**Figure 22: Percentage of bloodstream infections showing multi-drug resistance, EU/EEA, 2011 and trends for 2008-2011**




Source: European Center for Disease Prevention and Control, EARS-Net, 2012.

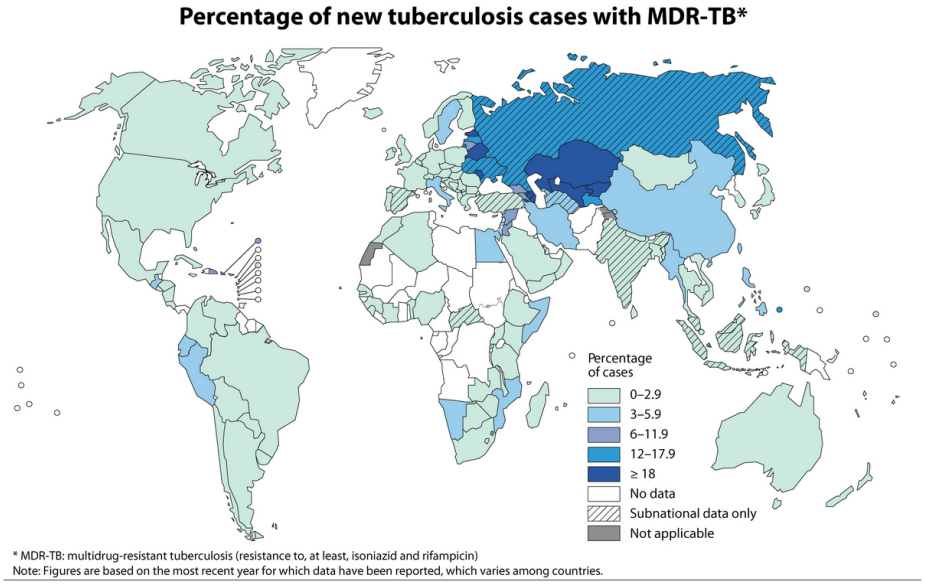
The impact of resistance to antibiotics on human health will be highest in developing countries, where poor hygiene, polluted water supplies, civil conflicts and overcrowded urban areas are more common – conditions which will all facilitate the spread of bacteria. Moreover, people with HIV/AIDS or affected by malnutrition will be particularly vulnerable to develop (fatal) infections. But the resistance to antibiotics will also have a significant impact on high-income countries, as people here depend on the use of antibacterial and antimicrobial compounds as well. Antibiotics are used to guard against infection during medical procedures

[21] World Economic Forum, Insight Report: Global Risks 2013 – Eight edition (2013)

such as organ transplantation, immune-modulating therapy and surgeries that are required as a result of chronic diseases such as diabetes and hypertension. As discussed previously, with ageing populations and increasing rates of non-communicable diseases globally, the need for effective antibiotics for such needed medical interventions will be growing.[22]

Antibiotic-resistant infections will result in significant costs for the health care systems. In the US, the annual cost to its health care system is estimated at US$21-34 billion and the number of days of lost productivity in Europe due to the spread of antibiotic-resistant bacteria is estimated at 600 million.[23,24] Moreover, antibiotic-resistant bacteria could affect our livestock, probably resulting in shortages of food and restrictions on trade in case we won't be able to treat infections. Pandemic outbreaks of such bacteria will thus have the potential to destabilize healthcare systems, and will have significant implications for economic and social systems.[25]

**Figure 23: Share of multi-drug resistant tuberculosis among new cases**




*Source: WHO (2013a) (Manu to revise)*

***Multi-drug resistant tuberculosis***

The resistance to antimicrobial medicines is of particular concern in the case of tuberculosis (TB) (for more information about tuberculosis see chapter 2.2), as multi-drug resistant TB is virtually present in all countries surveyed by the WHO.[26] The share of new cases resistant to at least two of the key drugs used for treatment (isoniazid and rifampicin), rose to about 5% in 2011 and are seen in over 80 countries. As shown in figure 23, the rates of new cases with multi-drug resistant TB (MDR-TB) rates are even higher in some regions of the world. About 10% of the MDR-TB cases are also resistant to the two most important second-line drug classes. By September 2013, 92 countries had reported at least one such case of 'extensively drug-resistant TB' (XDR-TB).[27]

***Outbreaks of vector-borne diseases***

Rising temperatures, human exploitation of tropical rainforests, deforestation, population growth, increasing immigration and international air travel and tourism to tropical regions contribute to increased incidences of

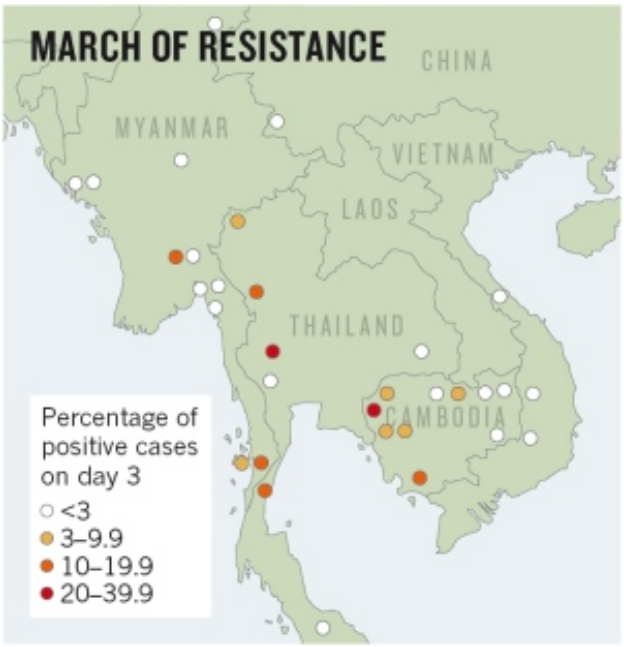
[22] World Economic Forum, Insight Report: Global Risks 2013 – Eight edition (2013)
[23] Spellberg, B., Blaser, M., Guidos, R. J., et al. Combating Antimicrobial Resistance: Policy Recommendations to Save Lives - Clinical Infectious Diseases: an Official Publication of the Infectious Diseases Society of America, 2011, 52:S397-428.
[24] White, A.R. Effective Antibacterials: at What Cost? The Economics of Antibacterial Resistance and its Control - Journal of Antimicrobial Chemotherapy, 2011, 66(9):1948-53.
[25] World Economic Forum, Insight Report: Global Risks 2013 – Eight edition (2013)
[26] http://www.who.int/mediacentre/factsheets/fs104/en/
[27] http://www.who.int/tb/challenges/mdr/mdr_tb_factsheet.pdf?ua=1

diseases such as malaria and dengue. Although the full global burden and risks of pandemic outbreaks of these diseases is uncertain, both present alarming patterns for both human health and the global economy.

The most deadly vector-borne disease globally is **malaria**. About half the world's population is currently at risk of getting malaria and, according to the latest estimates released in December 2013, there were around 207 million cases of malaria in 2012 and an estimated 627.000 deaths; 86% of them being children under the age of five years (WHO, 2013g). While malaria mortality rates have dropped by 45% globally since 2000 and by nearly 50% in the WHO African Region, malaria still claims a child's life every minute in Africa (WHO, 2013g). It is a significant and life-threatening disease and drug resistance poses a growing problem in the treatment of malaria (see section 2.3).

Drug resistance in the treatment of malaria poses a growing problem. Resistance has developed to every antimalarial medicine used so far and the malaria burden rebounded due to consequent treatment failures.[28] Moreover, in recent years, parasite resistance to the drug artemisinin - the key component of all artemisinin-combination therapies (ACTs), which are currently the best available anti-malarial drugs - has been detected in the Greater Mekong sub-region (figure 24). When used in combination with one of several other malaria drugs, ACTs typically vanquish the malaria parasite *Plasmodium falciparum* from people's blood within two days. But from the early 2000s health officials noticed malaria cases that took up to five days to clear, and some strains were completely unaffected by artemisinin. If resistance to artemisinins will further develop and spread to other large geographical areas, the consequences could be tremendous, as no alternative antimalarial medicines will be available for at least five years.[29,30] According to an article recently published in Nature: "*If full-blown artemisinin resistance were to reach Africa, it could be, truly, a global health catastrophe*".[31]

**Figure 24: March of resistance in the treatment of malaria – Greater Mekong sub-region**




*Source: Callaway E, Nature (18 December 2013) - http://www.nature.com/news/resistance-gene-identified-in-malaria-parasite-1.14404*

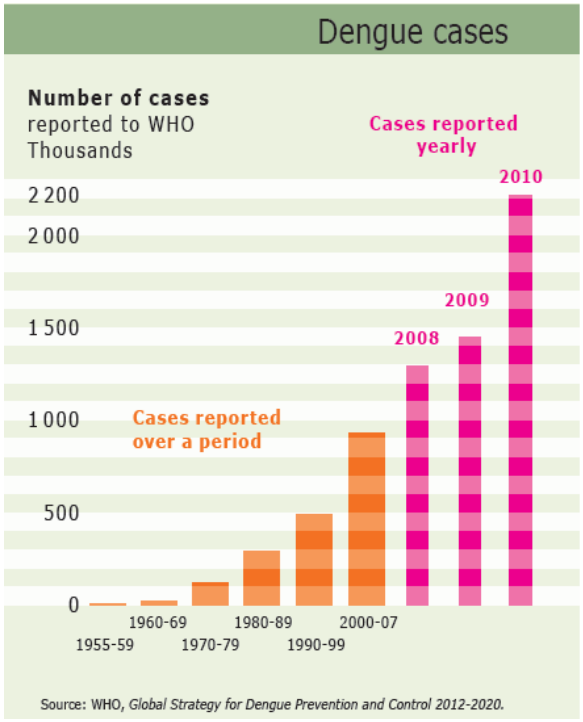
**Dengue fever**, together with associated **dengue haemorrhagic fever** (DHF), is the world's fastest growing vector borne disease. The worldwide incidence of dengue has risen 30-fold compared to the situation 50 years ago (see figure 25), and an increasing number of countries are reporting their first outbreaks (WHO, 2012b).

[28] World Health Organization: Global report on antimalarial drug efficacy and drug resistance, 2000–2010
[29] http://www.who.int/mediacentre/factsheets/fs094/en/
[30] World Health Organization: Global Plan for Artemisinin Resistance Containment (2011)
[31] http://www.nature.com/news/resistance-gene-identified-in-malaria-parasite-1.14404

In 2012, the geographical distribution of dengue included more than 125 countries – countries at risk of dengue transmission are shown in figure 26. The burden of disease of dengue is significant, and is similar in some regions to that of malaria or hepatitis.[32] Almost half of the world's population is living in areas where dengue is endemic, and currently close to 75% of the global population exposed to dengue are living in the Asia-Pacific region. Dengue caused an explosive outbreak in 2008 in the state of Rio de Janeiro in Brazil as a result of heavy rains, causing more than 158.000 reported cases with over 9.000 hospital admissions and 230 deaths within the first 4 months of 2008.[33]

The WHO estimates that around 50-100 million dengue infections occur annually, including 500,000 life threatening infections and 20,000 deaths. It is estimated that 264 disability-adjusted life years per million population per year are lost due to the disease and the healthcare cost of for each ambulatory and hospitalized case is estimated at US$ 514–1394 (WHO, 2012b). These numbers are probably underestimations, as severe underreporting and misclassification of dengue cases have been documented. Dengue can cause explosive local outbreaks due to, for example, extreme weather circumstances. There is currently no vaccine or medication available that protects against dengue fever.

**Figure 25: Average number of dengue and severe dengue cases reported to WHO annually in 1955-2007 and number of cases reported in recent years, 2008-2010**

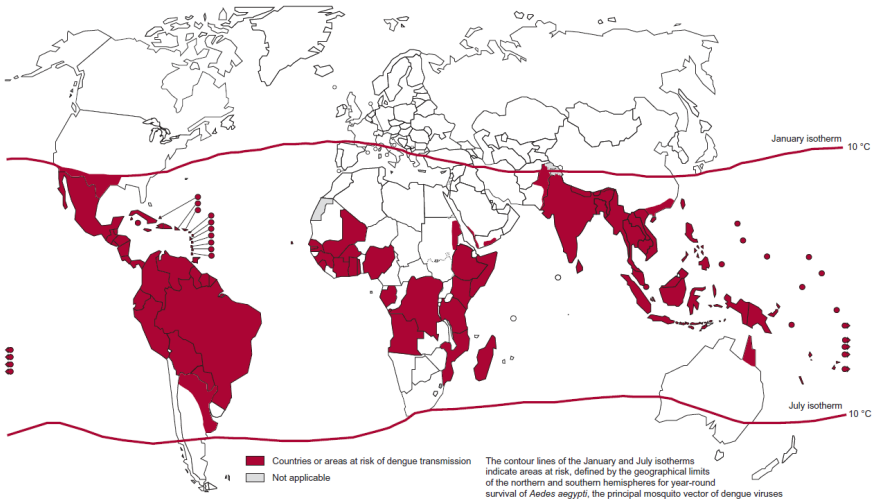



A driver that will influence the prevalence of infectious diseases such as malaria and dengue is climate change. Natural disasters and extreme weather conditions can have a significant impact on the vector breeding sites and vector-borne disease transmissions. Standing water as a result of heavy rainfall or overflow of rivers can create new breeding sites – this is a well-known phenomenon in the case of malaria. For example, periodic flooding linked to El Nino-Southern Oscillation has been associated with malaria epidemics in the dry coastal region of northern Peru.[34] Dengue transmission is not directly associated with flooding but is influenced by weather conditions such as rainfall and humidity.[35]

[32] http://apps.who.int/iris/bitstream/10665/75303/1/9789241504034_eng.pdf
[33] http://apps.who.int/iris/bitstream/10665/75303/1/9789241504034_eng.pdf
[34] Gagnon AS, Smoyer-Tomic KE, Bush AB. The El Nino southern oscillation and malaria epidemics in South America. *International Journal of Biometeorology*, 2002, 46:81–89.
[35] http://www.who.int/diseasecontrol_emergencies/guidelines/CD_Disasters_26_06.pdf

**Figure 26: Global distribution of countries or areas at risk of dengue transmission, 2011**

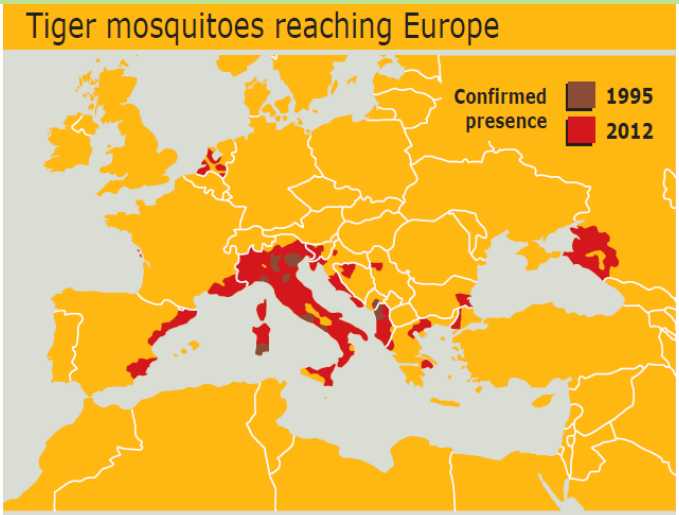
*Source: WHO, international travel and health, interactive map - [http://apps.who.int/ithmap/](http://apps.who.int/ithmap/)*




**Box 9. Disease vectors in Europe**

Rising temperatures will also influence the latitude and altitude limits of most vector-borne diseases. For example, the geographical distribution of disease-transmitting ticks in Europe has changed since the early 1980s and ticks are now found at higher latitudes and altitudes where the seasons were previously too short or too cold for ticks to survive and establish new populations. Additionally, Asian tiger mosquitoes, which are capable of spreading dengue fever and other tropical diseases, are now established in Southern Europe and are likely to spread further in Europe with climate change (Figure 27) (ECDC, 2010).

**Figure 27: Asian tiger mosquito in Europe**




## 3.4 Persistent health inequalities between and within countries

While the average life expectancy and level of health has improved globally over the last decades, significant differences still exist between and within countries. Nearly half the world's under-five deaths are concentrated in Sub-Saharan Africa[36], and while a child born in Sierra Leona has a life expectancy of 47 years, a child in Japan

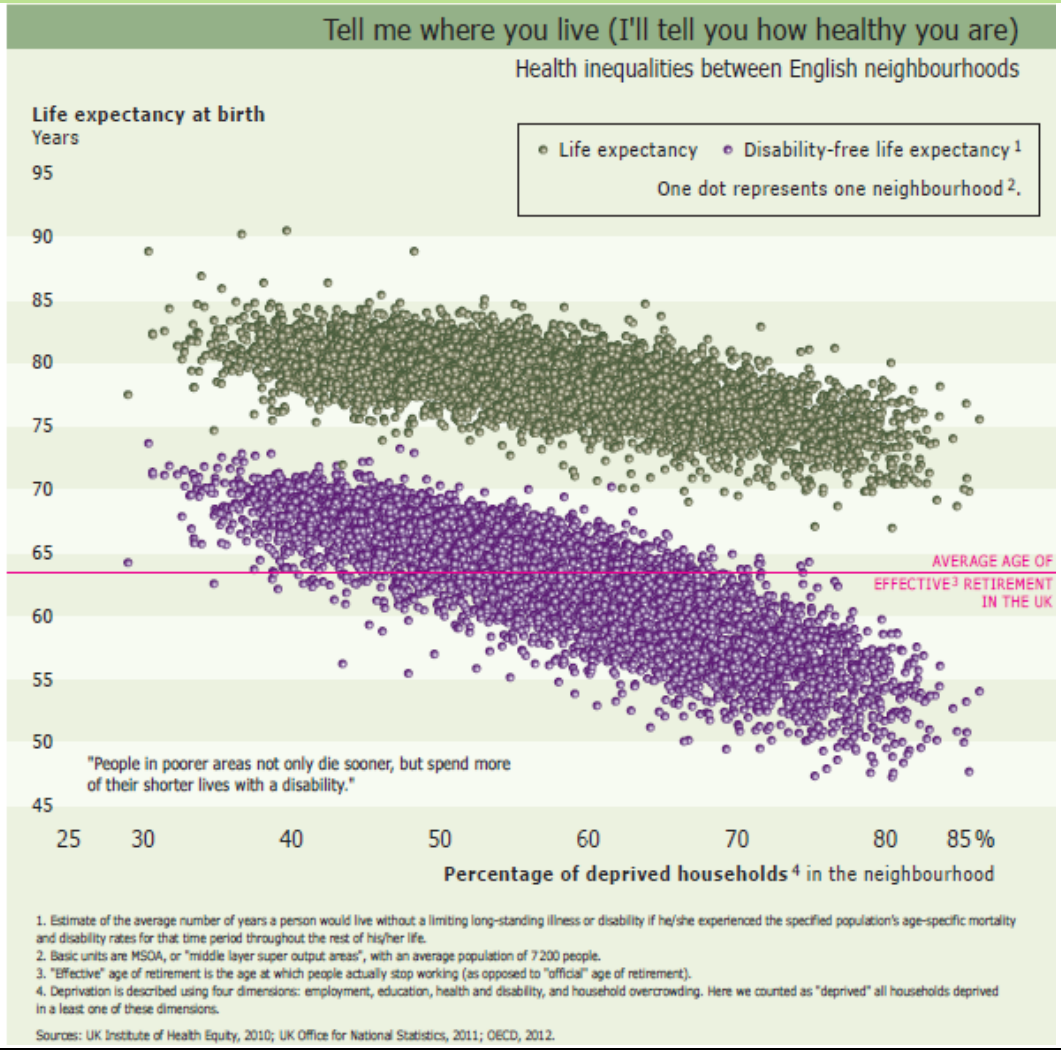
[36] UNICEF, WHO, The World Bank, United Nations: Levels and Trends in Child Mortality (2013)

can expect to live 36 years more[37]. Also within countries disparities exist, as people with lower levels of education, lower occupational classes and lower levels of income have a higher prevalence of health problems and tend to die at a younger age. For example, a child born in Bangladesh to a woman with no education has an infant mortality rate of 71%, while a child with to a woman with secondary education level or higher has a probability of dying between birth and age 1 of 41%[38].

**Box 10. Health inequities within European countries**

Health inequalities are seen within European countries, and are sometimes striking. Figure 28 shows the health gradient of neighbourhoods in England, UK. This means that the higher a person's socio-economic status, the healthier he/she is likely to be.

**Figure 28: Life expectancy and disability-free life expectancy (DFLE) at birth, persons by neighbourhood income level in England (1999-2003)**




These disparities in health outcomes between population groups are referred to as health inequalities, and are due to differences in a wide range of conditions affecting not only affect access to healthcare services but also more general life conditions. These are the so-called socio-economic determinants of health, which are a range of interacting factors that shape health and well-being. As shown in Figure 1, these conditions can be individual lifestyle factors, but also factors influenced by social and community networks, the broader living and working conditions such as level of education, housing, and water and sanitation, and the general socioeconomic, cultural and environmental conditions that people live in. Gender and race can have an

[37] World Health Organization: Global Health Observatory Data Repository – Life expectancy by country (2011)
[38] World Health Organization: Global Health Observatory Data Repository – Child Mortality: Education level by country (2007)

additional bearing on the health status of people, and the combination of poverty with other vulnerabilities such as childhood, old age, disability or minority background can further increase health risks.

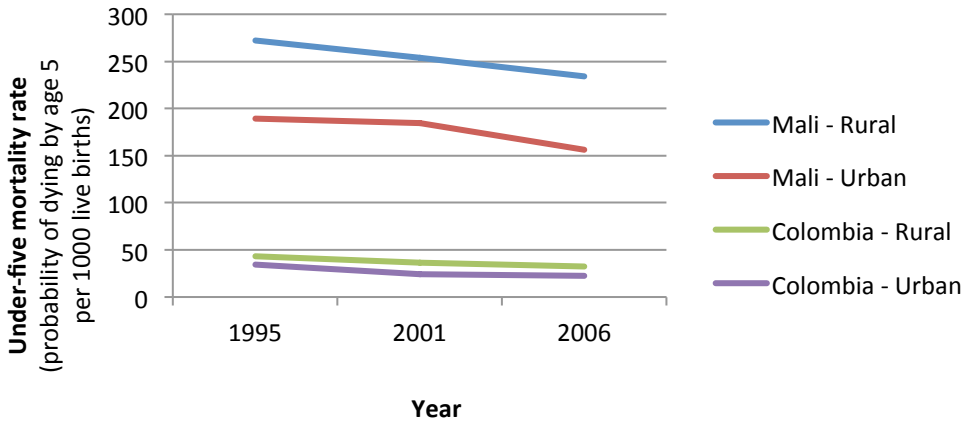
Although there is limited quantitative information available relating to inequalities, some data indicate a slight decline in inequalities in health across the globe: the UN's Human Development Report (HDR) found decreases in inequalities in health (and education) between 1990 and 2010 in all regions of the world, however this was offset by rising inequality in income. The overall inequality decline was therefore only marginal. The declines in inequalities in health were strongest in several developing regions, especially in South Asia; they were weakest in developed countries including those of Europe (UN, 2013c). Among the factors for change are improvements in education, especially for women, and declines in poverty levels.

As the level of health inequalities are influenced by a wide range of determinants, which often lie outside the scope of the health sector or even beyond our own direct control, it is difficult to fully understand whether overall levels are decreasing or increasing or if only part of the problem is being measured. For example, trends in health inequalities in terms of access to health care will be different compared to health inequalities that are measured against more 'social' indicators (e.g. access to education, social integration, housing conditions and living environments). This is confirmed by a study by J. Beckfield et al, which showed that there is a substantial variation in health inequalities when these are measured according to income, education, sex or migrant status. They argue that, while cross-country studies often describe average population health as the central outcome, it is important to focus on inequalities in health as cross-national variables that are sensitive to social conditions (Beckfield et al, 2013).

Additionally, it is important that cross-country studies not only consider country averages but also study trends at the local and regional level. While country averages of health inequalities might be declining, certain regions within countries might be experiencing significant increases in levels of health inequalities. Studying these trends at the lower level will thus help us to better understand trends and the impact policies and programmes might have on inequalities in health.

Large disparities in health are also found between rural and urban areas and neighbourhoods. For example, in many countries around the world, inhabitants from rural areas have less access to safe water and sanitation and limited access to healthcare services resulting in worse health outcomes. Different income levels have an impact on the health status of people as well. As shown in figure 29, a gap exists in under-five mortality rates between countries from different income groups (as defined by the World Bank) such as Mali and Columbia. But within countries health inequalities exist too; in Mali, a child born in a rural area has a probability of dying before reaching the age of five of 234/1000 while a child born in an urban area has a probability of 156/1000. This graph also shows that while under-five mortality rates have decreased in both countries, the gap between the rural and urban areas has barely closed up.

**Figure 29: Under-five mortality rate between and within countries**

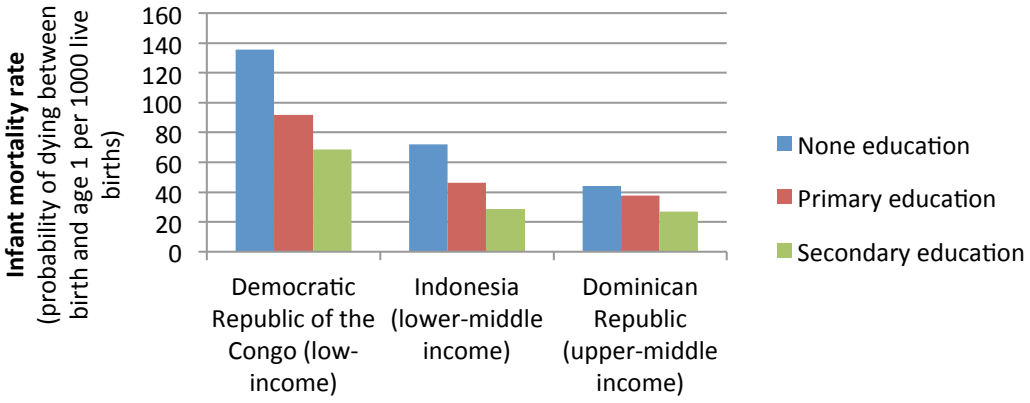



*Source: WHO, World Health Statistics*

The impact of education on health outcomes within countries from different income level is presented in figure 30. While there is a divide in infant mortality rates between disadvantaged and wealthier countries, significant inequalities exist within countries as well. The graph shows that the higher the educational level,

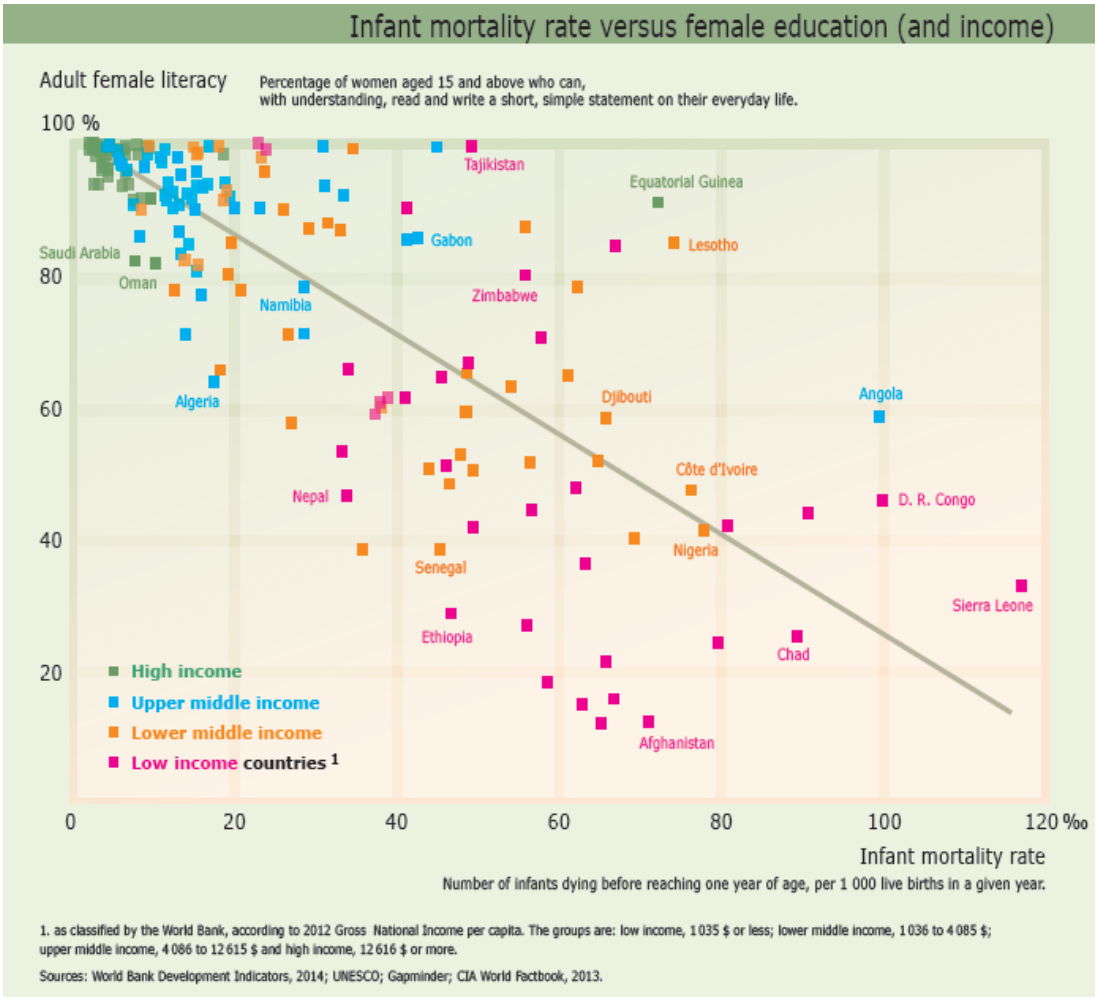
the lower the chance of a child dying before the age of one year old. Of particular importance is the level of female education (see Figure 31).

**Figure 30: Infant mortality rates, by income group and educational level**




*Source: WHO, World Health Statistics*

**Figure 31: Infant mortality rates and female education**

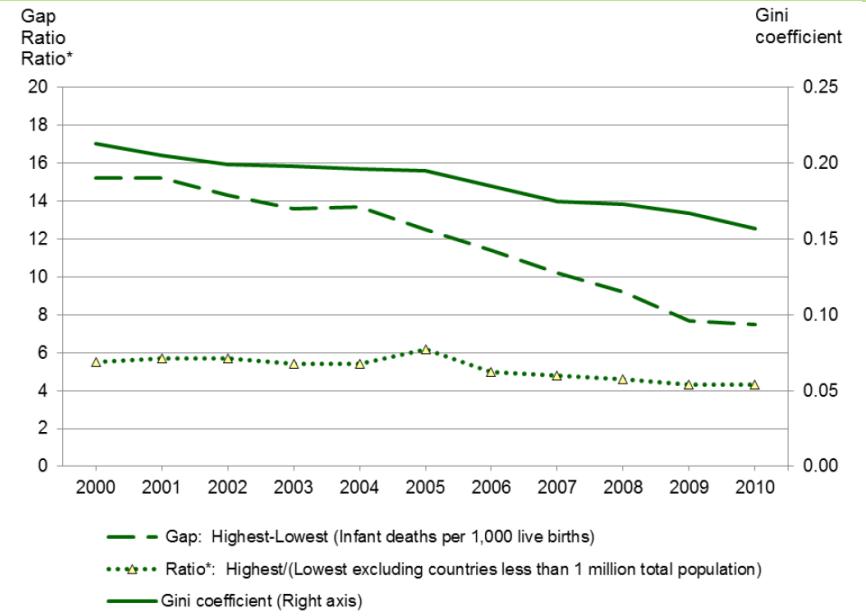



Major inequalities remain both within some European countries (as seen in Box 10 above) as well across countries (see Box 11).

**Box 11. Health inequalities across European countries**

A recent report by the European Commission confirms that significant health inequalities still exist between and within EU Member States, and that the size of the problem in 2013 was similar to the situation in 2006. Infant mortality rates have however decreased by 26% between 2000 and 2010, and the mortality of children aged less than 15 has gone down too (35% for males and 27% for females). The study used the Gini coefficient measure to quantify inequalities in income distributions, as shown below in figure 32. When applied to health outcomes, the Gini coefficient shows how unevenly health is distributed according to population share. It takes a value between zero and one (or 100 %), where zero indicates perfect equality and one indicates 'ultimate inequality'.

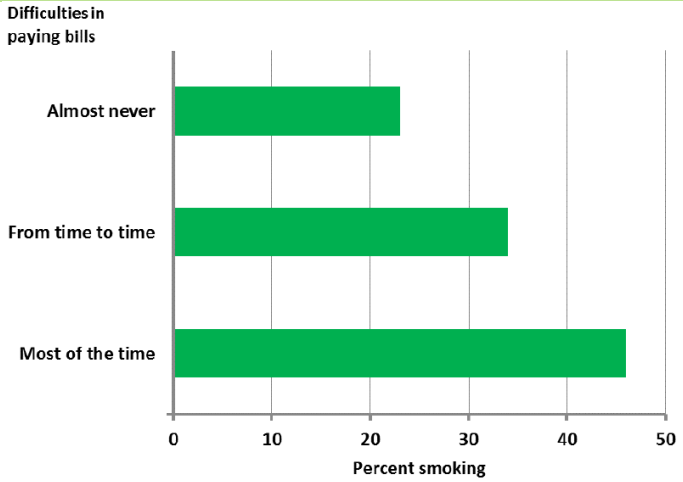
**Figure 32: Inequality in infant mortality between EU Member States, 2000-2010**




*Source: European Commission (2013), Health inequalities in the EU — Final report of a consortium led by Sir Michael Marmot - http://ec.europa.eu/health/social_determinants/docs/healthinequalitiesineu_2013_en.pdf*

The European review also found associations between risk factors such as tobacco use and obesity and socio-economic circumstances, showing that lack of control, stress and reduced capabilities have a strong influence on health and health-related behaviours (see figure 33).

**Figure 33: Correlation between people having difficulties in paying bills and smoking**




*Source: European Commission (2013), Health inequalities in the EU — Final report of a consortium led by Sir Michael Marmot - http://ec.europa.eu/health/social_determinants/docs/healthinequalitiesineu_2013_en.pdf*

Lack of access to healthcare is another major concern in relation to health inequalities, in particular but not only in developing countries. According to the World Health Organization, each year an estimated 150 million around the world face financial ruin to pay for medical expenses (WHO, 2013i). Surveys undertaken by WHO from 2007 to 2011 indicated that in the public sector, the average availability of generic medicines in low- and middle-income countries was only 52%[39]. Due to this scarcity, people are forced to turn to the private sector to obtain their medication, where prices are often significantly higher. WHO showed that the cost of the lowest priced generic medication in the private sector was on average five times the international reference price and in some countries the price was even up to 14 times more expensive. Due to the low availability and high prices in the private sector, people from the low-income households therefore do not always have access to the treatments and medications they need. Especially patients from lower socio-economic groups with chronic diseases, who require long-term treatment, are particularly vulnerable to such difficulties.

Overall, spending on health care varies greatly across regions of the world, and is more than 20 times higher in WHO's Americas region than in the African region. The number of health professionals, such as physicians, per population, also varies greatly, with more than 10 times as many per capita in WHO's European region than in the African region (see the table below).

**Table 4 Physicians and health expenditures by WHO region, 2010**

| WHO region | Physicians per 10 000 population | Health expenditures | |
|---|---|---|---|
| | | % GDP | USD/cap PPP |
| African | 2.5 | 6.2 | 154 |
| Americas | 20.4 | 14.3 | 3454 |
| SE Asia | 5.5 | 3.6 | 125 |
| European | 33.3 | 9.3 | 2282 |
| E. Medit. | 10.8 | 4.5 | 326 |
| W. Pacific | 15.2 | 6.4 | 650 |

Source: WHO, 2013o

In its twelfth general programme of work (2013), the WHO states that "*as the first decade of the twenty-first century has progressed, instead of shared prosperity, globalization has been accompanied by widening social inequalities*"[40]. The report sets out that while globalization has been beneficial to parts of the population in many countries as they could improve their living standards, it has superimposed upon pre-existing problems and inequities. The ongoing economic crisis, moreover, has also taken a toll on households around the world (see Box 12 below). Current policies and institutions have failed to ensure a balance between economic, social and environmental concerns, and as a result, the pursuit of economic growth has been too often seen as an end in itself. It emphasises that inequities are still persisting, both within and between countries and both as regards access to health services and in health outcomes. Health inequalities are not only a concern in its own right, but it can also act as a constraint to other aspects of economic and social development.

**Box 12: The impact of the global economic crisis**

Recent (post global economic downturn) analysis points to another global health trend: that a common "coping mechanism" of those impacted by low employment and poverty caused by the jobs crisis is reduced expenditure on healthcare (UNICEF, 2012): "in a number of developing countries, in particular, households have consistently reported lower healthcare spending and service utilization, which has exposed many people to a higher risk of sickness, disability or even death". The same report indicates that "*there is also ample evidence that unemployment can cause serious physical and mental impacts. In general, unemployment has been shown to increase susceptibility to physical illness, mental stress and loss of self-esteem, and ultimately lead to severe depression*" (UNICEF, 2012).

Additionally, the twelfth work programme of the WHO reports that the global economic crisis has resulted in some developed countries in a decrease in public spending. This puts the social contract between people and

[39] http://www.who.int/nha/docs/world_medicine_situation.pdf
[40] http://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_6-en.pdf

their governments under pressure, and creates a vicious cycle with a negative impact on basic services, low health and educational attainment, and high youth unemployment. All factors that will indirectly have an impact on the health of individuals and populations. At the opposite end of the age spectrum, those retiring from work may face the spectre of impoverishment and ill health in old age.

The UN Human Development Report 2013 (UN, 2013c) includes scenarios analysis relating to different development pathways: in the more ambitious scenario, actions such as increased investment in health and infrastructure, great emphasis on education, including for women and improvements in governance improve outcomes, including in areas such as human health. This work shows that health and social investments are a key factor in realising sustained improvements in human development (measured in relation to health, education and living standards) (UN, 2013c). These results echo the conclusions of the 2010 World Health Report (WHO, 2010d), which stresses that "*good health is essential to human welfare and to sustained economic and social development*".

Another potentially important factor for future health inequality is the role of technology (see Box 13). Already, high-income countries have greater access to new medicines and techniques; these are often available to high-income sectors of the population.

**Box 13: Incomes and medical technologies**

The range of treatable diseases is increasing, moving from infectious diseases to the treatment of medical issues which previously would have been considered a normal (if unfortunate) part of life (Heath, 2005). This increase in the range of treatable diseases reflects an increasing concern, primarily in high-income countries, with the concept of wellness (Heath, 2005). Another focus of attention in high-income countries is longevity research on methods to extend normal human life spans. The range and scope of treatments available is likely to increase with further technological progress; one concern is that this attention will draw resources away from research on infectious diseases. These are common in developing countries; however, as discussed in the following section, there has been a lack of development of new antibiotics to treat infections, including those that arise in hospitals.

Tackling the problem of health inequalities on a grand scale thus requires cross-sectoral policies and programmes that embody a new approach to development, by addressing inequalities, institutional failures, social barriers and personal vulnerabilities as central as promoting economic growth (UN, 2013c, WHO 2008).

# 4. Implications

The growing level of non-communicable diseases impedes social and economic development, deepens inequalities and is intrinsically linked to poverty and health costs-related poverty (see chapter 1 and 2).[41] At the same time, communicable, maternal, neonatal and nutritional deficits are persisting and are still posing a significant threat to human health, particularly in developing countries. These developments have implications for global governance systems and structures and require, as set out in this chapter, a coherent response across sectors, governments and geographic boundaries in order to address the global burden effectively. This chapter describes various global health initiatives to respond and study the changing global burden of disease, and also provides an outline on the implications of changing environmental factors on human health.

## 4.1 Global health initiatives

The global community has taken many steps to address world health problems.

***Global Conventions***

[41] The Lancet (2013): Inequalities in non-communicable diseases and effective responses. Di Cesare M et al http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)61851-0/abstract

International legal agreements have been one important tool. In order to be able to coordinate and manage global public health emergencies across countries, such as outbreaks of infectious disease that could lead to pandemics, the WHO adopted in 2005 the International Health Regulations.[42] This legally-binding agreement obliges countries to improve their capacity to detect, assess, notify and respond to acute public health events and threats.

The WHO Framework Convention on Tobacco Control (WHO FCTC) of 2003 is an evidence-based treaty that reaffirms the right of all people to the highest standard of health. The WHO FCTC represents a paradigm shift in developing a regulatory strategy to address addictive substances; in contrast to previous drug control treaties, the WHO FCTC asserts the importance of demand reduction strategies as well as supply issues.

The WHO FCTC was developed in response to the globalization of the tobacco epidemic. The spread of the tobacco epidemic is facilitated through a variety of complex factors with cross-border effects, including trade liberalization and direct foreign investment. Other factors such as global marketing, transnational tobacco advertising, promotion and sponsorship, and the international movement of contraband and counterfeit cigarettes have also contributed to the explosive increase in tobacco use.

***Global Initiatives***

#### *Global Burden of Disease Study 2010*

The Global Burden of Diseases, Injuries and Risk Factors Study 2010, which was led by the Institute for Health Metrics and Evaluation in Seattle, produced estimates measuring the impact of hundreds of diseases, injuries, and risk factors in 21 regions around the world over two decades. It was the largest ever systematic effort to describe the global distribution and causes of a wide array of major diseases, injuries, and health risk factors. This work was carried out in conjunction with 800 researchers around the world with the objective of ensuring that the global health community is able to base its research and policies on complete, valid, and reliable information.

Results of the study were published in 2012 in the Lancet[43], showing that infectious diseases, maternal and child illness, and malnutrition now cause fewer deaths and less illness than they did twenty years ago. As a result, fewer children are dying every year, but more young and middle-aged adults are dying and suffering from disease and injury, as non-communicable diseases, such as cancer and heart disease, become the dominant causes of death and disability worldwide. Since 1970, men and women worldwide have gained slightly more than ten years of life expectancy overall, but they spend more years living with injury and illness.

#### *UN Millennium Development Goals*

In September 2000, all 189 UN Member States adopted the Millennium Declaration and committed themselves to eight time-bound goals to reduce extreme poverty – the so-called Millennium Development Goals (MDGs).[44] The MDGs, which form a blueprint agreed to by all world's countries and leading development institutions, range from halving extreme poverty to halting the spread of HIV/AIDS and providing universal primary education - all by the target date of 2015.

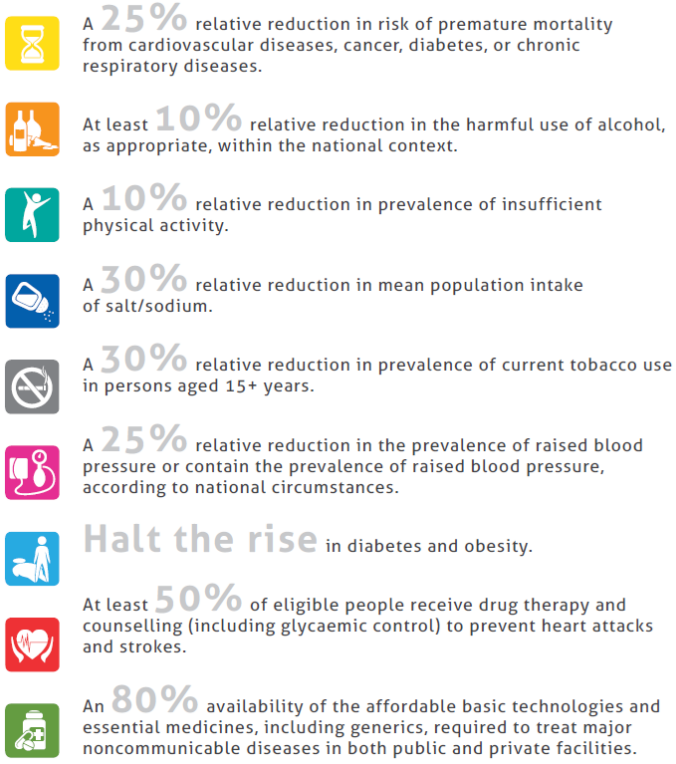
***Fighting non-communicable diseases worldwide***

Non-communicable diseases and their risk factors have close and strategic links to health systems and universal health coverage, environmental, occupational and social determinants of health, communicable diseases, maternal, child and adolescent health, reproductive health and ageing. Synergies also exist between major non-communicable diseases and other conditions such as Alzheimer's and Parkinson's diseases, disabilities and genetic disorders, and musculoskeletal conditions. Therefore a comprehensive and integrated response to NCDs requires cognizance of these other diseases, and recognizes the inter-linkages between different risk factors, as it may influence the development, progression and response to treatment. The

[42] http://www.who.int/ihr/en/
[43] http://www.thelancet.com/themed/global-burden-of-disease
[44] United Nations (2001) Road map towards the implementation of the United Nations Millennium Declaration: Report of the Secretary-General. New York: United Nations. Document A/56/326.

following section sets out some of the key strategic global documents that exist to tackle some of the main NCDs or risk factors, or non-communicable diseases in general.

**Figure 34: Global action plan for the prevention and control of non-communicable diseases (2013-2020) – nine voluntary global targets.**




The World Health Organization, which is the only global health body with the power to create international law, adopted in 2013 a global action plan for the prevention and control of non-communicable diseases (2013-2020).[45] The action plan, which was endorsed by the World Health Assembly in May 2013 and builds on the 2008-2013 global action plan, provides a roadmap and a menu of policy options for all Member States and other stakeholders, to take coordinated and coherent action at all levels (from local to global). The document is accompanied by a political declaration of the high-level meeting of the General Assembly on the prevention and control of NCD's. The action plan contains nine voluntary global targets (see figure 34), including a 25% relative reduction in premature mortality from NCDs by 2025.

The main focus of this Action Plan is on four types of NCDs — cardiovascular diseases, cancer, chronic respiratory diseases and diabetes — which make the largest contribution to morbidity and mortality due to NCDs, and on four shared behavioural risk factors — tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol. It recognizes that the conditions in which people live and work and their lifestyles influence their health and quality of life.

The Action Plan was developed as a result of a global and regional consultation process, engaging WHO Member States, relevant United National system agencies, funds and programmes, international financial institutions, development banks and other key international organisations, health professionals, academia, civil society and the private sector. These consultation processes took place through regional meetings organized by the six WHO regional offices, four web consultations which received 325 written submissions, three informal consultations with Member States and two informal dialogues with relevant nongovernmental organizations and selected private sector entities.

The Global Action Plan states that the cost of inaction far outweighs the cost of taking action and that continuing 'business as usual' will result in productivity and an escalation of health care costs in all countries

[45] World Health Organization (2013): Global Action Plan for the Prevention and Control of Non-communicable Diseases. http://apps.who.int/iris/bitstream/10665/94384/1/9789241506236_eng.pdf

worldwide. It also sets outs concrete examples of affordable interventions for all countries, which generate one year of healthy life for a cost that falls below the gross domestic product per person. The report shows that in health terms, the return on investment of such interventions will be many millions of avoided premature deaths, and in terms of economics, the return will be billions of dollars of extra output.

By reducing mortality rates by 10% for ischemic heart disease and stroke, economic losses would be brought down by an estimated US$ 25 billion per year, which is three times greater than the investment needed for the implementations of the interventions to achieve these benefits (WEF 2011). The Global Action Plan shows that investments in tackling non-communicable diseases can therefore not only result in better health but will also make a significant contribution to reducing poverty and inequalities and enhancing economic development.

### *WHO Programme on Cardiovascular Diseases*[46]

The WHO Programme on Cardiovascular Diseases works on prevention, management and monitoring of cardiovascular disease globally. It aims to develop global strategies to reduce the incidence, morbidity and mortality of CVD by reducing risk factors and their determinants, developing cost effective and equitable health care innovations for the management of CVD and monitoring trends of CVD and their risk factors.

In 1988, the CVD Research initiative kicked off as a joint programme of WHO and the Global Forum for Health Research, and has since then expanded to include the Institute of Medicine, World Heart Federation, National Public Health Institute (Finland), World Hypertension League, International Obesity Task Force, International Institute for Health and Development (Australia), Institut Universitaire de Médecine Sociale et Préventive (Switzerland), Centres for Disease Control (USA), and National Institutes of Health (USA).[47] The Initiative has developed six multicentre collaborative research projects on capacity assessment, surveillance, community-based interventions, clinical management and global information networks.

INTER-HEART is a global case-control study that seeks to understand the importance of both traditional and emerging risk factors for acute myocardial infarction.[48] Such findings are relevant for developing health policies that can be applied to different countries and ethnic groups. The study may also lead to cohort studies in participating countries and foster a network of committed investigators in approximately 50 countries. INTER-HEART is sponsored by the WHO and the World Heart Federation, and has received funding from peer-review agencies and industry.

### *WHO Chronic Respiratory Diseases Programme*[49]

The aim of the WHO Chronic Respiratory Diseases Programme is to support Member States in their efforts to reduce the toll of morbidity, disability and premature mortality related to chronic respiratory diseases, specifically asthma and chronic obstructive pulmonary disease (COPD). The Programme is supported by the Global Alliance against Chronic Respiratory Diseases (GARD), which is a voluntary alliance of national and international organizations, institutions and agencies from a range of countries working towards the common goal of reducing the global burden of chronic respiratory diseases.[50] GARD promotes an integrated approach that capitalizes upon synergies of chronic respiratory diseases with other chronic diseases. GARD focuses specifically on the needs of low- and middle-income countries and vulnerable populations, and fosters country-specific initiatives that are tailored to local needs and primary health care.

### *WHO Cancer Control Programme*[51]

In 2005, the World Health Organization adopted as a response to the World Health Assembly resolution on cancer prevention and control (WHA58.22), a cancer control programme which calls on Member States to intensify action against cancer. The Cancer Control Programme supports countries in developing and implementing an effective national cancer control plan and offers practical guides for programme managers.

[46] http://www.who.int/cardiovascular_diseases/priorities/en/
[47] http://www.who.int/cardiovascular_diseases/research/en/
[48] http://www.who.int/cardiovascular_diseases/research/en/
[49] http://www.who.int/respiratory/about_us/en/index.html
[50] http://www.who.int/gard/en/index.html
[51] http://www.who.int/cancer/modules/en/index.html

The WHO programme recognizes the links between cancer and other conditions such as chronic diseases, reproductive health, immunization for hepatitis B, HIV/AIDS, occupational health and environmental health.

#### *WHO Diabetes Programme*[52]

The mission of the WHO Diabetes Programme is to prevent diabetes whenever possible and, where not possible, to minimize complications and maximize quality of life. The Programme supports and stimulates Member States to adopt effective measures for the surveillance, prevention and control of diabetes and its complications, particularly in low- and middle-income countries. Guidelines for the development of a national programme for diabetes mellitus were adopted in 1991 as a result of the adoption of the 42nd World Health Assembly resolution on prevention and control of diabetes mellitus. Various reports have been published by WHO that acknowledge the linkages between diabetes and other conditions and risk factors such as tuberculosis, blindness, and hyperglycaemia.

The Diabetes Action Now programme is a joint programme of the World Health Organization (WHO) and the International Diabetes Federation (IDF). By stimulating and supporting the adoption of effective measures for the surveillance, prevention and control of diabetes, it aims to substantially increase the global awareness about diabetes and its complications. Diabetes Action Online is one of the five goals of the Diabetes Action Now Programme, and aims to improve the quality of diabetes care. Developed by the World Health Organization (WHO) in collaboration with the International Diabetes Federation (IDF), it speaks to decision makers at all levels of the health care system walking them through the improvement process with supporting documents, tools and expert guidance.

***Tackling persistent communicable diseases***

Several global programmes, policies and initiatives tackle communicable diseases.

#### *TDR: the Special Programme for Research and Training in Tropical Diseases*[53]

TDR, the Special Programme for Research and Training in Tropical Diseases, is a global programme of scientific collaboration that helps facilitate, support and influence efforts to combat diseases of poverty. TDR is hosted at the World Health Organization (WHO), and is sponsored by the United Nations Children's Fund (UNICEF), the United Nations Development Programme (UNDP), the World Bank and WHO. TDR has conducted research in the areas of malaria, neglected tropical diseases (such as dengue), tuberculosis and HIV and vectors, environment and society.

#### *WHO Global Malaria Programme*[54]

The WHO Global Malaria Programme (GMP) is responsible for the coordination of WHO's global efforts to control and eliminate malaria. The Programme sets evidence-based norms, standards, policies and guidelines to support malaria-affected countries around the world. As one of its key mandates, the Programme also keeps independent score of global progress in the fight against malaria. Its flagship annual publication, the World Malaria Report, contains the latest available data on the impact of malaria interventions around the world.

GMP's activities are focused on providing an integrated solution to the various epidemiological and operational challenges that affect different parts of the world. The Programme ensures harmonized policy advice on all technical and programmatic challenges at the national, regional and global level. GMP's policy guidance on prevention, case management, surveillance, monitoring and evaluation, and malaria elimination provides a benchmark for national malaria programmes and multilateral funding agencies.

In 2011, WHO redesigned its policy-setting process on malaria to make it more responsive to the rapidly evolving epidemiological and development context. A Malaria Policy Advisory Committee (MPAC) was established to provide independent advice to WHO with regard to policy recommendations for the control and

[52] http://www.who.int/diabetes/goal/en/index.html
[53] http://www.who.int/tdr/about/en/
[54] http://www.who.int/diabetes/goal/en/index.html

elimination of malaria. Under the umbrella of the MPAC, WHO also convenes expert groups to review evidence and make recommendations.

GMP works closely with all major partners in the global malaria community: with endemic country governments and regulatory authorities, UN agencies, inter-governmental organizations, private-public partnerships and campaign groups. The Department also participates in all major inter-agency taskforces, and in multi-partner and multi-sectoral initiatives on malaria. Its experts lead several technical working groups within the Roll Back Malaria partnership, of which WHO is a founding partner.

***A global response to the growing risk of pandemics***

Building on the 2005 International Health Regulations, described above, recent developments by the WHO on global risks of epidemics and pandemics include the adoption by the Sixty-fourth World Health Assembly (2011) of the Pandemic Influenza Preparedness (PIP) Framework for the sharing of influenza viruses and access to vaccines and other benefits.[55] Additionally, the WHO's 12th General Programme of Work (2013) sets the reduction of *"mortality, morbidity and societal disruption resulting from* epidemics*... through prevention, preparedness, response and recovery activities"* as one its five strategic imperatives.

***Responding to global health inequalities***

***WHO Commission on Social Determinants of Health[56]***

In 2005, the World Health Organization established the Commission on Social Determinants of Health (CSDH) to support countries and global health partners in addressing the social factors leading to ill health and health inequities. The Commission aimed to draw the attention of governments and society to the social determinants of health and in creating better social conditions for health, particularly among the most vulnerable people. The CSDH was a global network of policy makers, researchers and civil society organizations brought together by the WHO and it had a three year directive to gather and review evidence on what needs to be done to reduce health inequalities within and between countries and to report its recommendations for action to the Director-General of WHO. The Commission was chaired by Prof. Sir. Michael Marmot, Director of the International Institute for Society and Health and Head of the Department of Epidemiology and Public Health at University College London.

Dedicated Knowledge Networks were covering a number of themes reviewed the evidence and reported their findings to the Commission. In its final report called: "Closing the Gap in a Generation", the Commission demonstrated that health inequities are the result of a complex system operating at global, national and local levels. The global context affects how societies prosper through its impact on international relations and domestic norms and policies. These in turn shape the way society, at national and local level, organizes its affairs, giving rise to forms of social position and hierarchy. Where a person is in the social hierarchy affects the conditions in which they grow, learn, live, work and age, their vulnerability to ill health and the consequences of ill health.

To decrease the health inequality between and within countries, it is necessary to look beyond the immediate causes of disease. The Commission focused on the 'causes of the causes' - the social factors which determine how people grow, live, work and age. The underlying determinants of health inequities are interconnected and therefore, they must be addressed through comprehensive and integrated policies, responsive to the specific context of each country and region. The Commission delivered its final report to the World Health Organisation in July 2008 – this subsequently ended its functions.

***Joint Action and Learning Initiative on National and Global Responsibilities for Health (JALI)***

The Joint Action and Learning Initiative on National and Global Responsibilities for Health (JALI) has emerged as a response to the existing health inequalities worldwide.[57] JALI aims to raise awareness among people and governments in all regions of the world, and to improve the health of the world's population, especially the

[55] http://apps.who.int/gb/dvr-a64/PDF/A64_REC1-en.pdf
[56] http://www.who.int/social_determinants/thecommission/finalreport/about_csdh/en/
[57] http://www.jalihealth.org/about/index.html

poorest and most disadvantaged people. The initiative advocates for a Framework Convention on Global Health, which could establish a post-Millennium Development Goals global health agenda.

JALI began to emerge through a consensus process during an international meeting held at the Norwegian Directorate of Health in Oslo, March 17, 2010. JALI would be a collective commitment to research and share knowledge on the most constructive ways in which to redress the most prominent inequalities in global health. Further discussions among initial JALI partners, and then broader consultations in Johannesburg and New Delhi led to a decision that a central aim of JALI will be to explore the potential for and possible content of a Framework Convention on Global Health, to frame post-Millennium Development Goals global health commitments and help close these inequalities and serve as an important tool for social movements to organize a round and use to hold their governments accountable for implementing the right to health.

## 4.2 Environment and health

The environment and human health are linked via a complex set of interactions. Section 2.3 highlights how many environmental problems have direct, negative impacts on human health, including air and water pollution as well as exposure to a mix of chemicals. Addressing these issues will bring a range of benefits: for example, reducing fossil fuel combustion for transport, electricity production and heating will tackle both climate change as well as health impacts from urban air pollution. These and other interactions call for stronger integration between environmental and health initiatives at all scales, from global to local (EEA and JRC, 2013).

In coming decades, the majority of the world's population will live in cities: good governance of the world's growing urban areas can bring both environmental and health benefits. Cities will need to build the infrastructure to replace growing motor vehicles and to provide access to drinking water and sanitation, along with health care for all segments of the population (WHO, 2010c). In addition, a range of studies have shown that access to green areas can bring health benefits for urban residents (EEA and JRC, 2013).

In rural areas, an integrated assessment of the health and interactions between wildlife, domestic animals and human health can address growing risks of disease transmission across species: this is the goal of the 'one health' approach (Choffnies et al, 2012)

In the broad perspective,

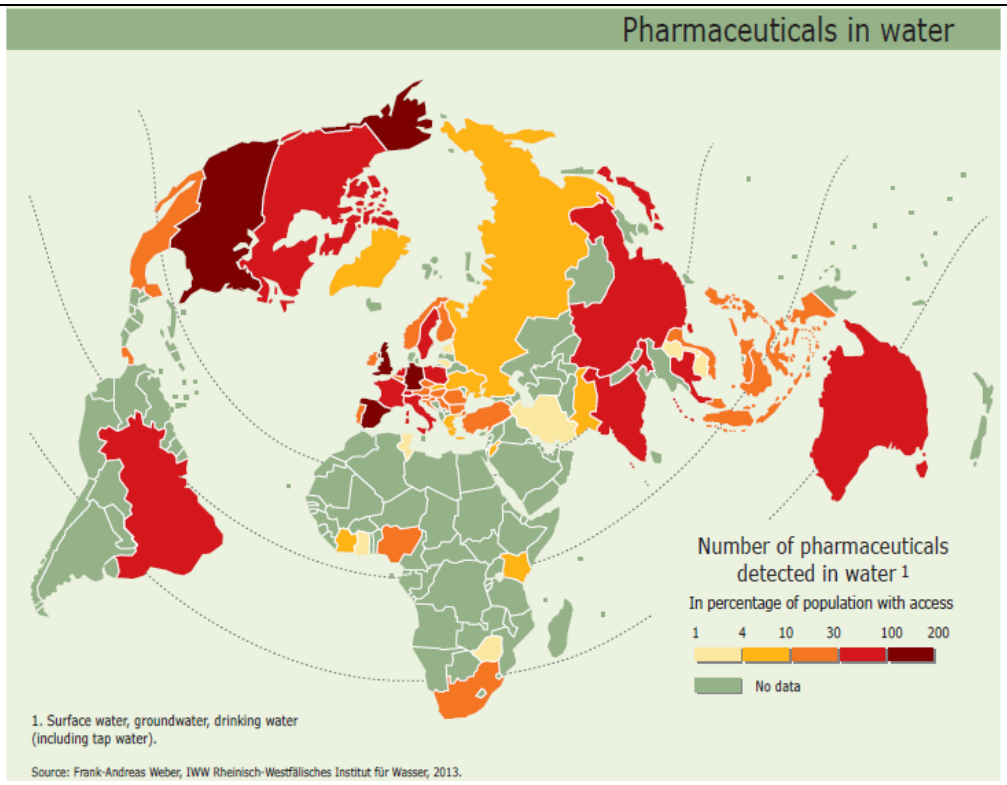
> '*As argued convincingly in the Millennium Ecosystem Assessment... human health and well□being ultimately depend on well□functioning ecosystems and the way we use our natural resources.*' (EEA and JRC, 2013)

One facet of the link between environment and health is the impact of pharmaceuticals on the environment, in particular via water pollution (see Box 2 on the following page).

**Box 14: Pharmaceuticals and the environment**

A recent review found that pharmaceuticals have been identified in water bodies across more than 70 countries in the world (see Figure 35 below). Information is strongest for developed economies – however, many pharmaceuticals have also been detected in emerging and developing countries. Most discharges appear to come after human use of pharmaceuticals, often flowing through urban sewer and wastewater treatment systems. Urban wastewater treatment plants usually have only a limited effect, reducing the load of pharmaceutical products by about 20% before they reach water bodies. While some pharmaceuticals are biodegradable or photodegradable, others are not (Sumpter and Roig, 2012). Other sources include from pharmaceutical production and also their use in agriculture and aquaculture. The issue of pharmaceutical use in the environmental is being studied by SAICM (the Strategic Approach to International Chemicals Management), a global initiative for the sound management of chemicals.

**Figure 35. Pharmaceuticals detected in surface water, groundwater and drinking water**


Pharmaceuticals in water
Number of pharmaceuticals detected in water 1
In percentage of population with access
1
4
10
30
100
200
No data
1. Surface water, groundwater, drinking water (including tap water).
Source: Frank-Andreas Weber, IWW Rheinisch-Westfälisches Institut für Wasser, 2013.

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