

From the Earth Summit to Rio+20: integration of health and sustainable development



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In 2012, world leaders will meet at the Rio+20 conference to advance sustainable development—20 years after the Earth Summit that resulted in agreement on important principles but insufficient action. Many of the development goals have not been achieved partly because social (including health), economic, and environmental priorities have not been addressed in an integrated manner. Adverse trends have been reported in many key environmental indicators that have worsened since the Earth Summit. Substantial economic growth has occurred in many regions but nevertheless has not benefited many populations of low income and those that have been marginalised, and has resulted in growing inequities. Variable progress in health has been made, and inequities are persistent. Improved health contributes to development and is underpinned by ecosystem stability and equitable economic progress. Implementation of policies that both improve health and promote sustainable development is urgently needed.

Introduction

The world's heads of state and government will meet in Rio de Janeiro, Brazil, on June 20–22, 2012—20 years after they met there at the historic Earth Summit. The 1992 conference adopted an ambitious programme of action on sustainable development known as Agenda 21, which was supposed to be undertaken globally into the 21st century.¹ It had three broad goals: to better the living standards of people in need; to improve management and protection of the ecosystem; and to bring about a prosperous future for all. However, substantial gaps remain in the implementation of Agenda 21 and the accompanying Rio Declaration on Environment and Development,^{2,3} which encompassed 27 principles that were adopted by 178 nations.

International cooperation to accelerate development has made little progress. Agenda 21 aimed to achieve a fair and just international trading system, which was supposed to provide development opportunities for the least developed countries. Although many countries in Africa have liberalised trade since the early 1990s—particularly after the inception of the World Trade Organisation in 1995—members of the Organisation for Economic Co-operation and Development did not lower subsidies quickly enough to create a fair trading system. Subsidies from the USA, European Union, and Japan (eg, for their agricultural products) greatly exceed their spending on development assistance, and aid expenditure is much less than what was agreed at the G8 Summit in 2005. Growing inequities both between and within many countries have overshadowed the benefits of economic growth, and many ecosystems are in decline (appendix).^{2,3}

The fundamental principle established at the Earth Summit in 1992 was that people are at the centre of concerns for sustainable development and that they are entitled to a healthy and productive life in harmony with nature.¹ The 20th anniversary will provide an opportunity to reaffirm the vision, to review progress, to reinvigorate political commitments, and to establish a systematic programme of action that could have far-reaching effects on prospects to address needs of people with low income

without causing irrevocable environmental damage. The original principle should be prioritised by the UN after the timeline of the Millennium Development Goals (MDGs) comes to an end in 2015.

The notion of sustainable development was perhaps articulated most clearly in the Brundtland Report⁴ as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. It is open to various interpretations, but the husbanding of planetary resources is undoubtedly important. The Johannesburg World Conference on Sustainable Development in 2002 was the first large international gathering to propose that social, economic, and environmental factors underpin sustainable development.⁵ In 2011, UNEP advanced the idea of the triple helix, in which the three types of factor are intertwined in a helical fashion, as a powerful representation of what constitutes sustainable development.⁶

Public health and sustainable development are linked by interactions between the physical environment (eg, air

Lancet 2012; 379: 2189–97

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Search strategy and selection criteria

We identified reports published by various UN agencies that addressed issues relevant to health and sustainable development, detailed reviews of the implementation of the Rio Principles and Agenda 21 prepared by the Stakeholder Forum for a Sustainable Future, and reports reviewed as part of work undertaken by WHO for the series of papers entitled *Health in the Green Economy*. The development of the WHO papers was led by CD and used specific search strategies for every sector covered—ie, transport, housing, and energy. The searches were done with several databases depending on the sector, such as Medline, Web of Science, PubMed, and Google Scholar. The search strategies are described in the relevant papers and use keywords to detect health effects of specific climate change mitigation strategies described by the UN Intergovernmental Panel on Climate Change.

See Online for appendix

pollution, chemical exposures, and climate change) and the social environment (eg, Ottawa Charter⁷ and World Conference on Social Determinants of Health⁸), together with poverty reduction and confrontation of diseases related to poverty (eg, MDGs 1, 4, 5, and 6⁹). The value of health is not only intrinsic (ie, in its own right), but also in its contribution to social and economic development.¹⁰ Good health is a prerequisite for development of the capabilities necessary for people to reach their full potential.¹¹ The world's ecosystem services provide the foundations for population health.¹²

Trends in environment, development, and health

Several key environmental indicators show worrying negative trends. For example, the living planet index¹³ provides an overview of trends in biodiversity based on changes in the size of roughly 9000 populations of nearly 2700 vertebrate species around the world. It shows that overall populations were 28% smaller in 2008, than in 1970, due to species loss in the tropics. Historical data is restricted, but in temperate regions, population loss was probably much greater in the past than it is now, and is now recovering in some cases. Only about 13% of land, 7% of coastal waters, and 1.4% of oceans are protected.¹⁴ Growth of sugar cane for ethanol, soya beans for livestock, and palm oil for food, drug products, and biofuels in tropical areas has increased substantially, often leading to the displacement of primary forests.¹⁴

Roughly 3 billion people consume some fish; however, only about 15% of fish stocks are underexploited or moderately exploited, with adverse trends recorded since 1992.¹⁴ The absorption of growing emissions of carbon dioxide has resulted in ocean acidification,¹⁵ which further threatens the integrity of coral reefs and shellfish

populations and potentially has major adverse effects on fish stocks.

Some have proposed that there are boundaries of the Earth's major biophysical systems or processes within which human beings can safely operate.¹⁶ Once they are breached, non-linear, potentially irreversible changes will probably occur in the life support systems, with incalculable results. For example, much of Arctic and Antarctic ice caps, glaciers, and many coral reefs could be lost. Nine boundaries have been proposed,¹⁶ of which three have probably been exceeded already: climate change, rate of biodiversity loss, and the nitrogen cycle (table 1). Others have almost been breached: stratospheric ozone depletion, ocean acidification, global freshwater use, the phosphorous cycle (part of a boundary with the nitrogen cycle), and changes in land use.¹⁶ Perturbations in the biophysical systems have direct and indirect health effects (table 1).

High-income nations have historically consumed many more resources per head than have low-income countries, and have also had a disproportionate share of greenhouse-gas emissions.²² However, consumption patterns are changing and per head greenhouse-gas emissions of many middle-income countries are growing rapidly. Additionally, a substantial proportion of developed countries' emissions have been exported overseas because manufacturing of consumer products has moved to nations with emerging economies (most notably China).²² That most of the future increase will be a result of economic growth in such countries poses major additional challenges to sustainability. By 1999, people were already exceeding the Earth's capacity to regenerate the resources used in 1 year by roughly 20%.²³ The USA was using the equivalent of 7.19 hectares of land per person as natural

	Cause	Proposed boundary ¹⁶	Present level	Potential health effects
Climate change	Accumulation of greenhouse gases (eg, carbon dioxide, methane, nitrous oxide)	350 parts per million	393.87 parts per million in March, 2012 ²⁷	Increased heat-related (and possibly reduced cold-related in some countries) deaths because heatwaves increase in frequency and intensity ^{18,19} Falls in food production and thus increased malnutrition in vulnerable regions ^{18,19} Health effects of extreme events (eg, floods and droughts) ^{18,19} Increased tropospheric ozone levels ^{18,19} Raised diarrhoeal disease incidence ^{18,19} Changes in vector-borne disease distribution ^{18,19}
Rate of biodiversity loss	Extinction rate of species as a result of factors such as climate change and land use changes	10 species per million per year	>100 species per million per year	Positive and negative changes in exposure to disease vectors because of deforestation ²² Loss of potential natural sources of new pharmacological agents ¹² Declining production of many fisheries and resulting effects on nutrition for many communities ¹²
Nitrogen cycle	Amount of N ₂ removed from the atmosphere for human use	35 million tonnes per year	121 million tonnes per year	Possible increased risk of colon cancer because of increased nitrate concentrations in drinking water, ²⁰ particularly in people who consume few fruits and vegetables Substantial uncertainty about adverse effects because robust epidemiological evidence is scarce Exposure to various toxins released from algal blooms caused by eutrophication of freshwater from heavy nutrient loading could lead to adverse but still poorly understood effects ²¹

Table 1: Potential health effects of exceeding three biophysical boundaries

capital to support the lifestyles of its citizens in 2008, the UK 4.57 hectares, and Germany 4.71 hectares, compared with the global average of 2.7 hectares per head.¹³ By 2050, if the present situation continues without decisive policies to reduce environmental damage, humanity will need 2.9 planets equivalent to Earth to support its population.¹³

Health and environmental burdens

Overall, about 24% of the global burden of disease and 23% of deaths are attributable to environmental causes; 36% of the disease burden in children is caused by environmental factors.²⁴ The highest burden is in sub-Saharan Africa and south Asia. The major disease burdens are diarrhoeal diseases, infections of the lower respiratory tract, injuries related to workplace hazards and road traffic, and malaria.²⁴ Additionally, products of incomplete combustion in inefficient cooking stoves or open fires burning biomass or coal, which cause roughly 2 million deaths worldwide per year, mainly of women and children.²⁵ The incomplete combustion products can also contribute to climate change. Prevalence of malaria is affected by environmental factors such as climate, deforestation, water resource management, and location and design of housing. This burden of disease caused by environmental factors has been neglected, resulting in a legacy of ill health to which the health effects of emerging threats such as climate change will be added.

Concern about the effect of non-communicable diseases on health and economic development is growing (appendix). The prevailing patterns of inequitable development and unsustainable lifestyles that are largely the cause of many environmental threats are related directly or indirectly to the burden of these diseases. In the food production system, the focus is increasingly on promotion of consumption of refined, energy-dense food containing substantial amounts of saturated fats from animal sources, which increases the risk of ischaemic heart disease and obesity.²⁶ Consumption of red meat is associated with increased risk of colon cancer.²⁷ Concurrently, the agriculture sector releases 10–12% of global greenhouse-gas emissions (an additional 6–17% when change in land use is included) and livestock contributes roughly 80% of these emissions, particularly methane from ruminants such as cows and sheep.²⁸ The demand for animal products is increasing as affluence rises and drives forest clearance in some places. At a time when freshwater supplies are diminishing in many areas, animal products also contain much embedded water (ie, amount of water used in the entire process of product manufacture, retail, and consumption). In the UK, about 65% of water consumed is embedded in food—eg, a 150 g burger has about 2400 litres of embedded water.²⁹

Roughly 3.2 million deaths a year are thought to be related to sedentary lifestyles,³⁰ partly because of growth in motorised transport, particularly private cars. Increased risk of seven conditions—diabetes, ischaemic heart disease, cerebrovascular disease, breast and colon

cancers, Alzheimer's disease, and depression—has been consistently associated with little physical activity.³¹ Road transport causes a growing proportion of greenhouse-gas emissions and contributes substantially to urban fine-particulate air pollution, which is thought to result in about 1.3 million deaths per year,²⁵ and accumulation of tropospheric ozone and the subsequent health effects.³² 1.3 million deaths a year are caused by road injuries,³³ particularly those of pedestrians and cyclists.

Combustion of fossil fuels for electricity generation, particularly coal, generates a substantial proportion of fine-particulate air pollution.³⁴ Generally, exposure to outdoor air pollution rises at first as societies develop, then decreases because effective pollution controls are implemented and sources of energy causing reduced amounts of pollution are used, particularly for electricity generation and transportation.³⁵ However, this change has historically been accompanied by increasing greenhouse-gas emissions.³⁵

In high-income and middle-income countries, the household environment can contribute to ill health in several ways, such as mould and damp, indoor air pollutants (eg, radon and environmental tobacco smoke), exposure to cold or heat, and risk of fires.³⁶ Poor design and maintenance means that many dwellings use energy inefficiently because of heat loss or gain due to inadequate insulation or ventilation control, or both, thus contributing to fuel poverty and emission of large amounts of greenhouse gases.

How can sustainable development be achieved?

The Earth's environment is affected by three factors: population, affluence, and technology (impact = population × affluence × technology).³⁷ Global population growth has slowed in the past four decades, but is high in parts of sub-Saharan Africa. Projections suggest that the world population will be roughly 10 billion before the end of this century,³⁸ posing additional challenges for development. The unmet need for contraception is as high as 30% in some sub-Saharan African countries.⁹ Funding for family planning on a per head basis has fallen in the past decade in virtually all recipient nations.⁹ Reductions in population growth can bring direct and indirect benefits to health through improved child survival, reduced maternal mortality, and decreased pressures on land use. In low-income countries, such a decrease will have few effects on greenhouse-gas emissions in the short term, but could have substantial effects in the long term, especially if populations with low income adopt western lifestyles in large numbers. Population growth in high-resource-use economies could also have an important effect on future emissions. For example, if present trends continue, the population of the USA will have risen from 296 million in 2005, to 438 million in 2050, largely due to immigrants and their descendants.³⁹ The resulting emissions would be equivalent to those from several billion people of low income at present.

Countries with similar per head income have variable per head greenhouse-gas emissions. Some of these differences might be due to importation of products that have high embodied carbon and are not generally counted in national greenhouse-gas inventories.⁴⁰ Carbon-exporting countries might accrue fewer socioeconomic benefits than do carbon-importing ones.²² Furthermore, many countries with low per head greenhouse-gas emissions (<1 tonne of carbon) have average life expectancies of older than 70 years, although high incomes (average >US\$12 000 per year) are not compatible with such low emissions.²² Therefore, with new, so-called clean technologies and implementation of policies to reduce inequities and promote healthy lifestyles, health could improve greatly worldwide with fewer environmental effects than we have nowadays.

Health co-benefits of improved policies in other sectors

The existence of health co-benefits (ie, ancillary benefits) from policies to reduce greenhouse-gas emissions is increasingly recognised (table 2).^{31,36,41-45} These co-benefits can reduce costs to health-care systems.⁴⁶ Economic benefits can partly or wholly offset the costs of implementation of low-carbon strategies, the assumptions made, and the socioeconomic context, depending on the sector. Some low-carbon technologies might, however, have adverse health effects—eg, growth of biofuels that compete for land with food crops could increase food prices⁴⁷—so every strategy should be assessed separately.

Health can be improved through efficient use of energy in housing. A randomised trial of retrofitting insulation in low-income housing in New Zealand⁴⁸ showed that net savings in electricity were 13% in the intervention group, and that number of days absent from school, self-reported poor health, and adults' days absent from work reduced. Total benefits were estimated to be larger than were the costs of insulation,⁴⁸ but adequate ventilation is needed to prevent accumulation of indoor air pollutants.

Large-scale introduction of clean cooking stoves will address health inequalities; the half of the world's population that has low income is affected most by indoor air pollution. New stove technologies can reduce such pollution by 90% and fuel consumption by 40%, as well as the time needed for cooking and collection of wood and the associated risk of violence.⁴⁹ Previous efforts to deploy improved cooking stoves and to install chimneys reduced fuel consumption, but had few effects on health because of insufficient reductions in air pollution.⁵⁰ Kerosene lamps are associated with particulate air pollution,⁵¹ burns, and poisoning;⁵² they can be effectively substituted by solar powered lamps or biogas.

Transportation policies could prevent non-communicable diseases, especially in rapidly growing cities in emerging economies, where use of motor vehicles increases. Increased reliance on rapid transit systems, walking, and cycling lowers air pollution and noise, reduces traffic injuries, and promotes physical activity. These policies also give people of low income, women, children, and elderly individuals—who rarely own private

	Main greenhouse pollutants reduced with strategy	Positive effect linked to main health benefits	Main health benefits	Factors affecting magnitude of effect
Reduced fossil fuel combustion (particularly coal) to generate electricity	Carbon dioxide, methane, and black carbon	Reduction in fine-particulate air pollution and ozone	Decreased mortality and morbidity due to cardiorespiratory diseases ^{32,41}	Existing pollution control measures and fuel mix; probably greater effects in low-income and middle-income countries where background air pollution is higher than in high-income nations
Cooking stoves with improved efficiency in households burning biomass or coal in open fires*	Black carbon, ozone, and carbon monoxide	Decreased fine-particulate air pollution and other pollutants, risk of fires and fuel collection, and costs of fuel	Reduced incidence of acute respiratory infections in childhood, chronic obstructive pulmonary disease, ischaemic heart disease, and burns ³⁶	Present stove design and fuel type; performance of improved stove; and affordability of household energy
Increased active travel in urban areas	Carbon dioxide and ozone	Increased physical activity as a result of walking or cycling; reduced fine-particulate air pollution and ozone	Reduced incidence of ischaemic heart disease, cerebrovascular disease, diabetes, colon and breast cancers, Alzheimer's disease, depression; possible increase in road injuries; decreased mortality and morbidity due to cardiorespiratory diseases ^{31,32,42}	Pre-existing levels of physical activity; epidemiological profile of disease; extent of behaviour change; policies to reduce road injuries; and future projections of motor-vehicle use
Low-emission vehicles	Carbon dioxide and ozone (depending on technology used)	Reduced fine-particulate air pollution and ozone	Decreased mortality and morbidity due to cardiorespiratory diseases ^{31,32}	Baseline emission standards and future projections
Reduced consumption of animal products in high-consuming populations	Methane and nitrous oxide	Reduced intake of saturated fat, and red and processed meat	Reduced incidence of ischaemic heart disease ⁴³ and colon cancer ²⁷	Baseline incidence of ischaemic heart disease and risk factor profile of population

Further details are available in Haines et al,⁴⁴ and Haines and Dora.⁴⁵ *Benefits could also be achieved by a switch to biogas or liquefied petroleum gas.

Table 2: Strategies to reduce emissions of greenhouse gases and their health co-benefits

vehicles—access to goods and services. However, clean transport fuels and efficient motor-vehicle engines do not affect physical activity, noise, or traffic injuries, and might not lead to reductions in air pollution because numbers of vehicles and sizes of engines might increase.⁵³ Longitudinal studies in Copenhagen⁵⁴ and Shanghai⁵⁵ showed that people who cycle to work regularly have 30% lower all-cause mortality than do those who do not cycle. Transport interventions and urban planning are some of the most effective interventions to promote physical activity.⁵³ They provide an example of the potential benefits of integration of social, economic, and environmental components of development.

A shift from combustion of coal for electricity generation will reduce greenhouse-gas emissions and fine-particulate air pollution. Several studies⁴¹ have estimated the probable health benefits. In India, roughly 90 000 premature deaths could be averted every year. In high-income nations, the health co-benefits would be comparatively less than in other countries because of existing air pollution legislation, but would still be worthwhile. Conservative estimates suggest that the annual costs of air pollution from industrial facilities in Europe are €102–169 billion.⁵⁶

One approach is to generate electricity without production of air pollution by concentrating solar power in deserts and transmission of this power through high-voltage direct current transmission lines. Solar-concentrating power plants in less than 1% of the world's deserts could produce as much electricity as is used now.⁵⁷ Shindell and colleagues⁵⁸ identified 14 measures targeting methane and black carbon emissions that could reduce projected mean global warming by roughly 0.5°C by 2050. These measures would prevent 0.7–4.7 million premature deaths every year from outdoor air pollution and increase annual crops because of ozone reductions by 2030.⁵⁸ The gains would be substantially greater than would the marginal costs of mitigation. Reductions in consumption of animal products can improve health in countries with high consumption and reduce greenhouse-gas emissions.⁴³

Health benefits and co-benefits of policies to reduce environmental damage have been less well explored for other biophysical boundaries. However, such gains would include reduction in exposures of populations to algal toxins because of reduced eutrophication of freshwater or exposure to nitrates in drinking water.⁵⁹

Is addressing poverty compatible with sustainable development?

In view of present unsustainable patterns of development, a legitimate question is whether the needs of people with low income can be addressed within environmental constraints. Because consumption patterns are so asymmetrical, provision of sufficient energy services (eg, heating, lighting, and cooking) to nearly 3 billion people presently without them would add only

1.3% to global greenhouse-gas emissions, even with fossil-fuel-intensive sources.⁶⁰ To address food and income needs of people with the lowest incomes would necessitate redirection of small proportions of global food supply and income.⁶¹ The high resource consumption of the wealthiest 10% of people poses the greatest threat to sustainability.

Developing and emerging economies are subsidising consumption of fossil fuels with about \$409 billion per year, although people of low income benefit comparatively little, while members of the Organisation for Economic Co-operation and Development provide subsidies of \$45–75 billion a year for fossil-fuel production and use.⁶² By comparison, government support of electricity from renewable and biofuel sources was \$57 billion worldwide in 2009.⁶² Thus, gradual removal of fossil-fuel subsidies could provide most resources necessary to provide cheap renewable energy.

Progress towards sustainable development

Information systems do not yet make the connections between relevant sectoral policy, related risks to health, and health outcomes. This information gap means that development choices are often made without consideration of health effects. A new generation of indicators that integrate economic, environmental, and social dimensions of development are needed to measure progress towards sustainability and other goals (appendix).

Access to information about sector policies and their associated health risks and effects by use of integrated indicators of health, development, and environment, and with systematic health-effect assessment of policies is key to global governance for sustainable development; public awareness and accountability of decision makers would be raised.⁶³ Such an approach will be crucial when goals for development are assessed after 2015 (the finish date for the MDGs).

Challenges of global governance

Many global challenges cannot be effectively addressed by present models of development and governance. These interconnected challenges include systemic shocks (eg, natural disasters) and long-term processes (eg, food insecurity, climate change, and widening economic disparities). To advance sustainable development and global health, three main issues must be confronted: development can no longer be measured in only economic terms; transnational difficulties can be effectively addressed only through agreements between nation states; and the barriers between policy making in different sectors need to be overcome.

The challenge of how to govern the world arose as a challenge in the environmental debate earlier than in global health. Indeed, much of the published information about new approaches to global governance arose from the environmental discourse about civil society and non-governmental organisations. In 1994, Young⁶⁴ said that

“Governance arises as a social or societal concern whenever the members of a group find they are interdependent in the sense that the actions of each impinge on the welfare of the other.”

The international effects on health became apparent in the 1980s and 1990s, with the AIDS pandemic and the SARS outbreak, and with the issues associated with a transnational business such as tobacco. Nowadays, one of the key governance challenges of non-communicable diseases is the movement of ideas, people and their behaviours across national borders, together with products and their marketing.

One of the issues of governance to be discussed at Rio+20 is the institutional mechanism with which sustainable development is to be anchored in the UN system; several different models are being considered.⁶⁵ Key concerns are whether such a mechanism should be focused on the environment or whether it should integrate environment with development (which would also have institutional effects such as the merger of UNDP with UNEP).⁶⁶

How to address sustainable development is a challenge to all intergovernmental multilateral organisations as they assess their role in the 21st century. New approaches to legitimacy, representation, participation, funding, and effectiveness are necessary to deal with worldwide challenges in an integrated manner. They are a challenge to WHO, which is in the process of reform to increase its ability to address global challenges. The limits of WHO as an operational organisation have become apparent in a global health arena that is now full of many participants, such as non-governmental organisations, foundations, hybrid organisations, and activists. However, in the past 10 years, WHO has been able to forge major agreements between member states in relation to key transboundary issues precisely because of its intergovernmental nature and constitutional powers. For example, it implemented the International Framework on Tobacco Control in 2003,⁶⁷ the International Health Regulations in 2005,⁶⁸ and the Global Code of Practice on the International Recruitment of Health Personnel in 2010.⁶⁹ However, global health priorities need a commitment beyond that of Ministers of Health in the context of the World Health Assembly. Two major health issues—HIV/AIDS and non-communicable diseases—have already been taken to the UN General Assembly, and crucial health challenges have been central to MDGs, which also necessitate implementation by several actors outside the health sector. WHO should have an important voice in the sustainable development agenda, but new mechanisms are needed for the broad and integrated engagement of the UN system.

In the health arena, the UN’s political statement on non-communicable diseases⁷⁰ called for “whole of government” and “whole of society” approaches, which would address the challenges in an integral way. The approach of health in all policies (policy or reform that aims to ensure communities are healthy, with integration of public health

actions with primary care and healthy public policies in all sectors) has long been advocated by public health experts and is gaining new traction as the fact that much of population health is created outside of the health sector is increasingly acknowledged.⁷¹ Environmental and social issues need to be integrated into economic decision making. Many have been calling for the environment to be included in all policies for some time,⁷² and this change is now happening in the health sector. In its reform process, WHO should emphasise the need for such integration more than it has done so far.

Both in health and in sustainable development, the issue of equity and fairness has moved to the forefront of policy discourse (appendix) and has led to calls to address the so-called causes of the causes⁸ of health, economic, and environmental challenges. The institutions and approaches needed to address these issues will need to be global and cross-sectoral; they should engage non-governmental organisations and civil society. Financing of global public goods could be ensured, for example, by taxes on global financial transactions on products that result in harmful externalities (eg, carbon taxes),⁷³ with safeguards to prevent regressive effects that lead to people of lower income paying higher proportions of their incomes in taxes than do those of high income, or the UNITAID airline tax that aims to address health and environmental goals.⁷⁴

However, a new type of verticality could be achieved, which would not be based on functional issues and sectors but on epistemic communities that remain self-contained. In the health arena, little communication occurs between the communities of non-communicable disease, MDGs, and social determinants of health, although their goals (if not their language) are similar. These communities in turn generally have few links with that of sustainable development. Non-governmental organisations have an important role in bridging of these gaps—eg, the NCD Alliance has outlined the links between non-communicable diseases and unsustainable patterns of economic development and environmental degradation.⁷⁵

One way forward is to create partnerships to address major development challenges across sectors (ie, food, water, social protection, and energy) that affect human wellbeing and ultimately survival. The overall challenge is to develop a blueprint for sustainable living that ensures the wellbeing of people in an equitable manner, which could be a starting point for a new debate about global public goods after the MDGs. These global goals need to address unsustainable lifestyles, patterns of production and consumption, and effects of population growth.⁷³ An initiative throughout the UN for sustainable development is needed, with improved health as a major focus, addressing both poverty and overconsumption and engaging non-governmental organisations and civil society together with private sector interests that take a responsible view of the need for development within finite boundaries.

Conclusions

Unfortunately many sustainability challenges have not even been begun to be addressed at national or global levels. In many ways, the world is at a more dangerous impasse than it was two decades ago. Present trends show unacceptable inequities in health and wealth. Additionally, the environmental basis of health and development is being rapidly undermined by outmoded and unsustainable patterns of consumption and development. The challenge in the 21st century is to provide for a healthy world population of potentially 10 billion people without undermining sustainability. Several priority actions could address this challenge.

A fundamental change in economies and lifestyles is needed; activities that do not result in net environmental and health damage are essential. All policies—including economic policies—should take into account external costs as a result of their effects on the environment and health. This change will necessitate appropriate integrated assessments that would send strong messages about the long-term affordability of different policies.

There is an urgent need to obtain increased financial resources for sustainable development and health at a time of widespread economic negativity, particularly in Europe and North America. Taxes that target externalities should be introduced, but negative effects on people with low income should be avoided, potentially by direction of some resulting resources to a reduction in income inequalities. Gradual removal of damaging subsidies for both fossil fuels and agricultural policies could provide much of the necessary funds.

Systems of governance—national, regional, and global—need to be reoriented with a core set of global public goods that need to be ensured, governed, and financed through a common global effort. This reorientation should be the focus of MDG goals after 2015. Alternative metrics of human progress should be sought to measures of economic development such as gross domestic product, which is weakly related to human development above a threshold of roughly \$12000 per head²² but strongly to greenhouse-gas emissions because of the dependence on fossil fuels and unsustainable patterns of land use. These alternatives should build on the human development index and its modifications to enable assessment of inequalities in health, education, and development,⁷⁶ and to capitalise on other work that establishes the need to move from measuring of production to wellbeing and to give prominence to inequities in income and consumption.⁷⁷ The health-damaging effects of present policies could prove to be a more powerful motivator for changes in policy than are exhortations to protect the environment for its own sake.

High-income countries have a specific responsibility to embark on development with prioritisation of health, environmental protection, and redistributive national policies to reduce inequities. They will need to reduce the damage to health and development prospects caused by

their models of economic growth in disadvantaged populations worldwide, while also addressing their own economic crisis; emerging economies should do the same.

International law is an important instrument to address global health challenges such as the threat of disease outbreaks or of tobacco consumption, as WHO has shown.⁶⁷ International environmental law could be one of the most important areas, because it has the potential to advance health goals. Additionally, countries should revisit their public health laws and explore how the new interface of environmental and health challenges can be addressed to support sustainable development. Developing countries should be supported in building of institutions—including information and legal systems—that allow for accountability when health or the environment is threatened by national or global actors.

Existing agencies should integrate environmental, social, economic, and health goals. They need to bring together state and non-state actors, as well as different levels of governance to address global challenges. WHO, together with the Food and Agriculture Organization, could be responsible for addressing the food and health agenda. Similar approaches need to be investigated by national governments, which tend to prioritise short-term economic growth and single-sector policies acting in isolation rather than coordinated action. Provision for a healthy world population of 10 billion should be possible without undermining of sustainability. However, such provision will need major changes in policies, institutions, governance, and lifestyles on an unprecedented scale.

Contributors

AH had the original idea for this report. All authors wrote specific sections of the text, commented on drafts, and approved the final draft.

Conflicts of interest

AH previously spent a sabbatical at WHO and has been an adviser to WHO on various issues. GA is Director Emeritus of the Pan American Health Organization. IK was previously employed by WHO and is presently a senior adviser to WHO. CD is employed by WHO. The views expressed here do not necessarily represent the decisions or policies of WHO.

Acknowledgments

We thank the individuals who worked on WHO's series entitled *Health in the Green Economy*; the series particularly informed the sections of this Review about health and environmental burdens and about health co-benefits of improved policies in other sectors.

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