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GLOBALIZATION AND HUMAN HEALTH: TOWARD SCENARIOS FOR THE 21st CENTURY

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1. Introduction

Good health for all populations has become an accepted international goal. Looking at past and contemporary developments in human health, we can state that there have been broad gains in life expectancy over the past century. However, health inequalities between rich and poor persist, and the future prospects for health depend increasingly on the relatively new processes of global change and globalization. In the past, globalization was often seen as a more or less economic process characterized by trade liberalization and capital mobility. Nowadays, globalization is increasingly perceived as a more comprehensive phenomenon that is rapidly reshaping society.

Due to the processes of globalization, the geographical scale of important health issues is progressively increasing. This was, for example, clearly demonstrated by the rapid spread of the Severe Acute Respiratory Syndrome (SARS) epidemic in 2003. Additionally, the intergenerational equity implied by sustainable development also forces us to consider the right of future generations to a healthy life.

The pathways from globalization to health are often complex and mediated by a multitude of factors, such as economic development, lifestyle and ecological changes. Therefore, exploring the health effects of globalization requires a more holistic approach than has previously been taken. This paper describes a first attempt to add a health dimension to existing global scenarios in order to explore the future health effects of globalization.

2. Population Health: A Conceptual Framework

As the world around us becomes more interconnected and complex, human health is increasingly perceived as the integrated outcome of its ecological, socio-cultural, economic and institutional determinants. Therefore, it can be seen as an important high-level integrating index that reflects the state – and, in the long term, the sustainability – of the natural and socio-economic environment [1, 2]. The conceptual framework of population health described in this section is based primarily on a comprehensive analysis of a diverse selection of existing models of population health (see for more details [3]). Although the selected models vary in complexity, purpose and content, their strengths and weaknesses reveal the following guidelines for an ideal-type model of population health, which:

– makes a distinction between determinants of different natures;

– makes a distinction between determinants of different levels of causality;

– is as comprehensive as possible without becoming too complex; and

– includes response variables/determinants.

The nature and level of causality of the determinants can be combined into a basic framework that conceptualizes the complex multi-causal aspects of population health. In referring to the nature of the determinants, we make the traditional distinction between institutional, economic, socio-cultural, and environmental factors. These factors have different positions in the causal chain, and so operate at different hierarchical levels of causality. The chain of events leading to a certain health outcome includes both proximal and distal causes: proximal factors act directly to cause disease or promote health, and distal determinants affect health via (a number of) intermediary causes [4]. We also distinguish contextual factors. These are the macro-level conditions that form the context in which the distal and proximal factors operate and develop. Determinants with different positions in the causal chain probably also differ in their temporal dimensions. Individual-level proximal health risks can be altered relatively quickly, for example by a change in personal behavior; for disease rates in whole populations to change requires slower and more sedimentary changes in contextual factors, often over the course of a few decades.

Further analysis of the selected health models and an intensive literature study resulted in a wide-ranging overview of the health determinants that can be fitted within this framework (Table 1). Figure 1 (see page 418),

TABLE 1. Determinants of population health [3, 5].

Level/Nature	General determinants	More detailed determinants
Contextual		
Institutional	Institutional infrastructure	Governance structure
		Political environment
		System of law
		Regulation
Economic	Economic infrastructure	Occupational structure
		Tax system
		Markets
Social-cultural	Culture	Religion
		Ideology
		Customs
	Population	Population size
		Structure
		Geographical distribution
	Social infrastructure	Social organization
		Knowledge development (incl. technology)
		Social security
		Insurance system
		Mobility and communication
Environmental	Ecological settings	Ecosystems
		Climate
Distal		
Institutional	Health policy	Effective public health policy
		Sufficient public health budget
	Health-related policies	Effective food policy
		Effective water policy
		Effective social policy
		Effective environmental policy
Economic	Economic development	Income/wealth
		Economic equity
	Trade	Trade in goods and services
		Marketing
Social-cultural	Knowledge	Education and literacy
		Health education
		Technology
	Social interactions	Social equity
		Conflicts
		Travel and migration
Environmental	Ecosystem goods and services	Habitat
		Information
		Production
		Regulation
Proximal		
Institutional	Health services	Provision of and access to health care services
Economic	-	-
Social-cultural	Lifestyle	Healthy food consumption patterns
		Alcohol and tobacco use
		Drug abuse
		Unsafe sexual behavior
		Physical activity
		Lifestyle related endogen factors (blood pressure, obesity, cholesterol levels)
		Stress coping
		Child care
	Social environment	Social support and informal care
		Inhanced injuries and abuse/violence
Environmental	Food and water	Adequate water quality and quantity
		Adequate food quality and quantity
		Sanitation
	Physical living environment	Quality of the living environment: biotic factors (e.g., infectious disease pathogens), physical factors (e.g., temperature, radiation) and chemical factors (e.g., pollution);
		Unintended injuries (e.g., disasters, traffic accidents, work-related accidents)

which draws on this analysis, shows a manageable number of general determinants and includes important response variables such as health policies and health-related policies.

We must keep in mind, however, that determinants within and between different domains and levels interact in complex and dynamic ways to 'produce' health at a population level. In addition, the pathways between these determinants and population health are not unidirectional; for example, ill health can have a negative impact on economic development.

3. The Globalization Process as a Determinant of Population Health

More and more scholars agree that globalization is an extremely complex phenomenon. Rennen and Martens [6] define contemporary globalization as an intensification of cross-national cultural, economic, political, social and technological interactions that lead to the establishment of transnational structures and the global integration of cultural, economic, environmental, political and social processes on global, supranational, national, regional and local levels. This definition aligns with the view of globalization as deterritorialization, and it explicitly acknowledges the multiple dimensions involved in the process.

To focus our study, we identify global governance structures, global markets, global communication, global mobility, cross-cultural interaction and global environmental changes as important features of the globalization process (Table 2). These features all operate at the contextual level of health determination and influence distal factors such as health (related) policy, economic development, trade, social interactions, knowledge, and ecosystem goods and services. In turn, these changes in distal factors have the potential to affect proximal health determinants and, consequently, health [3, 5].

4. Health in Existing Global Scenarios

The value of scenario studies to explore possible future events and provide sound policy-relevant guidance for decision-makers is increasingly and widely recognized (Box 1). Globalization is often included as an important driver in existing global scenarios and sometimes even as a distinguishing factor between different storylines (see e.g., the Special Report on Emission

TABLE 2. Features of globalization [3, 5].

Features of globalization	
Global governance structures	Globalization influences the interdependence among nations as well as nation-states' sovereignty, leading to (a need for new) global governance structures.
Global markets	Globalization is characterized by worldwide changes in economic infrastructures and the emergence of global markets and a global trading system.
Global communication	Globalization makes the sharing of information and the exchange of experiences with common problems possible.
Cross-cultural interaction	Globalizing cultural flows result in interactions between global and local cultural elements.
Global mobility	Global mobility is characterized by a major increase in the extensity, intensity and velocity of movement and by a wide variety in 'types' of mobility.
Global environmental changes	Global environmental threats to ecosystems include global climate change, loss of biodiversity, global ozone depletion and a global deterioration of natural areas.

Scenarios [7]). However, a set of integrated global scenarios on future health has not been generated to date.

With the following criteria in mind – integration, long-range outlook and global scope – we considered eight scenario studies (with a total of 31 scenarios) developed since 1995: Global Environmental Outlook 3 (GEO-3) [8], the Global Scenario Group [9], Global Trends 2015 [10], the Millennium Project [11], Which World [12], the Special Report on Emission Scenarios (SRES) [7], the World Business Council on Sustainable Development Global Scenarios [13], and the World Water Scenarios (WWS) [14] (for more details see [15, 16]). Only fourteen out of the 31 selected scenarios give a reasonable description of future developments in health. Eight scenarios completely neglect the health dimension. Only four scenarios explicitly discuss several socio-cultural, economic and ecological developments as determinants of health [15, 16].

A mere 15% of the selected scenarios describe health adequately and in an integrated way, which indicates that health is not consistently handled within current global scenarios. However, other developments that possibly affect future health (e.g., food, water, environment, social change, equity, economic growth, technology) are well addressed in most scenarios [15, 16]. Therefore, it would have been possible to describe future developments in health as an outcome of these multiple drivers and pressures.

BOX 1. SCENARIOS

Scenarios are descriptions of journeys to possible futures that reflect different assumptions about how current trends will unfold, how critical uncertainties will play out and what new factors will come into play [8]. They describe hypothetical future pathways that consist of states, events, actions and consequences that are causally linked.

Scenarios were first used primarily as planning and forecasting tools, displaying a mechanistic and deterministic view of the world. Today, it is generally accepted that scenarios do not predict but paint pictures of possible futures by exploring different outcomes that might result from changing basic assumptions [8]. The relevant question that scenarios can address is not whether any particular development will happen in the future, but rather what might happen and how we act to encourage, discourage, prepare for, and/or respond to such an event or development. In this way scenarios can go beyond the conventional paradigm and may result in surprising and innovative insights.

5. LINKING SCENARIOS TO FUTURE HEALTH

So what 'health future' lies ahead? We explore this question by looking at two recently developed sets of scenarios: the SRES-scenarios [7] and the GEO3-scenarios [8]. The socio-cultural, institutional, economic and environmental developments described in these scenarios are linked to three potential health futures (Box 2): the 'Age of emerging infectious diseases', the 'Age of medical technology' and the 'Age of sustained health'. Although these futures are hypothetical, they are based on views in current literature and possible 'early signs' observed within society. They also build upon past and current developments described by the health transition (Figure 2, see page 418). The projected picture of future health in a particular scenario evolves from (our interpretation of) a combination of the described developments in relevant health determinants. We describe the results of this exercise in the next sections.

BOX 2. THREE POTENTIAL FUTURE STAGES IN THE HEALTH TRANSITION

Past changes in population health encompass several related developments such as the increase in life expectancy, declining mortality and fertility, shifting causes of death, the changing character of morbidity and continuing developments in the provision of health services. These long-term changes in the patterns of health and disease and their multiple determinants can be described and explained within a conceptual framework known as the health transition (sometimes also referred to as the epidemiologic transition [17, 18]). Although it has limitations [19], the health transition is a useful tool for understanding current health trends and exploring future developments.

Although the future of human health cannot be predicted with certainty, there are patterns of change and signs that can be anticipated. Below, three possible, but hypothetical, health futures are sketched; these build on past and current transition 'stages'.[1] These health futures are based on views in current literature and possible 'early signs' observed within society. They could follow from stages in the health transition we have seen in the past and are facing at present (Figure 2). There is also the possibility that economic, political, social, or environmental crises will cause the process of transition to stagnate, or to go into reverse. Additionally, these 'futures' are not sharply delineated but reflect a continuum of possible outcomes.

Age of Emerging Infectious Diseases

Current outbreaks of SARS and other (re)emerging diseases are a reminder that sudden disease emergence is a permanent part of the world and should be anticipated [20]. It is recognized that communicable diseases are possible threats to the future of mankind [18]. According to Olshansky *et al*. [21], for example, the next stage in the health transition could possibly be characterized by emerging-disease outbreaks.

In this picture of future health [22], the emergence of new infectious diseases or the re-emergence of 'old' ones will have a significant impact on health. A number of factors will influence this development: travel and trade, microbiological resistance, human behavior, breakdowns in health systems, and increased pressure on the environment [23]. Social, political and eco-

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[1] This first stage of the health transition (the 'Age of pestilence and famine') is characterised by the kind of mortality that has prevailed throughout most of human history. Most developing countries are now in the second stage: the 'Age of receding pandemics'. It involves a reduction in the prevalence of infectious diseases, and a fall in mortality rates. In the third stage (the 'Age of chronic diseases'), the elimination of infectious diseases makes way for chronic diseases among the elderly. Currently, most developed countries are in this stage. Adopted from Omran (1983, 1998).

nomic factors that cause the movement of people will increase contact between people and microbes; environmental changes caused by human activity (e.g., dam and road building, deforestation, irrigation, and climate change) will contribute to the further spread of disease. The overuse of antibiotics and insecticides, combined with inadequate or deteriorating public health infrastructures will hamper or delay responses to increasing disease threats. Control of infectious diseases will be hampered by political and financial obstacles, and by an inability to use existing technologies. As a result, infectious diseases will increase drastically, and life expectancy will fall (as is currently the case in many developing countries due to the AIDS pandemic). Ill health will lead to lower levels of economic activity, and countries will be caught in a downward spiral of environmental degradation, depressed incomes and ill health.

Age of Medical Technology

Past shifts in health patterns and risk factors have been driven mainly by economic development (and associated modernization processes) and improvements in (medical) technology and health care [17, 18]. Vice versa, shifts in health and disease patterns have influenced the organized response to the changing needs of the global population, particularly in the provision of health services [24]. In the developed world, for example, the emergence of chronic health problems and unhealthy lifestyles changed the focus of health systems dramatically. In the developing world, policies concentrate on the widespread implementation of modern health care and development programs.

A continuation of these trends could possibly be described as the 'Age of medical technology' [22]. Such a future is in line with Omran's futuristic stage called 'aspired quality of life with paradoxical longevity and persistent inequities' [18]. There will be continued achievements in disease control, health promotion, and prolongation of life. To a large extent, increased health risks caused by unhealthy lifestyles and environmental changes, among other things, will be offset by increased economic growth and technological improvements. Still, some health problems will, at least for a while, challenge existing diagnostic and therapeutic abilities (just as with the evolution of HIV/AIDS). Additionally, longevity is a mixed-blessing, as it is accompanied by increasing chronic morbidity and mounting medical costs. There will also be continued socio-economic inequities.

Without long-term, sustainable economic development, increased environmental pressure and social imbalance may eventually propel poor societies into the 'Age of emerging infectious diseases'. On the other hand, if environmental and social resources eventually are balanced with economic growth, then sustained health may be achieved.

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Age of Sustained Health

The Earth Charter Initiative [25] is a good example of a present-day movement promoting a global ethic for sustainability. It is based on the participation of thousands of organizations, groups and individuals worldwide. The Earth Charter envisions a future characterized by a societal transformation toward sustainability, which the document itself calls 'a change of mind and heart'.

From a health perspective, such a future can possibly be described as an 'Age of sustained health' [22]. Economic growth will stay within social and ecological limits. In order to enhance physical, mental, spiritual and social well-being, policies will focus on the wide-range of health determinants, social participation, social justice, and the sustainable use of the environment. Investments in social services will lead to a sharp reduction in lifestyle related diseases, and most environment-related infectious diseases will be eradicated. Health policies will be designed to improve the health status of a population in such a way that the health of future generations is not compromised, for example, by the depletion of resources needed by future generations. Although there is only a minimal chance that infectious diseases will emerge, improved worldwide surveillance and monitoring systems will properly manage any outbreak. Health systems will be well adjusted to the ageing world population. Furthermore, disparities in health between rich and poor countries will eventually disappear. This picture of future health is in line with Omran's vision of future health described as 'quality of life, equity, development, and social justice for all' [18], which takes a holistic view of health in the context of human well-being and human rights.

6. Linking the SRES-Scenarios to Health

The most recent scenario efforts of the Intergovernmental Panel on Climate Change (IPCC) resulted in four scenarios that extend through 2100 [7]: A1, A2, B1, B2. The distinctions among these scenarios are broadly structured by defining them ex ante along two dimensions. The first dimension relates to the extent of cross-regional economic convergence and social and cultural interactions; the second relates to the balance between economic objectives and environmental and equity objectives. See also Table 3.

TABLE 3. The SRES-scenarios [7].

Scenario study	Scenarios	Brief description of storyline
Special Report on Emission Scenarios (SRES)	A1	Rapid market-driven growth, with convergence in incomes and culture.
	A2	Self-reliance and preservation of local identities; fragmented economic and technological development.
	B1	Convergent world with rapid changes in economic structures and emphasize on global solutions to sustainability.
	B2	Local solutions to economic, social, and environmental sustainability.

6.1. *Future Health in A1*

In scenario A1, economic growth, technological developments and globalization play a central role. This scenario describes decreasing mortality and increasing life expectancy due to economic growth. Global population will peak in mid-century and decline thereafter due to a rapid worldwide demographic transition. Societies will emphasize the health needs of an ageing population. Although economic development will contribute to improvements in social conditions, the focus on economic growth may lead to the 'social exclusion' of some communities. Relative income disparities will decrease, but absolute differences will remain large. Additionally, income growth will put pressure on (global) resources, leading to ecological degradation. Market-based and technological approaches will be the common response to environmental problems.

From a health perspective, this scenario might see a divergence between the developed world and parts of the developing world. In developed countries, increasing wealth, technology, and improvements in healthcare will offset most of the emerging health risks. At least in the short-to-medium term, material advances, allied with improving social conditions, will lead to gains in overall population health. As a result, the richest populations may experience particularly pronounced health improvements as they advance to the 'Age of medical technology'. Although the poorer countries will experience economic growth and subsequent health improvements, leading to increased life expectancy and increasing prevalence of chronic diseases, absolute income differences will remain. Poorer countries will not advance to the 'Age of medical technology' because they will not have sufficient means to finance wide-scale use of newly developed technologies (despite the diffusion of technological knowledge). As a result they will not be able to achieve the same level of health care as the developed countries, and they will experience more difficulties averting the neg-

ative health impacts of increasing environmental pressures (e.g., water scarcity). Consequently, there may also be resurgence of old diseases and an increase in new infections. The developing world will likely experience an increase in both chronic and infectious diseases ('Age of chronic disease'/'Age of emerging infectious diseases').

6.2. *Future Health in A2*

In scenario A2, health to a large extent is left to individual choice and not public policy. In comparison to scenario A1, economic development is moderate. The greatest economic growth will take place in the developed regions, and technological advances will benefit only rich countries due to limited diffusion of knowledge. Developed countries will increasingly invest in better welfare. Globally, however, the gains in health brought about by economic development and technology will be partly offset by environmental problems and the exacerbation of the income gap between and within countries. Although most developed countries will be able to partially counteract the threat of emerging infectious diseases by increasing investment in public health and medical care (slowly advancing toward the 'Age of medical technology'), the proportion of the total burden of disease that is due to infectious disease will increase. This will be the result of population growth and ecological degradation combined with only moderate economic growth and 'leaner' governments. The situation will be fragile, and in some developed countries the risk of infectious disease may rise considerably, creating the potential for these countries to fall back into the 'Age of emerging infectious diseases'.

In developing countries, levels of health and welfare spending will either remain the same or decline. In poor countries, current barriers to the control of major diseases such as malaria will likely persist, and the importance of adequate water and food supplies will increase, as population growth remains high and environmental degradation increases. This combination of limited economic resources, high population growth, and increasing pressure on the local and global environments will increase the prevalence of infectious diseases, leading to the 'Age of emerging infectious diseases'.

6.3. *Future Health in B1*

A central element of scenario B1 is a high level of environmental and social consciousness, combined with a global approach to sustainable development. In the developed world, mortality will decline and life expectancy

will increase as a result of improved social infrastructure and institutions, economic growth, dematerialization, and investments that decrease pressure on ecological systems via the sustained management of resources. An extensive welfare net will prevent poverty-based social exclusion. Although the average age of the population will increase due to the rapid worldwide demographic transition, healthcare systems will probably be well adjusted to an older population. Under this scenario, developed countries may well complete the transition toward the 'Age of sustained health'.

Thanks to transfers of knowledge and technology, declining national debts, low population growth, increasing education levels, and decreasing social and environmental pressures, the developing world will pass through the 'Age of receding pandemics'. Although some countries will arrive at the 'Age of chronic diseases' (i.e., the stage at which the developed world finds itself today), the global approach toward sustainability will enable most of them to skip this stage and move toward the 'Age of sustained health'.

6.4. *Future Health in B2*

The scenario B2 is characterized by an increasing concern for environmental and social sustainability in a heterogeneous world. Governments primarily concentrate on community- and policy-based solutions to environmental and health problems. Most governments will increase public spending, including public health spending. Environmentally aware citizens will exercise a growing influence on national and local policy. There will be a shift to regional and local decision-making, with a high priority given to human welfare, equality and environmental protection. Education and welfare programs will be widely pursued, reducing mortality and fertility. Nonetheless, in this differentiated world, social and environmental progress will be relatively slow and will vary across regions and countries. Increased expenditure on 'health' and 'environment' will be implemented first in richer countries, and it will take time for developing countries to follow.

In this scenario, developing countries may experience an increase in life expectancy and chronic diseases (moving slowly to the 'Age of chronic diseases') and some may eventually also achieve technological progress on their own. However, due to the slow pace of change, the developing world will not make any significant progress toward true sustainable societies within the given timeframe. For developed countries, the situation will be more robust than in A2; they will slowly start to advance toward

the 'Age of sustained health', possibly via the 'Age of medical technology'. But the transition toward sustainability will be far from complete, and whether developed countries will ever be able to achieve sustained health beyond the timeframe of the scenario will probably depend on further health developments in current developing countries. It is important to note that this scenario incorporates a lack of global governance, which might cause difficulties in solving global problems. If, for example, severe global environmental changes were to occur, the improvements in health might be adversely affected, or even be reversed.

7. Linking the GEO3-Scenarios to Health

The GEO-3 scenario exercise developed four archetype views of the future up to the year 2032 [8]: Markets First (MF), Policy First (PF), Security First (SeF) and Sustainability First (SuF). These scenarios describe possible futures based on anticipated developments in demography, economic development, human development, science and technology, governance, culture, and environment. See also Table 4.

7.1. *Future Health in Markets First*

Markets First describes the continuation of economic growth and globalization. Environmental and social issues are valued as important, but do not have the highest priority, and governments primarily rely on market-based and technological solutions. In this scenario, however, technological

Table 4. THE GEO3-scenarios [8].

Scenario study	Scenarios	Brief description of storyline
Global Environmental Outlook-3 (GEO3)	Markets First (MF)	Market-driven developments converge on the values and expectations that prevail in industrial countries.
	Policy First (PF)	Strong actions are undertaken by governments in an attempt to reach specific goals.
	Security First (SeF)	A world of great disparities, where inequality and conflict prevail, brought about by socio-economic and environmental stresses.
	Sustainability First (SuF)	A new development paradigm emerges in response to the challenge of sustainability, and is supported by new, more equitable values and institutions.

innovation will not be able to keep pace with economic development and population growth. As a result, increases in social problems and environmental degradation will continue. Human health will be negatively affected by ongoing population growth (especially in the developing world), high migration pressures, regional conflicts (e.g., in Africa), the ongoing AIDS pandemic, pressures on food and water, losses in biodiversity, pollution and climate change. There will be, however, improvements in medical technology and health care. Although the developing world will participate in the global market, inequity and poverty will persist.

Growing environmental and social health pressures combined with serious economic troubles will cause developing countries to have a difficult time reaching the 'Age of chronic diseases'. They will slowly be overwhelmed by the accumulation of social, environmental and economic problems and gradually shift into the 'Age of emerging infectious diseases'. The developed countries, on the other hand, will continue as they are now; using economic and technological means to avert negative health impacts. They will advance to the 'Age of medical technology'. However, as pressures on health continue to increase and the migration from South to North facilitates the spread of infectious diseases, developed countries will have to keep in mind that there is a considerable risk of falling into the 'Age of emerging infectious diseases'.

7.2. *Future Health in Policy First*

In the Policy First scenario, sustainable development becomes the cornerstone of political agendas. This future is, however, also characterized by slow progress and mixed results of policy measures. There will be advances in education, reduction of extreme poverty, improvement in environmental quality and slowed population growth. However, progress in food and water availability will not be able to keep pace with the increasing demand, especially in developing countries. Other problems will remain or possibly increase: inequity (although efforts will be made to lower foreign debts and stimulate development in developing countries), regional conflicts, and climate change. In this scenario, there will be some progress toward sustainability, but a lot of work will still have to be done. The scenario itself describes improvements in infant and child mortality.

In this future, the developed countries will be in the process of shifting toward the 'Age of sustained health', but within the timeframe of the

scenario they will have not reached the completion of this transition to a considerable degree. Whether they will ever achieve sustained health will strongly depend on the health developments in the current developing world. The developing countries will not benefit as much from the described improvements as will the developed world, due to persistent inequity. They will probably advance to the 'Age of chronic diseases', but it is unclear whether they will ever be able to progress toward the 'Age of sustained health'.

7.3. *Future Health in Security First*

The main characteristic of the Security First scenario is the enormous increase in the income gap. In this 'future of inequity', the poor will inevitably be the first victims of the adverse effects of the numerous and growing pressures on population health. These pressures will include increasing resource problems (e.g., food and water scarcity), environmental degradation, (political) conflicts and tensions, migration, population growth, lack of education, inadequate healthcare, the continuing AIDS pandemic and climate change. The scenario also describes the resurgence of old diseases and the emergence of new diseases, relatively slow technological progress that only benefits the rich, low priority for social problems, and stagnant economies.

Society will find itself in a downward spiral and the poorest countries will not be able to advance to 'Age of chronic diseases'. Social, environmental and economic pressures will lead them to the 'Age of emerging infectious diseases' very rapidly. The rich will be able to avert negative health impacts, at least in the short-to-medium term. They will live separately from the poor in (metaphorical) fortresses, where they will be (temporarily) protected against environmental and social problems and where they will have access to proper health care and medical technology. At first, the developed world will be able to continue in the 'Age of chronic diseases' or even advance to the 'Age of medical technology'. But because the situation for the rich is less robust than in the Markets First scenario, the proportion of the total burden of disease comprising communicable diseases will grow. It is only a question of how long it will take for the rich countries to eventually shift completely into the 'Age of emerging infectious diseases' as the social, environmental and economic pressures from the outside increase.

7.4. *Future Health in Sustainability First*

In the Sustainability First scenario, people embrace a new sustainability paradigm. Social issues (including health) and environmental quality have high priority, policy measures have strong results, and gradual economic growth occurs within the limits of sustainable development. This scenario describes a successful transition toward sustainability that results in great reductions in the pressures on population health, stabilization of population at moderate levels, increasing education levels, reductions in conflicts and tensions, increasing environmental quality, sufficient water, and sufficient food. It is also characterized by a closing gap between rich and poor, and deliberate efforts to reduce child mortality and to increase life expectancy.

In the future described by the Sustainability First scenario, conditions will become favorable for both the developed countries and the developing world to reach the 'Age of sustained health'. It is even possible that the current developing countries will skip the 'Age of chronic diseases' and advance directly to the 'Age of sustained health'.

8. Future Health in a Globalizing World

The futures presented by the SRES, and GEO3 scenarios are diverse, and we must keep in mind that the timeframes of these scenarios differ [15]. However, beneath the diversity in the choice of scenario names and the narrative motivation for each lies a common set of globalization pathways: a globalizing world with an economic focus, a globalizing world with a focus on sustainability, and a fragmented world resulting from the retreat of globalization. In addition, each pathway has two main variants (see also Table 5).

– In a globalizing world with an economic focus, the scenarios present the following options. In the future of GEO3-MF, developing countries are likely to move slowly toward the 'Age of emerging infectious diseases', while the developed world manages to advance to the 'Age of medical technology'. SRES-A1, on the other hand, is more optimistic about the mitigation of social and environmental problems through global economic and technological developments. These developments make it possible for developing countries to experience improvements in health and increased life expectancy, while at the same time experiencing emerging infectious diseases.

– In a globalizing world with a focus on sustainability, as described by SRES-B1 and GEO3-SuF, both developing and developed countries are likely to advance to the 'Age of sustained health'. However, in the future described by the GEO3-PF scenario, global advances toward sustainability are slow and the developing countries are not likely to advance beyond the 'Age of chronic diseases'. The developed countries progress toward the 'Age of sustained health', but are not able to complete the transition to a sustainable society.
– The scenarios that unfold a fragmented world, SRES-A2 and GEO3-SeF, can be related to a future where the developed world is likely to advance to the 'Age of medical technology', but may also experience an increased risk of infectious disease. The developing countries shift into the 'Age of emerging infectious diseases'. In the alternative fragmented future presented in SRES-B2 there is some local and slow progress in achieving sustainability in the developed world, but the transition is not complete. In developing countries, life expectancy increases but the pace of health improvements is too slow for a shift beyond the 'Age of chronic diseases'. Some developing countries might achieve modest technological progress by themselves.

TABLE 5. Future health in a globalizing world: linking the SRES-scenarios and the GEO3-scenarios to future images of health (adopted from [15, 16]).

Globalization pathway	Variant (scenarios*)	Future health image	
		developed world	developing world
Globalization with an economic focus	Lower mitigation capacity (GEO3-MF)	'Age of medical technology'	Gradual shift into the 'Age of emerging infectious diseases'
	Higher mitigation capacity (SRES-A1)	'Age of medical technology'	'Age of chronic diseases'/ 'Age of emerging infectious diseases'
Globalization with a focus on sustainability	Rapid progress (SRES-B1 & GEO3-SuF)	'Age of sustained health'	'Age of sustained health'
	Slower progress (GEO3-PF)	Progress toward the 'Age of sustained health', but transition is not complete	'Age of chronic diseases'
Fragmentation (retreat of globalization)	Economic focus (SRES-A2 & GEO3-SeF)	'Age of medical technology'/ 'Age of emerging infectious diseases'	'Age of emerging infectious diseases'
	Some local focus on sustainability (SRES-B2)	Progress toward the 'Age of sustained health' (possibly via the 'Age of medical technology'), but transition is not complete	'Age of chronic diseases' (some local progress toward the 'Age of medical technology').

9. Discussion

The world around us is becoming more interconnected and complex, and human health is increasingly perceived as the integrated outcome of its ecological, socio-cultural, economic and institutional determinants. The effects of globalization are causing a growing concern for human health, and the intergenerational equity implied by 'sustainable development' forces us to consider the right of future generations to a healthy environment and healthy lives.

Scenario analyses are useful tools for the exploration of possible health impacts of different globalization pathways, and can be used to gain insights with regard to future global health and to support the decision-making process. An integrated set of global health scenarios could make a significant contribution to ongoing discussions on the health effects of globalization, and could stimulate a more integrated approach toward global health among scientists, governments and other stakeholders.

Recent research shows that the human health dimension is largely missing in existing global scenarios [15, 16]. Given that health is widely regarded as one of the most important aspects of human well-being and an important component of human security, one might ask why there has been so little effort to explicitly address human health in the past decade of scenario development. From the point of view of the global scenario community, exploring the potential health impacts of global changes poses a difficult challenge. Health is an integrated bottom-line outcome, and scenario builders might hesitate to include such a complex and multi-causal issue into their studies. From a public health point of view, exploration of these global, long term and complex risks to human health is far removed from the tidy examples that abound in textbooks of epidemiology and public health research. It is difficult to engage epidemiologists and other population health scientists in this unfamiliar domain. As a result, health is only beginning to play a role in global scenario assessments.

There are two main approaches to the development of global health scenarios [26]. First, one could develop new integrated health scenarios from scratch. This would be, of course, very challenging, but it would be possible to make use of the expertise already available in the scenario community. The second approach would build on the outcomes of earlier studies and would enrich existing global scenarios with a health component.

This paper describes an initial attempt to follow the second approach, adding a health dimension to existing global scenarios to explore the

health effects of future globalization. It provides useful insights in how to incorporate health in scenarios and shows that a comprehensive picture of future health evolves when all relevant socio-cultural, institutional, economic and environmental developments are taken into account. In order to connect current scenarios to a more robust analysis of changes in health outcomes, supplementary analysis is required. For example, an additional step would be the quantification of narrative storylines through modeled scenarios and quantitative estimates of relevant indicators such as life expectancy, healthy life expectancy or disease specific morbidity and mortality rates.

To conclude, the integration of health into global scenario development has the potential to be both instructive and exciting. In today's era of globalization, global environmental change and the subsequent increasing concern for present and future human health, the call for good global health governance becomes stronger and stronger. International agreements and conventions regarding environment, energy and many other sustainability issues need to be informed by the most comprehensive information regarding future scenarios and associated model outcomes – and health should be an integral part of this information.

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