

# Environment and health:

## 1. Population, consumption and human health

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There is strong evidence that the growth of the world population poses serious threats to human health, socioeconomic development and the environment.<sup>1,2</sup> In 1992 the Union of Concerned Scientists issued a World Scientists' Warning to Humanity, signed by 1600 prominent scientists, that called attention to threats to life-sustaining natural resources.<sup>3</sup> In 1993 a Population Summit of 58 of the world's scientific academies voiced concern about the intertwined problems of rapid population growth, wasteful resource consumption, environmental degradation and poverty.<sup>4</sup> These reports share the view that, without stabilization of both population and consumption, good health for many people will remain elusive, developing countries will find it impossible to escape poverty, and environmental degradation will worsen.

### Population growth

It has taken only 12 years for the world population to grow from 5 billion to today's 6 billion. This is the shortest time ever to add 1 billion people — a number equivalent to the population of India or the combined population of the United States and Europe.

Over the 17 centuries ending in 1800, the world population grew slowly, from an estimated 250 million to about 1 billion. Over the past 2 centuries, and especially after 1950, declining death rates brought about rapid growth. By 1950 the world population had reached 2.5 billion, the world total fertility rate (TFR: the mean lifetime number of children borne by each woman) was 5.3, and the population was growing by about 40 million per year.<sup>5,6</sup> Since 1950 the world TFR has declined to 2.9, but continued declines in death rates and the growth of the population to 6 billion have combined to bring about a doubling of annual growth to 84 million in the world population.<sup>7</sup>

Over the past 200 years Western nations have made a gradual demographic move from high to low birth rates and death rates. These countries are now growing by only 0.1% annually.<sup>7</sup> Over the past 50 years public health measures and improved nutrition in developing countries have rapidly lowered death rates. Although use of family planning in these countries has increased substantially (from about 10% of couples to over 50%), greater use of contraception is hampered by poverty, lack of education and inadequate access to family planning information and services.<sup>8,9</sup> As a result, declines in birth rates in developing countries have been uneven and have usually lagged behind declines in death rates. Therefore, growth rates have remained relatively high.<sup>5-7,9</sup> Currently, more than 97% of population growth is occurring in developing countries, which between 1987 and 1999 grew by 1 billion people.<sup>7,10</sup>

The United Nations recently presented 3 demographic projections for the next 100 years that, although rapid declines in fertility are expected, still see substantial increases in the world population.<sup>11,12</sup> Because population projections are extremely sensitive to fertility rates, the accuracy of long-range projections is uncertain.<sup>12,13</sup>

The UN's medium-fertility projection suggests a decline from the current world TFR of 2.9 to 2.1 by 2050, with a resulting population size of 8.9 billion that will continue to grow slowly to 9.5 billion by 2100. The US Census Bureau projects a slightly higher total world population in 2050 of 9.3 billion (Fig. 1).<sup>14</sup>

The UN's high-fertility model assumes that, in countries with high fertility rates (TFRs above replacement level), the TFRs will stabilize at 2.6 and that, in countries with low fertility rates (TFRs currently below 2.1), the TFRs will increase and stabilize at between 2.1 and 2.3. This model projects that the world population will

*Review*

*Synthèse*

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continue to grow rapidly, reaching 10.7 billion by 2050 and 16.2 billion by 2100.

The UN's low-fertility model, which assumes worldwide TFRs of less than 2.1, projects an initial increase in population size followed by a slow decline to 7.3 billion in 2050 and 5.1 billion in 2100.<sup>11,12</sup> In part because support for international family planning programs remains inadequate, the low-fertility projection seems unlikely. Without greatly strengthened efforts to provide family planning services, even the medium projection is in doubt.<sup>15-17</sup>

The fertility of the world's developed countries is now at a TFR of 1.5,<sup>7</sup> so low that gradual population decline can be expected in most of these countries.<sup>11</sup> The fertility rates of some 25 developing countries, including those in East Asia and China, are already at or are likely to soon decline to or go below replacement level. Some 44% of the world's people now live in low-fertility countries (20% in developed countries, 20% in China and 4% in other developing countries), and UN population projections suggest that more developing countries will reach fertility levels below replacement level.<sup>11,12</sup>

However, high fertility persists in much of the world. The current TFR for the 3.6 billion people living in poor countries outside of China is estimated to be 3.7 and their annual population growth rate 1.9%. At this rate, their population would double in just 36 years. Despite projected declines in fertility, the number of annual births worldwide are expected to remain at over 130 million for the next 25 years.<sup>14</sup> This is because past high fertility rates in most poor countries have left these countries with large and still increasing numbers of women of reproductive age; their number is projected to increase from 1.2 to 1.7 billion between 1998 and 2025.<sup>14</sup> In China, for example, although the TFR is estimated to be below the replacement level of 2.1, the large number of couples of reproductive age have kept China's population growing by more than 11 million annually.<sup>7,11</sup>

Even though Europe and Japan are densely populated and have high levels of consumption, the prospect of gradual population decline in these countries has raised concerns related to immigration, the ethnic composition of countries, the size of the labour force and the ability of workers to support elderly people as the share of population over retirement age increases.

The United States and Canada are, to some extent, exceptions among Western

nations. Because of high levels of immigration their populations are still growing relatively rapidly. The US population is projected to increase from 275 million to 394 million by 2050.<sup>18,19</sup> The arrival of about a million people per year (800 000 legal and 200 000 illegal immigrants) and the high fertility rate among the 26 million foreign-born residents is fuelling this growth.<sup>18,19</sup> Similar projections for Canada suggest an increase from the current 31 million to over 42 million in 2050, with over half of this growth the result of immigration.<sup>20,21</sup> Considering the high level of individual consumption in the United States and Canada, this 43% increase in population will have profound implications for land, air and water resources.

### Interactions between population, consumption, the environment and health

Some 10 000 years ago, when only about 5 million people inhabited the Earth, few biological systems were seriously damaged by human activity. Today, however, the world faces an environmental dilemma. Current demands are depleting many of the Earth's natural resources and ecological services.<sup>22-24</sup> Within the next 50 years, it is likely that those life-supporting systems will somehow have to accommodate 3 billion more people as well as support desperately needed advances in living standards for those in poverty, particularly the 3 billion people now living on about \$2 a day.<sup>11,25,26</sup>

The impact of humans on their environment is related to population size, per capita consumption and the environmental damage caused by the technology used to produce

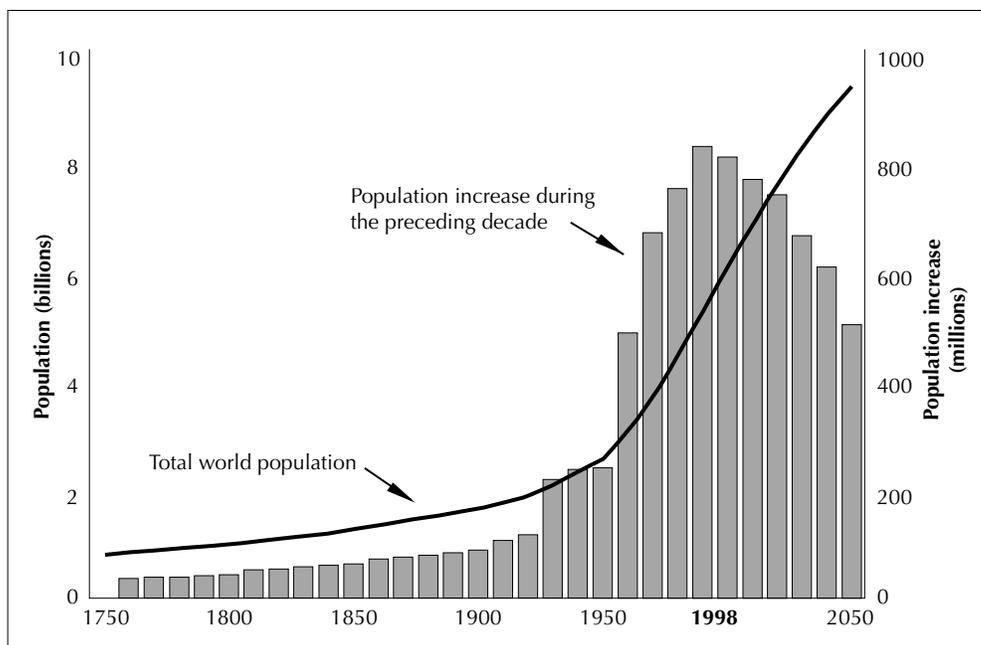


Fig. 1: World population from 1750 to 2050 (black line), and population increases by decade (grey bars).<sup>14</sup>

what is consumed. The exploitation of technology and the high consumption pattern of people in Japan, Europe, the United States and Canada have a greater adverse impact per capita on the world's environment than that of a subsistence farmer in Bangladesh, for example. Although they represent 20% of the world's population, the 1.2 billion people living in developed countries consume an estimated 67% of all resources and generate 75% of all waste and pollution.<sup>22-24</sup>

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Between 1950 and 1997 the world's population doubled and the global economy expanded 6-fold, from \$5 trillion to \$29 trillion of annual output.<sup>27</sup> A further modest 2% annual growth in incomes and consumption per capita worldwide could result in a doubling of consumption every 35 years, or about an 8-fold increase by the year 2100. This increased consumption per capita, on top of a projected population increase of 1.6 times, from 6 to 9.5 billion,<sup>11</sup> would require economic production to increase 13-fold. To achieve this without substantial degradation of important ecosystems presents a daunting challenge.

There are many important interactions between population growth, consumption, environmental degradation and health. Human activity has already transformed an estimated 10% of the Earth's surface from forest or rangeland into desert. The productive capacity of 25% of all agricultural lands, an area equal to the size of India and China combined, has already been degraded.<sup>24,28</sup> Unproductive land and food scarcity currently contribute to malnutrition among 1 billion people, with infants and children suffering the most serious health consequences.<sup>29,30</sup>

Projected population growth in Africa, South Asia and other developing countries, together with declining availability of water from aquifers, threatens the food security of more than 1 billion people in developing countries. Recent studies have indicated that depletion of aquifers threatens India with a 25% decline in grain production, at a time when over half of the country's children are malnourished and the population is projected to increase by some 500 million over the next 50 years.<sup>31,32</sup> Other large countries where rapid population growth and declining cropland per person threaten food security include Nigeria and Pakistan. If Nigeria's population increases from the current 111 million to a projected 244 million in 2050, grainland per capita will decline from 0.15 to 0.07 hectares. The corresponding projection for Pakistan is an increase in population from

146 million to 345 million and a shrinkage of grainland per person from 0.08 to 0.03 hectares.<sup>33</sup> Countries with these levels of grainland typically import over half of their grain, an expensive prospect for these impoverished countries.<sup>31,32</sup>

Water scarcity also impairs health as fresh water supplies for human use become polluted with toxic materials and pathogens. Proper treatment of human waste is currently not available for about 2 billion people, and 1.3 billion people are at risk of waterborne diseases because they lack access to pure drinking water.<sup>22,24,34</sup>

There is growing evidence that global warming is occurring, increasing the prospect of flooded coastal areas and cities, disruptions of agriculture, increasingly severe storm damage<sup>35-37</sup> and significant extension of the range of insects and other vectors of disease.<sup>38</sup>

Environmental degradation, declining food security and uncontrolled epidemics of communicable diseases have slowed, and even reversed, the demographic transition to low death rates in some poor countries. In contrast to developed countries, where cardiovascular diseases and cancer are the leading causes of death, in poor countries infectious diseases cause 45% of all deaths.<sup>39</sup> Ninety percent of annual worldwide deaths from communicable diseases are caused by 6 infectious diseases: acute respiratory infections (3.5 million deaths), AIDS (2.3 million), diarrheal diseases (2.2 million), tuberculosis (1.5 million), malaria (1.1 million) and measles (0.9 million).<sup>39</sup> As a consequence of the AIDS epidemic, some 29 African countries have experienced substantial increases in death rates and substantial declines in average life span. By 2010–2015 life expectancy is projected to decline by 17 years on average in the 9 hardest hit countries.<sup>40,41</sup> In Botswana and Zimbabwe over 20% of the adult population is HIV positive.<sup>40</sup>

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Poverty, lack of education, and social and economic factors are powerful, if indirect, correlates of health status. Wealthy nations provide environments that offer protection against infectious diseases through preventive measures such as vaccination, water purification, sanitary sewage disposal and control of insect vectors. Wealthier nations and individuals can better afford to pay for needed preventive and curative health services. Higher levels of education, especially among women, are also associated with low fertility and good health — the well educated are better equipped to stay healthy and obtain needed health care services.<sup>42-46</sup> It is reasonably well established that the families in

developing countries with the smallest number of children usually have the highest incomes and the healthiest and best-educated children. Therefore, to the extent that rapid population growth and large family size hamper economic development by perpetuating poverty, high growth rates also contribute to poor health.<sup>25,47-49</sup>

Developing countries that have established strong family planning programs and have successfully slowed rapid population growth have fared much better economically than countries that have neglected the population issue. The Asian economic “tigers” — South Korea, Thailand, Malaysia and Taiwan — have a 30-year history of supporting family planning and an average of about 2 children per family. This has benefitted the health of their people both by fostering economic development and establishing a healthy pattern of reproduction.<sup>48-50</sup>

### Facing the challenges of poor health, rapid population growth and high consumption levels

In 1994 demographer John Bongaarts<sup>51</sup> disaggregated the sources of future population growth in developing countries into 3 categories: 49% will come from momentum caused by the population’s young age structure (the result of previous high fertility), 33% will come from unwanted fertility (i.e., births to those who wish to stop child-bearing but who are not using contraception), and only 18% will come from high desired family size (i.e., desiring more than an average of 2 children). The fact that most couples in developing countries want small families<sup>51</sup> bodes well for the success of family planning programs in those countries. However, family planning must be accessible. Meeting the family planning needs of the 100–120 million women in developing countries who wish to limit their child-bearing but lack access to adequate information and services would lower the TFR from the current 3.2 half-way to the TFR of 2.1 needed for population stabilization.<sup>9,51</sup>

Participants at the 1994 United Nations International Conference on Population and Development made a collective commitment to improve women’s status and to make family planning and a limited array of reproductive health services universally available in developing countries by the year 2015.<sup>2</sup> Their emphasis on reproductive health recognized the reality that, in developing countries 25% to over 50% of treatable or preventable diseases among women aged 15–49 years are related to reproduction. Typically the largest share is associated with pregnancy, unsafe abortion and childbirth. In some countries AIDS and other STDs predominate.<sup>52-54</sup> Over a woman’s lifetime, the risk of dying from pregnancy-related causes is about 1 in 16 in Africa, 1 in 65 in Asia, 1 in 130 in Latin America, but only 1 in 6000 in the United States and 1 in 10 000 in northern Europe. A broader array of reproductive health care services, including safe abortion, prenatal care and the ability to deal with the complications of childbirth, could prevent many deaths.<sup>55-59</sup>

Family planning is necessary to allow a pattern of healthy child-bearing. Eliminating child-bearing among teenagers, women over 35 and women who have already had 4 children, and increasing intervals between births to at

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least 2 years, would avoid about 25% of the 585 000 maternal deaths each year. If women in poor countries bore only 2 children, the annual number of maternal deaths would be reduced by close to 50%.<sup>42,55,57-59</sup>

The safe pattern of child-bearing that reduces risk among women also lowers the risk of death among infants and children. Currently each year in developing countries some 11 million children do not survive their first 5 years of life.<sup>61</sup> Establishing a healthy pattern of child-bearing could be expected to reduce infant and child mortality by about 20% to 25%.<sup>42</sup> For example, in Kenya, a typical developing country, an interval of 18 months or less between births results in a risk of infant death that is twice the risk associated with a longer interval.<sup>42,60-64</sup>

Reproductive health programs that include but also go beyond family planning and safe childbirth services are needed to address domestic violence, which occurs in up to 1 in 3 women,<sup>65</sup> and STDs, which are responsible for 333 million new cases of infection throughout the world each year.<sup>66</sup> Family planning and maternity care programs can serve as a starting point for services that address these problems because they serve the same population of young, sexually active women who are most at risk of exposure to STDs and domestic violence.<sup>64-66</sup>

The cost of family planning and reproductive health services recommended for developing countries at the United Nations International Conference on Population and Development was estimated to be \$17 billion annually by the year 2000.<sup>2</sup> It was agreed that two-thirds of this total cost should come from developing countries — an expenditure of less than 5¢ weekly per person living in these countries — and that one-third should come from donor countries — an expenditure of less than 10¢ weekly per person living in developed countries. Unfortunately, developing countries are spending only about \$5 billion annually, less than 50% of their financial target of \$11.3 billion, and donor nations are spending only about \$1.4 billion, less than 25% of their \$5.7 billion goal.<sup>16,17</sup>

If we are able to summon the political will to make good reproductive health care, including family planning and safe abortion, widely available, and if we make reasonable progress in educating women and improving their status, population growth is likely to decline to manageable lev-

els.<sup>55,67,68</sup> In Thailand between 1970 and 1987, a voluntary family planning program, stressing cooperation between public and private sectors, brought about an increase in contraceptive use from about 10% to 67% of couples.<sup>67</sup> As a result, the average number of children per woman fell from 6.2 to 2.2. Important reasons for the program's success included use of the injectable contraceptive Depo-Provera, the distribution of oral contraceptives by non-physicians and strong government support of the program.

Better reproductive health care in poor countries, however, will not be enough to save our natural systems. Both developed and developing countries must introduce economic systems and new technologies that are more efficient, generate less waste and require less consumption of

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natural resources.<sup>22,23,69-72</sup> With the world increasingly seeking economic development through market-based policies, it is imperative that governments and the private sector integrate strategies into economic life that will protect the environment. The way forward to economic progress with more efficiency and less consumption is clear in many sectors, and research can bring additional advances.<sup>73</sup>

The limitation of greenhouse gas emissions, critical to climactic stabilization, can be addressed by less reliance on, and more efficient use of, fossil fuels. Further development of wind, geothermal, photovoltaic and other eco-friendly sources of energy is needed. Carbon emissions can be reduced by preserving forest resources through increased use of recycled paper and wood substitutes. These and other measures to slow the rapid decline in biodiversity are needed. The protection of habitats in ecologically threatened "hot spots" is one promising approach.<sup>70-72</sup>

Governments and international development agencies should eliminate environmentally unsound development projects and subsidies for a large array of ecologically unsound practices and products. Policies needing reform include those related to tobacco, mineral production, logging, transportation, agriculture, fisheries, livestock, energy use, waste disposal, control of pesticides and other toxic substances, air quality, and use of land and water resources.<sup>74</sup>

Efforts to address the environmental impact of consumption must give attention to the damage and waste

caused by conflict and worldwide outlays for military activities, estimated at \$700 billion annually.<sup>75</sup>

Of crucial importance is the path of economic development that is traversed by poor countries. China, with a population of 1.2 billion, has experienced an economic expansion of two-thirds since 1990 and a corresponding increase in consumption of many resources.<sup>76</sup> It has surpassed the United States in consumption of grain, meat, fertilizer, steel and coal. If China's per capita oil consumption equalled that of the United States, the Chinese would consume 80 million barrels a day, far outstripping the daily world production of 60 million barrels. Social and economic progress in China and other developing countries is necessary, but, according to Brown and colleagues,<sup>76</sup> these countries must bypass what the West has done and show how to build environmentally sustainable economies. Unfortunately, many rapidly industrializing countries are proceeding with little regard for the environment.<sup>76</sup>

Reforming our economies and industries will be technically difficult, costly and time-consuming. Measures that will help slow population growth are relatively less expensive. Our future well-being depends on increased access to family planning and reproductive health services in developing countries and decreased consumption by people in wealthy countries. We must develop and adopt more efficient technology for industrial production in all countries. Our governments, the private sector and individuals must work together to devise and adopt new patterns of sustainable economic behaviour and to support and enable voluntary and responsible family planning. The challenge is to meet the needs of today's populations without compromising the welfare of future generations.

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